







“The influence of banking liquidity risk on profitability: The moderating role of capital adequacy ratio”

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ARTICLE INFO	Meliza, Norraidah Abu Hasan and Hermilasari Saputri (2024). The influence of banking liquidity risk on profitability: The moderating role of capital adequacy ratio. <i>Banks and Bank Systems</i> , 19(2), 140-151. doi: 10.21511/bbs.19(2).2024.11
DOI	http://dx.doi.org/10.21511/bbs.19(2).2024.11
RELEASED ON	Tuesday, 28 May 2024
RECEIVED ON	Wednesday, 08 November 2023
ACCEPTED ON	Thursday, 11 April 2024
LICENSE	 This work is licensed under a Creative Commons Attribution 4.0 International License
JOURNAL	"Banks and Bank Systems"
ISSN PRINT	1816-7403
ISSN ONLINE	1991-7074
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

39



NUMBER OF FIGURES

0



NUMBER OF TABLES

9

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BUSINESS PERSPECTIVES



LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine
www.businessperspectives.org

Received on: 8th of November, 2023

Accepted on: 11th of April, 2024

Published on: 28th of May, 2024

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Conflict of interest statement:

Author(s) reported no conflict of interest

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THE INFLUENCE OF BANKING LIQUIDITY RISK ON PROFITABILITY: THE MODERATING ROLE OF CAPITAL ADEQUACY RATIO

Abstract

The decline in bank liquidity due to slowing economic growth in Indonesia has decreased bank profitability. COVID-19 and the increase in the number of non-performing loans increased the level of bank liquidity risk and decreased capital. Hence, the purpose of this study is to analyze the influence of banking liquidity risk on profitability in the Indonesian banking sector and to examine the role of capital adequacy ratio as a moderating variable. The method section explains panel data analysis using the random-effect model in analyzing the influence of liquidity risk on profitability and the role of capital adequacy ratio as a moderating variable. The results of the analysis show that liquidity risk has a significant positive influence on profitability at the 1% significance level. Moreover, the t-statistic value for capital adequacy ratio as a moderating variable is 2.59 at a 1% significance level. This result shows that the capital adequacy ratio can moderate the relationship between liquidity risk and profitability. Furthermore, the robustness test results show that the deposit risk ratio is a good indicator for estimating liquidity risk. In addition, this study is useful for the banking sector in managing its capital adequacy ratio and as a reference for the government in setting policies related to banking capital.

Keywords

bank risk, bank performance, commercial bank,
liquidity requirement

JEL Classification

G20, G21, M21

INTRODUCTION

Currently, the Indonesian banking sector faces fluctuations in profitability. According to Otoritas Jasa Keuangan (2022), the profitability ratio of commercial banks in Indonesia, as measured by return on assets, decreased from 2.45% in 2017 to 1.59% in 2020. This situation occurred due to the impact of COVID-19 and the increase in banking risk. One of the risks that can cause a decrease in profitability is liquidity risk. Several factors, such as slowing economic growth, financial difficulties, and currency depreciation, will affect bank liquidity (Yumaita et al., 2022). According to Otoritas Jasa Keuangan (2022), the credit ratio of commercial banks in Indonesia, as measured by the loan-to-deposit ratio (LDR), rose from 77.13% in 2021 to 79.6% in 2022. An increase in LDR indicates an increase in bank liquidity risk.

Another factor affecting bank liquidity and profitability is the adequacy of the bank capital; capital adequacy ratio (CAR). According to Otoritas Jasa Keuangan (2022), Indonesian commercial banks' CAR increased slightly from 23.18% in 2017 to 25.47% in 2022. Most previous studies show that strong capital indicates long-term liquidity sustainability. Besides liquidity, previous studies prove that CAR can also affect

a bank's profitability. The higher the bank's capital adequacy ratio, the higher the bank's capability to anticipate future conditions that could affect its profitability.

The influence of liquidity risk on bank capital adequacy (CAR) has been examined by some previous studies. Moreover, the effect of bank capital adequacy (CAR) on profitability also had been discussed by previous researchers. However, there is minimal research on the influence of liquidity risk on profitability and the CAR's role as a moderating variable. Therefore, this study can provide additional references for research on the influence of bank liquidity risk on profitability as well as research on the role of CAR as a moderating variable.

1. LITERATURE REVIEW

Liquidity risk is the risk a company faces to meet its short-term obligations. Liquidity risk in banking companies can occur due to excessive withdrawal of funds from the bank (Saleh & Abu Afifa, 2020). A bank's failure to fulfill its liquidity can cause bank losses. Therefore, analyzing the bank's risk level and profits is very important for the continuity of bank operations. This study uses signal theory to explain liquidity risk and its influence on profit levels as well as the role of capital adequacy as a moderator.

The signaling theory is the theoretical basis to explain the effect of liquidity risk on profitability. Signaling theory is applied to describe the relationship between risk and profit levels in this study. Increased banking risk reflects a bad signal for banks (Zafrizal et al., 2021) and ultimately can reduce the level of income and profitability. Increased liquidity risk can reduce a banks' ability to channel funds through loans. This circumstance can reduce bank interest income, reducing bank profitability. Meanwhile, the lower the bank's risk level, the higher the opportunity to increase profits.

Research on liquidity risk and profit levels has been discussed by several previous researchers. Duho et al. (2020) analyzed the relationship between liquidity risk and profitability of 32 banks in Ghana from 2000 to 2015. Poor cash management has an impact on decreasing profitability. Their analysis presented that liquidity risk and profitability have an opposite relationship. Hacini et al. (2021) discussed the influence of liquidity risk on the profitability of Saudi Arabian banks from 2002 to 2019. Their analysis showed that liquidity risk negatively and significantly influences profitability. Banks

that do not have sufficient liquidity can reduce their profitability. It is due to insufficient liquidity to cover financing needs, such as default or economic downturn, which negatively affects bank performance. Abdelaziz et al. (2022) examined the effect of liquidity risk on bank profitability in the MENA (Middle East and North African) countries from 2004 to 2015. They found that liquidity risk and bank profitability have opposite effects.

Nevertheless, previous studies revealed that liquidity risk and profitability have a unidirectional effect. Ebenezer et al. (2019) discussed the effect of liquidity risk on the profitability of 63 commercial banks in ASEAN countries from 2009 to 2017. They found that liquidity risk positively influences profitability. Improved liquidity management and lending activities can improve ROA. Rudhani and Balaj (2019) examined the relationship between liquidity risk and bank performance in Kosovo from 2019 to 2015. They found that liquidity risk has a positive relationship with bank performance. Purbaningsih and Fatimah (2018) examined the effect of liquidity risk on the profitability of Shariah Banks in Indonesia from 2014 to 2016; they found that liquidity risk positively affects profitability. It may be due to the ability of Islamic banks to maximize their liquid assets to gain profitability. Saiful and Ayu (2019) examined whether profitability is affected by liquidity risk; they showed that liquidity risk positively influences profitability. Cheng et al. (2020) discussed the impact of the existence of liquidity risk on the profitability of banks listed on the Johannesburg Stock Exchange from the 2012–2018 period. Their analysis found that liquidity risk and profitability have an influence in the same direction. This positive influence is because banks in South Africa have sufficient funds to meet urgent withdrawals by their customers. Moreover, Alim et al. (2021) analyzed the influ-

ence of liquidity risk on ROA. They analyzed commercial banks in Pakistan from 2006 to 2019 and revealed that liquidity risk positively influences profitability. Improvements in liquidity management and lending activities can improve ROA. Furthermore, Amalia and Nugraha (2021) also analyzed the impact of liquidity risk on the ROA of banking companies in Indonesia; they revealed that liquidity risk and ROA as profitability estimators have a positive impact. Increased lending can increase net interest income, indirectly increasing the bank's profitability. In addition, Huong et al. (2021) discussed the relationship between liquidity risk and the financial performance of 171 banks in Southeast Asia countries from 2004 to 2016; they revealed that an increase in liquidity risk will cause an increase in profitability, and vice versa. Optimal liquidity is a factor affecting profitability.

The signaling theory also explains the influence of CAR on profitability. Banks with a high level of profitability produce positive signals for the public to entrust their funds to be managed (Hasmiana et al., 2022). The signaling theory suggests how to provide signals to users of financial statements. Published financial information is expected to provide a company's financial signal and illustrate the possibilities related to the existence of debt (Sitompul & Nasution, 2019). CAR is the ratio used to measure a bank's ability to fulfill its capital aspects. A bank with a high CAR reflects the bank's high ability to finance its operational activities.

Handayani et al. (2019) analyzed the effect of CAR on the ROA of 13 Shariah commercial banks in Indonesia from 2012 to 2018. They found that increasing the number of CAR can cause an increase in ROA, and vice versa. Sufficient capital can increase a bank's capability to extend loans and ultimately increase profitability. Saleh and Abu Afifa (2020) examined the relationship between CAR and the profitability of Jordanian commercial banks from 2010 to 2018. They found that CAR and ROA have a positive relationship. The more capital a bank has, the better it will deal with future conditions that may impact its profitability. Olatayo et al. (2019) examined the influence of CAR on the ROA of eight deposit money banks in Nigeria. They showed that CAR and ROA have a positive influence. CAR is a strong factor in profit plan-

ning and capital structure decisions. Cruz-García and Fernandez de Guevara (2020) discussed the effect of capital requirement and the profitability of 31 Organization for Economic Cooperation and Development (OECD) countries from 2000 to 2014. They revealed that capital requirement has a positive effect on profitability. High capital requirements indicate that banks include these costs as additional funds into their net interest margin.

Besides liquidity risk, there are some other factors that may influence profitability. Bank-specific factors that influence profitability include credit risk, leverage, and bank size. Prastiwi and Anik (2020) discussed the influence of non-performing loans (NPLs) as credit risk on the ROA of Indonesian banks. Their analysis showed that NPL has a positive and significant influence on ROA. Abdelaziz et al. (2022) discussed the effect of NPLs on ROA in MENA countries from 2004 to 2015. Abdelaziz et al. (2022) found that NPLs have a negative effect on ROA. Siddique et al. (2022) examined the impact of NPLs on the ROA of South Asian commercial banks and found that NPLs have a negative and significant impact on ROA. Rahman et al. (2020) analyzed the relationship between leverage and profitability of listed textile firms in Bangladesh from 2011 to 2015. Their analysis revealed that leverage and profitability have the opposite effect. Bintara (2020) examined the impact of leverage on the profitability of property, real estate, and building construction companies listed in the Indonesia Stock Exchange from 2013 to 2018. Bintara (2020) also showed the opposite impact between leverage and profitability.

Signaling theory is also applied to explain the role of CAR as a moderating variable. According to this theory, investors and creditors have difficulty distinguishing between high-quality and low-quality companies. Therefore, the theory suggests providing signals to users of financial statements so that users of financial statements know the financial conditions related to capital, debt, and the company's financial performance.

Previous studies showed that CAR could affect profitability (Handayani et al., 2019; Olatayo et al., 2019; Cruz-García & Fernandez de Guevara, 2020; Saleh & Abu Afifa, 2020). CAR can affect not only profitability but also liquidity risk. Tamimi and

Obeidat (2013) discussed the relationship between liquidity risk and CAR of commercial banks in Jordan. They found that there is a positive relationship between liquidity risk and CAR. Dao and Nguyen (2020) analyzed the influence of CAR on LDR as a liquidity risk estimator of 16 Vietnamese commercial banks from 2010 to 2017. The analysis results showed that LDR has a negative influence on profitability. It also means that liquidity risk has a negative influence on profitability. Increased outstanding loans will increase Total Assets and Risk-Weighted Assets and decrease CAR. Ahamed (2021) analyzed the CAR and liquidity risk of 23 commercial banks in Bangladesh from 2005 to 2018. Liquidity risk is measured by loans/advances to total assets (LA). He revealed that CAR positively affects LA; strong bank capital indicates strong liquidity in the long run.

This research objective is to examine the influence of liquidity risk on profitability and to analyze the role of CAR as a moderating variable. Hence, this study establishes several hypotheses to test the influence of liquidity risk on profitability and the role of CAR as a moderating variable. These hypotheses are as follows:

- H_1 : *Liquidity risk negatively and significantly influences profitability.*
- H_2 : *CAR positively and significantly influences profitability.*
- H_3 : *CAR moderates the relationship between liquidity risk and profitability.*

2. METHOD

Data analysis in this study has four stages. The first stage is to determine a sample from the population using random sampling. The second stage is to collect data used as an indicator for each variable in this research. The third stage is to determine the regression model and several diagnostic tests. The final stage is to carry out a robustness test.

This study's sample consists of 46 commercial banks listed on the Indonesia Stock Exchange from 2018 to 2022. This study applies ROA as

a profitability indicator following Huong et al. (2021) and Saleh and Abu Afifa (2020). ROA is estimated by net income divided by total assets. The higher the ROA ratio, the higher the profits generated. On the other hand, the independent variable is liquidity risk, measured by the deposit risk ratio (DRR), following Mansur et al. (1993) and Dao and Nguyen (2020). Equity divided by total deposits estimates DRR. The higher DRR ratio indicates the higher resulting liquidity ratio. Moreover, this study also uses size as a control variable, following Abbas et al. (2019) and Golubeva et al. (2019). Total assets estimate size. Besides size, this study also employs inflation as a control variable, following Ammar and Boughrara (2019) and Singh et al. (2021). Annual consumer price inflation estimates inflation. Furthermore, this study uses CAR as a moderating variable, following Zafrizal and Said (2019). Equity capital divided by total risk-weighted assets calculates CAR (Abusharba et al., 2013); The higher the CAR ratio, the higher the bank's capital capability. Moreover, this study also applies the debt-to-equity ratio (DER) as a control variable. Leverage can also affect bank profitability (Harisa et al., 2019; Qayyum & Noreen, 2019). DER estimates leverage. The higher the DER, the higher the debt risk experienced by the company. Furthermore, another banking-specific factor affecting profitability is credit risk, estimated by NPLs (Adebisi & Matthew, 2017; Psaila et al., 2019). NPLs divided by total loans calculate this ratio.

Panel data analysis using multiple regression was applied to analyze how much influence liquidity risk (DRR) has on profitability (ROA) and the CAR's role as a moderating variable. There are three steps of analysis.

$$\begin{aligned} \text{Profitability}_{it} = & \beta_0 + \beta_1 \text{liquidityrisk} \\ & + \beta_2 \text{Size} + \beta_3 \text{Leverage} \\ & + \beta_4 \text{Creditrisk} + \beta_5 \text{Inflation} + \varepsilon_i. \end{aligned} \quad (1)$$

The first step of analysis is shown by Model 1, estimating the influence of liquidity risk on profitability.

$$\begin{aligned} \text{Profitability}_{it} = & \beta_0 + \beta_1 \text{liquidityrisk} \\ & + \beta_2 \text{CAR} + \beta_3 \text{Size} + \beta_4 \text{Leverage} \\ & + \beta_5 \text{Creditrisk} + \beta_6 \text{Inflation} + \varepsilon_i. \end{aligned} \quad (2)$$

Model 2 expresses the second step of the analysis. This model measures the influence liquidity risk and CAR have on profitability.

$$\begin{aligned} \text{Profitability}_{it} = & \beta_0 + \beta_1 \text{liquidityrisk} \\ & + \beta_2 \text{CAR} + \beta_3 \text{Liquidity Risk} \cdot \text{CAR} \\ & + \beta_4 \text{Size} + \beta_5 \text{Leverage} + \beta_6 \text{Creditrisk} \\ & + \beta_7 \text{Inflation} + \varepsilon_i. \end{aligned} \quad (3)$$

The last step of analysis is shown by Model 3, estimating the influence of liquidity risk on profitability and the role of CAR as a moderating variable.

This study also uses normality tests, multicollinearity tests, and heteroscedasticity tests. Data are declared free from problems of normality, multicollinearity, and heteroscedasticity if they have a significance level of >0.05 . Furthermore, the Lagrange Multiplier test is also employed to examine a better regression model between ordinary least squares (OLS) and the random-effect (RE) model. Indeed, this study also applies the Hausman test to examine a better regression model between the RE and FE (fixed-effect models). In addition, robustness tests are conducted to ensure that liquidity risk is a predictor that can affect profitability. Robustness tests are carried out using LDR as an indicator of liquidity risk, following Zafrizal et al. (2021).

3. RESULTS

Initially, the number of observations was 230. However, due to outlier problems, some data were discarded, so the total number of observations used was 186. According to Table 1, the mean, maximum, and minimum values of ROA are about 0.01, 0.13, and 0.0002, respectively. Meanwhile,

DRR has a mean value of about 0.20. Moreover, DRR has a maximum of about 1.44. On the other hand, DRR has a minimum value of about 0.01, respectively. Furthermore, for the total assets, the mean value is about Rp 148,479,532 (in a million rupiah), the maximum is about Rp 1,572,761,035 (in a million rupiah), and the minimum is about Rp 664,673 (in a million rupiah). As a control variable, inflation has a mean value of about 2,61, the maximum is about 3,61, and the minimum is about 1.68. Moreover, as a leverage indicator, DER has a mean value of about 5.35, the maximum is 16.08, and the minimum is 0.15. Next, as a credit risk indicator, NPL has a mean value of about 1.77, the maximum is about 9.92, and the minimum is about 0.15. As the last control variable, gross domestic product (GDP) has mean, maximum, and minimum values of about Rp 15,000,000 (in a billion rupiah), Rp 17,000,000 (in a billion rupiah), and Rp 13,600,000 (in a billion rupiah). Indeed, CAR has a mean value of about 0.27, the maximum is about 0.95, and the minimum is about 0.11.

Table 2 presents the three regression models' variance inflation factor (VIF) values. Column 2 of Table 2 shows the VIF values for all variables in Model 1. The VIF of liquidity risk and size is 1.02. As the second variable, inflation has a VIF value of about 1.00. DER has a VIF value of about 1.27, while GDP has a VIF value of about 1.05. Moreover, the VIF value for liquidity risk and size in Model 2 is about 1.02, while the VIF value for inflation is about 1.01. NPL has a VIF value of about 1.32, and DER has a VIF value of about 1.27. Meanwhile, the VIF value of CAR is about 1.01. Furthermore, Column 4 shows the result of VIF values for Model 3. Liquidity risk has a VIF value of about 1.23, while size has a VIF value of about 1.06. Inflation has a VIF value of about 1.01. DER has a VIF value of 1.58, while NPL has a VIF value

Table 1. Descriptive statistics

Variable	Mean	Maximum	Minimum
Return on Assets (Profitability)	0.01	0.13	0.0002
Deposit Risk Ratio (Liquidity Risk)	0.20	1.44	0.01
Total Assets (Size)	148,479,532	1,572,761,035	664,673
Inflation	2.61	3.61	1.68
Debt-to-Equity Ratio (Leverage)	5.25	16.08	0.15
Non-Performing Loan Ratio (credit risk)	1.77	9.92	0.02
Gross Domestic Product (in a billion rupiah)	15,000,000	17,000,000	13,600,000
Capital Adequacy Ratio	0.27	0.95	0.11

Table 2. Variance inflation factor

Column 1	Column 2	Column 3	Column 4
Variables	Model (1)	Model (2)	Model (3)
	$Profitability_{it} = \theta_0 + \theta_1$ $liquidity\ risk + \theta_2 Size + \theta_3$ $Inflation + \varepsilon_i$	$Profitability_{it} = \theta_0 + \theta_1$ $liquidity\ risk + \theta_2 CAR + \theta_3$ $Size + \theta_4 Inflation + \varepsilon_i$	$Profitability_{it} = \theta_0 + \theta_1$ $liquidity\ risk + \theta_2 CAR + \theta_3$ $Liquidity\ Risk.CAR +$ $\theta_4 Size + \theta_5 Inflation + \varepsilon_i$
Liquidity Risk (Deposit Risk Ratio)	1.02	1.02	1.23
Size (Total Assets)	1.02	1.02	1.06
Inflation	1.00	1.01	1.01
Debt-to-Equity Ratio (Leverage)	1.27	1.27	1.58
Non-Performing Loan Ratio (credit risk)	1.31	1.32	1.35
Gross Domestic Product (in a billion rupiah)	1.05	1.07	1.04
Capital Adequacy Ratio (CAR)	–	1.01	1.01

of about 1.35. As a fifth control variable, GDP has a VIF value of about 1.04. In addition, CAR, as a moderator, has a VIF value of about 1.01.

Table 3 shows the regression result for Model 1. The Hausman test produces a value of 0.057, indicating that the RE model is better to be applied than the FE model. Table 3 also shows that liquidity risk, estimated by DRR, positively and significantly influences profitability. The coefficient value is about 1.70, while the value of t -statistics is about 6.04. This value is significant at 1%. Like liquidity risk, size also positively and significantly influences profitability. The coefficient value is about 0.62, while the value of t -statistics is about 3.65. This value is also significant at 1%. On the other hand, as a control variable, inflation negatively influences profitability. The value of t -statistics is about -0.18 . This value is not significant. As a leverage indicator, DER has a coefficient val-

ue of about -0.106 , while the t -statistics is about -0.44 . NPL has a positive influence on profitability. Unfortunately, this influence is not significant. The coefficient value is about 0.182, and the t -statistics value is about 1.47. GDP, as the last control variable, has a coefficient value of about 2.06 and the t -statistics is about 1.01. Indeed, the value of the adjusted R -square is about 0.332.

Table 4 presents the regression result for Model 2. According to Table 4, the Hausman test generates a value of 0.340. This value is higher than 0.05. This value indicates that the RE model is better employed than the FE model. Liquidity risk, which is estimated by DRR, has a positive and significant influence on ROA. The coefficient value of liquidity risk is about 1.71, while the t -statistic value is about 6.02. This t -statistics value is significant at 1%. Moreover, size also has a positive and significant influence on profitability. The coef-

Table 3. Result for Model 1 (Dependent variable: Profitability)

Variable	Coefficient Estimates	t -statistics
Liquidity Risk (Deposit Risk Ratio)	1.70	6.04***
Size (Log of Total Assets)	0.62	3.65***
Inflation	-0.037	-0.18
Leverage (Debt-to-Equity Ratio)	-0.106	-0.44
Credit risk (Non-Performing Loan)	0.182	1.47
Gross Domestic Product (GDP)	2.06	1.01
Adjusted R^2	0.332	–
Wald χ^2	47.66	–
Probability $> \chi^2$	0.000	–
Hausman test (p -value)	0.057	–

Note: (*) significance level at 10%; (**) significance level at 5%; and (***) significance level at 1%.

Table 4. Result for Model 2 (Dependent variable: Profitability)

Variable	Coefficient Estimates	t-statistics
Liquidity Risk (Deposit Risk Ratio)	1.71	6.02***
Size (Log of Total Assets)	0.62	3.78***
Inflation	-0.02	-0.10
Leverage (Debt-to-Equity Ratio)	-0.09	-0.41
Credit risk (Non-Performing Loan)	0.16	1.30
Gross Domestic Product (GDP)	2.26	1.09
Capital Adequacy Ratio (CAR)	-0.008	-0.84
Adjusted R^2	0.348	–
Wald χ^2	49.36	–
Probability > χ^2	0.000	–
Hausman test (p -value)	0.340	–

Note: (*) significance level at 10%; (**) significance level at 5%; and (***) significance level at 1%.

coefficient value of size is 0.62, while the t -statistics value is about 3.78. The t -statistics value is significant at 1%. On the other hand, inflation has a negative influence on profitability. However, this influence is not significant. The coefficient value is about -0.02, while the t -statistics is about -0.10. Like inflation, DER, as a leverage indicator, has a coefficient value of about -0.09, while the t -statistics value is about -0.41. As a credit risk indicator, NPL has a positive but insignificant influence on profitability. Its coefficient value is 0.16, while the t -statistics value is about 1.30. GDP and profitability have a unidirectional influence. This influence is not significant. The coefficient value of GDP is 2.26, while the t -statistics value is about 1.09. In addition, the coefficient value of CAR negatively influences profitability. This influence is also not significant. The coefficient value is about -0.008, while the t -statistic is about -0.84. In addition, the value of the adjusted R -square is about 0.384.

Table 5 shows the regression result for Model 3. According to Table 5, the Hausman test value is about 0.055. Hence, this result indicates that the RE model is better employed than the FE model. The coefficient value of liquidity risk is about 10.01, while the t -statistics value is about 6.09. This value is significant at 1%. This result also shows that DRR, as a liquidity risk indicator, positively and significantly influences profitability. Moreover, size, as the control variable, positively and significantly influences profitability. The coefficient value of size is 14.05, while the t -statistics value is about 4.79. This value is significant at 1%. As a control variable, inflation has the opposite effect on profitability and the effect is not significant. The coefficient value is about -0.229, and the t -statistics val-

ue is about -0.39. As a leverage indicator, DER has a coefficient value of about 0.08, while the t -statistics value is about 1.01. Credit risk, estimated by NPL, has a coefficient value of about 0.067, while the t -statistics value is about 0.46. GDP has the opposite effect on profitability. The coefficient value is about -1.54, while the t -statistics value is about -0.64. This value is not significant. Like GDP, CAR also has the opposite effect on profitability and the effect is not significant. Meanwhile, CAR successfully moderates the relationship between liquidity risk and profitability with a significance level of 5%. The coefficient value of CAR as a moderating variable is 0.587. This value indicates that CAR enhances liquidity risk's effect on profitability. The existence of a capital adequacy policy can increase the positive influence between liquidity risk and profitability. In addition, the value of the adjusted R -square is about 0.508.

The robustness test employs LDR as a liquidity risk estimator. This robustness test is also calculated by multiple regression analysis. The analysis shows that the RE model is better applied than OLS. Moreover, the value of the Hausman test is about 0.456. This result indicates that a RE model is better than a FE model. Table 6 shows the regression result of the robustness test for Model 1. According to this table, liquidity risk positively and significantly influences profitability. This result is consistent with the result in Table 3, employing DRR as a liquidity risk estimator.

The result of the robustness test for Model 2 is presented in Table 7. This result is consistent with the previous analysis in Table 4. According to Table 8, liquidity risk positively and significantly influ-

Table 5. Result for Model 3 (Dependent variable: Profitability)

Variable	Coefficient Estimates	t-statistics
Liquidity Risk (Deposit Risk Ratio)	10.01	6.09***
Size (Log of Total Assets)	14.05	4.79***
Inflation	-0.229	-0.39
Leverage (Debt-to-Equity Ratio)	0.08	1.01
Credit risk (Non-Performing Loan)	0.067	0.46
Gross Domestic Product (GDP)	-1.54	-0.64
Capital Adequacy Ratio (CAR)	-0.087	-0.47
Liquidity Risk. Capital Adequacy Ratio	0.587	2.59***
Adjusted R ²	0.508	-
Wald χ^2	70.01	-
Probability > χ^2	0.000	-
Hausman test (p-value)	0.055	-

Note: (*) significance level at 10%; (**) significance level at 5%; and (***) significance level at 1%.

Table 6. Robustness test result for Model 1 (Dependent variable: Profitability)

Variable	Coefficient Estimates	t-statistics
Liquidity Risk (Loan to Deposit Ratio)	0.005	4.12***
Size (Log of Total Assets)	0.076	1.68*
Inflation	0.026	0.63
Leverage (Debt-to-Equity Ratio)	-0.015	-1.24
Credit risk (Non-Performing Loan)	-0.030	-1.70
Gross Domestic Product (GDP)	-0.258	-0.78
Adjusted R ²	0.164	-
Wald χ^2	26.54	-
Probability > χ^2	0.000	-
Hausman test (p-value)	0.456	-

Note: (*) significance level at 10%; (**) significance level at 5%; and (***) significance level at 1%.

ences profitability. Moreover, CAR has an insignificant influence on profitability.

Table 8 presents the robustness test result for the influence of liquidity risk on profitability and CAR's role as a moderating variable. Table 8 also

indicates that CAR successfully moderates the influence of liquidity risk on profitability and can also enhance the relationship between liquidity risk and profitability. Overall, all the robustness test results indicate that DRR is a good estimator for estimating liquidity risk.

Table 7. Robustness test result for Model 2 (Dependent variable: Profitability)

Variable	Coefficient Estimates	t-statistics
Liquidity Risk (Loan to Deposit Ratio)	0.212	5.29***
Size (Log of Total Assets)	0.075	1.70*
Inflation	0.029	0.91
Leverage (Debt-to-Equity Ratio)	-0.013	-1.14
Credit risk (Non-Performing Loan)	-0.05	-2.39**
Gross Domestic Product (GDP)	-0.198	-0.62
Capital Adequacy Ratio (CAR)	-0.158	-0.23
Adjusted R ²	0.260	-
Wald χ^2	39.10	-
Probability > χ^2	0.000	-
Hausman test (p-value)	0.767	-

Note: (*) significance level at 10%, (**) significance level at 5%, and (***) significance level at 1%.

Table 8. Robustness test result for Model 3 (Dependent variable: Profitability)

Variable	Coefficient Estimates	t-statistics
Liquidity Risk (LDR)	0.013	1.33
Size (Log of Total Assets)	0.614	3.11***
CAR	-0.001	-0.10
Inflation	-0.201	-0.77
Leverage (Debt-to-Equity Ratio)	0.047	0.49
Credit risk (Non-Performing Loan)	-0.09	-0.59
Gross Domestic Product (GDP)	-2.70	-1.05
Liquidity Risk. Capital Adequacy Ratio	0.733	2.98***
Adjusted R ²	0.264	-
Wald χ^2	26.27	-
Probability > χ^2	0.000	-
Hausman test (p-value)	0.097	-

Note: (*) significance level at 10%; (**) significance level at 5%; and (***) significance level at 1%.

Table 9 shows that Liquidity risk and profitability have an influence in the same direction. In fact, this result contradicts the hypothesis, which states that liquidity risk has a significant negative effect. Moreover, CAR has a negative but not significant effect on profitability, while the expected result is positive and significant. Hence, hypotheses 1 and 2 are rejected. On the other hand, the interaction variable of liquidity risk and the CAR generate positive and significant results. Thus, the last hypothesis is accepted.

Table 9. Expected and actual hypotheses

Variable	Profitability	
	Expected results	Actual results
Liquidity risk	-	+
CAR	+	-
Liquidity risk. CAR	+	+

4. DISCUSSION

The regression analysis using the random effect of Model 1 shows that liquidity risk, estimated by DRR, has an influence in the same direction on profitability. Banks can utilize increasing the amount of equity to increase the number of loans distributed and the amount of investment. This condition impacts increasing loan and investment interest income, which, in turn, can increase profitability. This result is in line with the signaling theory in which banks with a high level of profitability produce positive signals. COVID-19 has a cross-country systemic risk link. Banks with high-risk leverage, weak capital,

and low network have higher systemic risk due to the shock of the COVID-19 pandemic. The pandemic also caused a decrease in liquid assets due to bank investment activities in the money and capital markets and a decrease in credit installments from business debtors affected by the pandemic (Putra et al., 2022). However, most banks in Indonesia have sufficient liquidity to survive the exposure to COVID-19. Furthermore, the positive relationship between liquidity risk and profitability is also in line with Alim et al. (2021), Amalia and Nugraha (2021), Ebenezer et al. (2019), Huong et al. (2021), and Rudhani and Balaj (2019). Nevertheless, this result is inconsistent with Abdelaziz et al. (2022), Duho et al. (2020), and Hacini et al. (2021). The regression analysis of Model 2 also shows that liquidity risk positively influences profitability.

CAR negatively and significantly affects profitability. The negative effect of CAR on profitability indicates that the higher the amount of CAR, the lower the amount of funds allocated for investment and lending. As a result, this condition can reduce loan and investment interest income and eventually reduce profitability. This result is contrary to Handayani et al. (2019), Olatayo et al. (2019), Cruz-García and Fernandez de Guevara (2020), and Saleh and Abu Afifa (2020). Indeed, this result is also inconsistent with the signaling theory.

The regression analysis result of Model 3 reveals that CAR can moderate the relationship between liquidity risk and profitability. The random-effect model of Model 3 shows that CAR can enhance

the relationship between liquidity risk and profitability. CAR is useful for determining the adequacy of bank funds in facing the risk of bank business losses. The existence of CAR can make banks more careful in maintaining their liquidity. Banks will be more selective in investing their deposit funds and maintaining their deposit ratio. Hence, this circumstance can reduce the level of bank liquidity risk, which, in turn, can bring down the level of bank loss and raise the amount of profitability.

The robustness test analysis shows that LDR positively influences profitability as a liquidity

risk indicator. Moreover, the robustness test also found that CAR can enhance the relationship between liquidity risk and profitability. Thus, all these results indicate that DRR is a good estimator of liquidity risk.

Several other banking risks can affect bank profitability. Therefore, further research can analyze the effect of several other risks, such as credit and interest risks, on profitability and examine other aspects, such as a bank's capital structure and macroeconomic conditions, as moderating variables.

CONCLUSION

The study's purpose was to analyze the influence of banking liquidity risk on profitability in the Indonesian banking sector and examine the role of the capital adequacy ratio as a moderating variable. Results of regression analysis using a random effects model show that liquidity risk has a unidirectional influence on profitability. Moreover, this result is consistent with the signaling theory. CAR enhances the influence of liquidity risk on profitability. Indeed, a robustness test using LDR proves that DRR is an appropriate indicator to measure liquidity risk.

This study has implications for regulations regarding bank liquidity. Banks must comply with bank liquidity requirements because sufficient liquidity can anticipate losses due to high operational costs and increased NPL. In addition, bank capital must be further strengthened because, with sufficient capital, banks can optimize their funds to be distributed to the earning assets, increasing profitability.

AUTHOR CONTRIBUTIONS

Conceptualization: Meliza.

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Formal analysis: Meliza, Norraidah Abu Hasan.

Funding acquisition: Norraidah Abu Hasan.

Investigation: Meliza.

Methodology: Meliza, Norraidah Abu Hasan.

Project administration: Meliza.

Resources: Norraidah Abu Hasan, Hermilasari Saputri.

Software: Hermilasari Saputri.

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