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Original Article

The Effects of Credit Risk, Income Diversification, and Liquidity Coverage Ratio on Banking Profitability: CAR as Moderator

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Abstract: *This study examines the effect of Credit Risk, Income Diversification, and Liquidity Coverage Ratio (LCR) on bank profitability, with Capital Adequacy Ratio (CAR) as a moderating variable. Credit Risk is measured using Non-Performing Loan (NPL), while profitability is proxied by Return on Assets (ROA). The sample used for this research is based on secondary data for 43 commercial banks that were listed on the Indonesia Stock Exchange (IDX) during the years 2020 through 2024. Therefore, there are 215 observations. This secondary data was collected from annual reports, financial reports and Bloomberg. Panel data regression analysis was utilized to test the direct relationship between independent variables and the dependent variable (profitability), as well as Moderated Regression Analysis (MRA) to test whether CAR serves as a moderator. Results showed that Credit Risk is negatively associated with profitability and is statistically significant. Income Diversification and LCR also showed negative associations with profitability and were statistically significant. Additionally, CAR moderated the relationship between Credit Risk, Income Diversification, and LCR and profitability. The positive interaction coefficient indicated that higher CAR will reduce the negative effects of each of the above-mentioned variables on profitability. This indicates that managing Credit Risk, diversifying income streams, managing liquidity, and having sufficient capital can help maintain bank profitability.*

Keywords: *Credit Risk, Income Diversification, Liquidity Coverage Ratio, Capital Adequacy Ratio, Profitability*.

I. INTRODUCTION

Banks play an important role in the economy through their intermediation function of collecting and channeling funds to the public. In performing this function, banks are exposed to various risks that may affect their ability to generate profits. One of the indicators used to measure bank performance is profitability, which is proxied by Return on Assets (ROA). Bank profitability may be influenced by credit quality, income structure, and the ability to maintain liquidity. Therefore, effective credit risk management, income diversification, and liquidity management are important for maintaining bank financial performance.

Credit risk represents a significant risk that arises through banks' role in providing financial services. As credit risk increases, represented by an increasing non-performing loan (NPL) ratio, there will be higher levels of potential credit loss and greater need for provisions for loan losses, which could ultimately lead to lower profits. Previous research indicates that higher levels of credit risk negatively affect banks' profitability (Kwashie et al., 2022; Muthoharoh & Pambekti, 2024). However, there is some disagreement among researchers about whether or not income diversification contributes positively or negatively to banks' profitability. Rahmawati and Mardanugraha (2023) identified that aggregate income diversification had a detrimental impact on ROA and ROE, while Susanto et al. (2024) indicated that total revenue diversification had a positive relationship with profitability; however, they also identified that a larger percentage of total income derived from non-interest sources was negatively correlated with profitability. Therefore, the findings regarding the relationship between income diversification and bank profitability continue to differ.

Liquidity is another factor to consider, as banks are required to be able to pay off short-term debts without reducing their capacity to produce revenue. The Liquidity Coverage Ratio (LCR) measures whether a bank has enough high-quality liquid assets to handle any immediate cash needs. A larger LCR will increase a bank's ability to resist liquidity problems. However, it can also lead to an opportunity cost, as most liquid assets produce less income than productive ones. Vu (2024) discovered a nonlinear relationship (an upside-down U shape) between the LCR and profitability. On the other hand, Sidhu et al. (2022) stated that complying with LCR requirements could negatively impact Net Interest Margins. These results suggest that the connection between liquidity and profitability continues to be a relevant area of study.

The fourth variable used in this study to measure the impact on a bank's ability to take on risk and maintain its business activities is the Capital Adequacy Ratio (CAR). Prior research has focused primarily on how CAR influences financial performance. However, there has been very little research conducted on CAR as a moderating factor in the relationship between

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credit risk, income diversification, liquidity, and profitability. There has also been very little research that integrates all three variables into one model with CAR as a moderating variable. Thus, there is the potential to investigate whether capital adequacy influences the relationships between credit risk, income diversification, liquidity, and profitability of a bank.

Based on these phenomena and the identified research gap, this study aims to examine the effects of Credit Risk, Income Diversification, and Liquidity Coverage Ratio on bank profitability and to test the moderating role of Capital Adequacy Ratio among commercial banks listed on the Indonesia Stock Exchange during 2020–2024.

II. LITERATURE REVIEW

A) Hypotheses Development

a. Effect of Credit Risk on Profitability

Credit Risk is the risk arising when borrowers are unable to fulfill their obligations to the bank. In this study, Credit Risk is proxied by the Non-Performing Loan (NPL) ratio. An increase in NPL indicates deteriorating credit quality, which may increase potential credit losses and provisioning requirements, thereby reducing bank income and profits. Muthoharoh and Pambekti (2024) and Kwashie et al. (2022) found that higher credit risk tends to reduce bank financial performance. Therefore:

H1: Credit Risk has a negative effect on profitability.

b. Effect of Income Diversification on Profitability

Diversification of revenue streams is an approach used by banks to generate revenue through different means; i.e., both interest-based revenues and non-interest-based revenues. Revenue stream diversification can help banks to lessen their reliance on traditional intermediation-based revenues. On the other hand, engaging in non-interest-based revenue generation can create more operational complexity, cost and risk. Thus, revenue stream diversification may not result in higher profitability. Rahmawati and Mardanugraha (2023) demonstrated that overall diversification of revenue streams negatively affects return on assets (ROA) and return on equity (ROE), whereas Susanto et al. (2024) indicated that there could be variation in the effects of revenue stream diversification on profitability depending on which types of revenues are included in the analysis.

H2: Income Diversification has a negative effect on profitability.

c. Effect of Liquidity Coverage Ratio on Profitability

The Liquidity Coverage Ratio (LCR) measures the degree of confidence in a bank's ability to satisfy its immediate funding requirements by using its portfolio of high-quality liquid assets (HQLA). A higher LCR would enhance the bank's ability to withstand short-term funding pressures, but a greater amount of liquid assets on hand could limit the amount of capital available for investment in higher-yielding assets. Therefore, there exists a potential conflict between the need for financial stability and the goal of achieving maximum profits. Vu (2024) observed a non-linear relationship between the LCR and a bank's profitability, while Sidhu et al. (2022) suggested that banks with high levels of compliance with the LCR rules will likely experience lower net interest margins.

H3: Liquidity Coverage Ratio has a negative effect on profitability.

d. Moderating Role of Capital Adequacy Ratio in the Relationship between Credit Risk and Profitability

The Capital Adequacy Ratio (CAR) reflects a bank's capital capacity to absorb the risks it faces. When a bank has a higher level of capital adequacy, the negative effect of increased credit risk on profitability may be contained because the bank has a larger capital buffer to absorb potential credit losses. Accordingly, CAR is expected to reduce the magnitude of the negative effect of Credit Risk on Profitability. Therefore:

H4: Capital Adequacy Ratio moderates the effect of Credit Risk on Profitability.

e. Moderating Role of Capital Adequacy Ratio in the Relationship between Income Diversification and Profitability

Income diversification may increase the complexity of banking activities and generate additional costs and risks. Banks with higher capital adequacy have greater capacity to absorb risks arising from more diversified income-generating activities. Accordingly, capital adequacy may reduce the negative effect of income diversification on profitability. Therefore:

H5: Capital Adequacy Ratio moderates the effect of Income Diversification on Profitability.

f. Moderating Role of Capital Adequacy Ratio in the Relationship between Liquidity Coverage Ratio and Profitability

An increase in LCR may create an opportunity cost because a portion of bank assets is held in relatively less productive liquid assets. However, banks with higher CAR have stronger capital capacity to absorb risk and maintain flexibility in asset and liquidity management. This condition may reduce the negative effect of LCR on profitability. Therefore:

H6: Capital Adequacy Ratio moderates the effect of Liquidity Coverage Ratio on Profitability.

g. Research Variables and Operational Definitions

The dependent variable used in this research is profitability. Profitability can be defined as how well a bank is able to produce profit with the use of the assets or resources that it possesses. This research defines profitability through the use of ROA, which represents the extent to which a bank produces profit with the use of all of its available assets. Therefore, a higher ROA would indicate that a bank has a better capacity to produce profit with the use of its available assets. Credit Risk can be defined as the risk associated with a borrower being unable to meet their obligation to pay off a loan according to the terms of a credit agreement. This research defines Credit Risk through the use of the NPL ratio, which represents the percentage of non-performing loans in relation to the total amount of loans made by a bank. Thus, a higher NPL ratio would represent a higher level of Credit Risk experienced by a bank. Income Diversification can be defined as a method employed by a bank to create income from various types of activities, such as both interest-based and non-interest-based activities. This research utilizes a Herfindahl-Hirschman Index (HHI)-based diversification index to measure Income Diversification based on the percentages of interest income and non-interest income created in comparison to the overall amount of operating revenue generated.

$$DIV = 1 - [(\frac{INT}{TOR})^2 + (\frac{NON}{TOR})^2]$$

DIV = Income Diversification
INT = Interest income
NON = Non-interest income
TOR = Total operating revenue (INT + NON)

The Liquidity Coverage Ratio (LCR) is a measure that shows whether a bank has enough high-quality liquid assets (HQLA) to cover its expected net cash outflows over a given period of time, in order to continue operating even if there are severe market conditions. This research measures how well a bank can maintain an adequate level of liquidity to fulfill all net cash outflow requirements. Banks with higher LCRs have a better capacity to fulfill their short-term liquidity needs.

The Capital Adequacy Ratio (CAR) is a ratio that shows the capability of a bank to have enough capital to cover all the risks that are associated with the operation of the bank. This study will use CAR as a moderating variable to see if there is an effect of capital adequacy on the relationship between Credit Risk, Income Diversification and Liquidity Coverage Ratio and profitability. Banks with a higher CAR have more available capital to absorb possible losses and to help them deal with the risks that the bank faces.

h. Data Analysis Technique

This study employs panel data regression using Moderated Regression Analysis (MRA) to examine the effects of Credit Risk, Income Diversification, and Liquidity Coverage Ratio (LCR) on profitability and the moderating role of Capital Adequacy Ratio (CAR). MRA is used to analyze the interaction effects between each independent variable and CAR on Profitability through the construction of interaction terms, namely Credit Risk × CAR, Income Diversification × CAR, and LCR × CAR. This approach allows the study to evaluate the direct effects of Credit Risk, Income Diversification, and LCR on Profitability while testing whether CAR moderates the relationships between these variables and profitability.

B) Research Framework

$$ROAit=\alpha+\beta1CRit+\beta2IDit+\beta3LCRit+\beta4CARit+\beta5(CRit\times CARit)+\beta6(IDit\times CARit)+\beta7(LCRit\times CARit)+\varepsilon it$$

Where:

ROA = Bank profitability, proxied by Return on Assets (ROA)
α = Constant
β = Regression coefficient
CR = Credit Risk, proxied by Non-Performing Loans (NPL)
ID = Income Diversification
LCR = Liquidity Coverage Ratio
CAR = Capital Adequacy Ratio
CR × CAR = Interaction between Credit Risk and Capital Adequacy Ratio
ID × CAR = Interaction between Income Diversification and Capital Adequacy Ratio
LCR × CAR = Interaction between Liquidity Coverage Ratio and Capital Adequacy Ratio
ε = Error term
i = Bank number-i
t = Research Period t

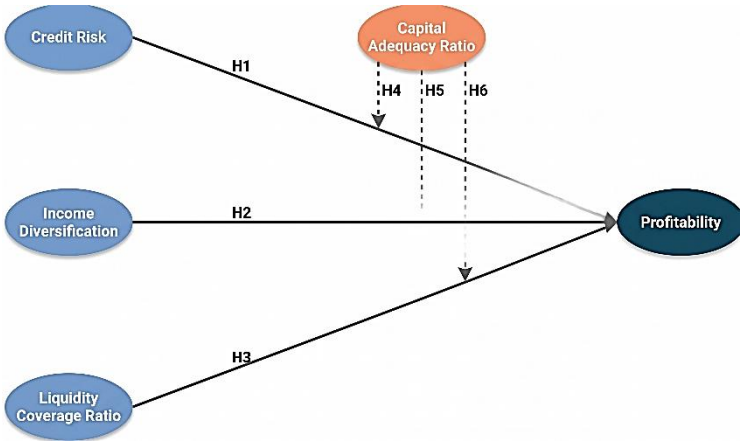


Figure 1. Research Framework

Source: *Literature Review (2026)*

III. RESULTS AND DISCUSSION

A) Coefficient of Determination

The coefficient of determination is used to assess the ability of the independent and moderating variables to explain variation in profitability. The model incorporating the moderating variables produces an Adjusted R-squared of 0.164588.

Table 1: Regression Correlation Coefficient

Description	Value
Rsquare	0,191914

Source: *Processed Data, (2026)*

B) Individual Parameter Significance Test (t-Test)

Multiple linear regression analysis was conducted to determine whether the independent variables affect the dependent variable. Table 2 presents the multiple linear regression results for the study data:

Table 2: Results of the t-Test for Model with Moderating Variable

Variables	Coefficient	t-Statistic	Prob.
Credit Risk	-2.124325	-2.821556	0.0052
Income Diversification	-27.310220	-2.415842	0.0166
LCR	-0.051591	-2.995310	0.0031
Credit Risk × CAR	0.076979	2.371321	0.0186
Income Diversification × CAR	1.354256	2.675669	0.0081
LCR × CAR	0.001995	2.622417	0.0094

Source: *Processed Data (2026)*

All variables in the model have probability values below 0.10. The interpretation of each relationship is presented below.

C) Effect of Credit Risk on Profitability

The results show that the variable Credit Risk has a negative coefficient of -2.124325, with a probability value of 0.0052. Since the negative coefficient means there is an opposite relationship between Credit Risk and Profitability, and the probability value is less than 0.10, this relationship is statistically significant. The results suggest that increases in Credit Risk, represented by NPL, relate to decreases in bank Profitability. When banks have more NPLs, they can experience higher possible credit losses and additional provisioning needs, and their productive assets can lose their capacity to produce income. These circumstances can limit the ability of banks to produce earnings. The result is comparable to Kwashie et al. (2022), who found that NPL negatively impacts ROA. Also, the result is similar to Muthoharoh and Pambekti (2024), who stated that higher levels of credit risk negatively affect bank financial performance. Therefore, the hypothesis (H1) that Credit Risk negatively affects profitability is supported.

D) Effect of Income Diversification on Profitability

The negative sign of the coefficient for Income Diversification (-27.310220) and the low p-value (0.0166) suggest that Income Diversification has a negative and statistically significant impact on profitability. This implies that there is no automatic benefit to profitability from diversifying the types of income generated by a bank. Diversifying income sources will typically involve increasing operational complexity, increasing operating expenses, and adding risk through the management of non-

traditional income-generating functions. Therefore, whether a bank realizes benefits from income source diversification depends on its capacity to manage those income sources efficiently. This result aligns with Rahmawati and Mardanugraha (2023), who concluded that Income Diversification as a whole had a negative impact on ROA and ROE, while observing variations in effects across different capital group levels of banks. On the other hand, Susanto et al. (2024) observed that total revenue diversification had a positive effect on profitability, while the ratio of non-interest income had a negative effect. These variations in results point out that the effects of diversification on profitability could vary based upon the nature and composition of a bank's income sources. As such, H2 is supported, suggesting that Income Diversification has a negative effect on profitability.

E) Effect of Liquidity Coverage Ratio on Profitability

The results indicated that LCR was negatively and significantly related to profitability (coefficient = -0.051591, p-value = 0.0031). This negative association indicates a trade-off between the level of liquidity resilience and the bank's capability of generating profits. Higher LCR levels suggest that banks are able to retain sufficient amounts of high-quality liquid assets to satisfy their liquidity needs. However, retaining large sums of money in liquid assets may limit the opportunity to use those same funds to acquire productive assets, which can produce higher rates of return. The results obtained are similar to those reported by Sidhu et al. (2022), as they also stated that complying with LCR standards would lower NIM due to a narrowing interest spread. Conversely, Vu (2024) discovered a nonlinear relationship between LCR and Profitability in the shape of an inverted U; therefore, there may be variations in how LCR affects profitability depending on the degree of liquidity held by the institution. Accordingly, H3 is supported, indicating that LCR has a negative effect on profitability.

F) Moderating Effect of CAR on the Relationship between Credit Risk and Profitability

The interaction between Credit Risk and CAR has a coefficient of 0.076979 with a probability value of 0.0186. Because the probability value is below 0.10, the Credit Risk × CAR interaction is statistically significant in explaining profitability. The positive interaction coefficient indicates that a higher CAR reduces the magnitude of the negative effect of Credit Risk on Profitability. In other words, when a bank has a higher level of capital adequacy, the negative effect of Credit Risk on Profitability becomes relatively smaller. This finding indicates that stronger capitalization provides banks with greater capacity to absorb potential losses arising from credit risk. Accordingly, H4 is supported, indicating that CAR moderates the effect of Credit Risk on Profitability.

G) Moderating Effect of CAR on the Relationship between Income Diversification and Profitability

The effect of the interaction of Income Diversification and CAR on Profitability has a p-value of 0.0081 and is represented by the coefficient of 1.354256; this means the interaction is statistically significant as a predictor of profitability. The positive coefficient of the interaction represents the fact that as CAR increases, the negative effect of Income Diversification on Profitability decreases. Therefore, the greater capital adequacy of a bank allows it to better handle the complexities and risks associated with having multiple sources of revenue generation. This finding implies that when looking at how diversification impacts profitability, researchers should examine the bank's capital capacity as well. Banks that diversify their revenues and have strong capital positions will likely experience different outcomes regarding profitability than those that diversify their revenues and have limited capital capacity. Based on these results, H5 is supported; therefore, CAR influences the impact of Income Diversification on Profitability.

H) Moderating Effect of CAR on the Relationship between LCR and Profitability

The interaction of LCR and CAR has a coefficient of 0.001995 with a probability value of 0.0094, which suggests that the interaction of LCR and CAR (LCR x CAR) is a significant factor in explaining the profitability of banks. A positive interaction coefficient means that as CAR increases, the negative impact of LCR on Profitability decreases. Banks that have higher levels of Capital Adequacy will be able to manage their liquidity requirements, continue to lend money and produce, and therefore will have more flexibility in addressing liquidity issues. Therefore, Capital Adequacy could be a factor that influences the relationship between liquidity and profitability. The findings show that the effect of an increase in the amount of a bank's liquidity buffer on profitability is affected by both the level of the LCR as well as the bank's ability to maintain capital. This finding supports H6, as CAR moderates the effect of LCR on Profitability.

IV. CONCLUSION

This research investigates how Credit Risk, Income Diversification, and Liquidity Coverage Ratio (LCR) impact profitability. Capital Adequacy Ratio (CAR) serves as a moderating factor for this relationship. A total of 43 commercial banks were selected from those listed on the Indonesia Stock Exchange during the period of 2020 to 2024. Profitability was measured through Return on Assets (ROA), whereas Credit Risk was measured through Non-Performing Loans (NPL). Panel Data Regression with Moderated Regression Analysis (MRA) was utilized in the analysis. Based on the findings, Credit Risk, Income Diversification, and LCR all have a negative effect on profitability and are statistically significant. Furthermore, CAR moderates the relationship between Credit Risk, Income Diversification, LCR, and Profitability. The positive interaction coefficient suggests that an increase in capital adequacy will reduce the negative effect of the other three variables on profitability.

There are some limitations to this research. One limitation is that the data were collected only from commercial banks listed on the Indonesian Stock Exchange (IDX) between 2020 and 2024; therefore, the results may not apply to all of the banking industry as well as the entire financial sector. Another limitation is that the study focused on Credit Risk, Income Diversification, LCR, and CAR as determinants of profitability. An adjusted R-squared value of 16.46% indicates that a significant amount of variance in profitability is determined by variables other than those included in the model. Additionally, the study period (2020-2024) included the Covid-19 pandemic and its aftermath. Therefore, it is possible that the economic climate and the performance of the banking industry during this time frame affected how the relationships between the various variables were manifested.

Banks should manage credit risk, income diversification, liquidity and capital adequacy as part of a single strategy to maximize profits. Researchers should include other variables affecting profits in future studies, as well as use longer time frames and analyze banks according to their capital levels or type of business model. It would be helpful to apply more sophisticated analytical techniques to examine the possibility of non-linear relationships between liquidity and profits.

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