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The Impact of Credit Risk, Capital Adequacy, Liquidity, and Efficiency on Return on Assets in Indonesian Banking

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A B S T R A C T

This study aims to determine the effect of credit risk, capital adequacy, liquidity and efficiency on return on assets of banks in Indonesia with the control variable bank size. This research was conducted at Conventional Commercial Banks listed on the Indonesia Stock Exchange for the period 2019 to 2023. The research population is the annual report of conventional banks in Indonesia so that the number of samples obtained is 37 banks using purposive sampling method. The analysis method used is data panel analysis. The results showed that credit risk has no effect on return on assets, capital adequacy has no effect on return on assets, liquidity has a significant positive effect on return on assets, efficiency has a significant positive effect on return on assets and bank size has an effect on return on assets. The managerial implications of this study indicate that despite increased credit risk, banks in Indonesia can still maintain profitability through strengthening risk management, optimizing capital utilization, balanced liquidity management, improving operational efficiency, and strategically managing bank size growth. The novelty of this research lies in its use of the most recent period covering the pandemic and recovery phase, as well as the integration of key banking indicators into a comprehensive empirical model. Managerial implications highlight the need for strengthening liquidity management, enhancing operational efficiency, and optimizing bank scale to maintain profitability in a dynamic economic environment.

INTRODUCTION

Economic growth is closely related to the role of banking, as banking is an important indicator for a country. Good banking performance reflects the overall economic health of a country. With the advancement of time, people are increasingly involved in various payment transactions, both directly and indirectly, which always involve the role of banking. Therefore, the banking sector continues to strive to meet the needs of the community by providing a variety of services that facilitate financial transaction processes. Based on Law Number 10 of 1998 article 1 paragraph 2, a bank is a business entity that functions to collect funds from the public in the form of deposits and channel them back in the form of credit to improve the welfare of the community. Banks are known as financial intermediaries because their main task is to collect funds from those who have excess funds and channel them to those who need them (SUMARNI, 2021). Funds can be collected from the public through products such as checking accounts, savings accounts, deposits, and initial capital contributions for the establishment and development of banks. Meanwhile, funds are channeled through credit facilities to those who need them.

Banking performance can be improved by the bank's ability to earn profits effectively and efficiently from fund collection and fund distribution activities. It is important for banks to maintain their profitability stability in order to fulfill their obligations to shareholders, increase investor confidence to invest, and strengthen public confidence in depositing their surplus funds in banks. Based on bank health assessments and Bank Indonesia Regulation No. 6/10/PBI/2004 concerning the Commercial Bank Health Assessment System, it is stated that if the health of a financial institution improves, its performance is also expected to improve, thereby supporting the reputation of banks, especially those listed on the Indonesia Stock Exchange (Irawati & Ismadi, 2019). A bank's financial performance can be seen from its income (Irawati & Ismadi, 2019). This study uses ROA to see a bank's ability to earn profits by utilizing its total assets (Ikatan Bankir Indonesia, 2015). The higher a bank's ROA, the greater the level of profit achieved by the bank because it is able to stabilize the bank's position in terms of assets s (Irawati & Ismadi, 2019). Banks with stable or increasing ROA are a positive indicator for banks, both in attracting deposits from the public and in providing loans, because it shows that the bank has profitability and sound financial management. (Praja & Hartono, 2019). In BI SE No. 20/4/PBI/2018, in determining the level of bank health, Bank Indonesia places more importance on the use of Return on Assets (ROA) because Bank Indonesia prioritizes the profitability of a bank as measured by assets, most of which come from public deposits. Banks with stable or increasing ROA values show positive prospects for the future, as this indicates the bank's potential to generate profits, thereby attracting the public to deposit and demand funds because the bank has a high rate of return. To that end, the researcher conducted a search of Indonesian Banking Statistics data related to banking performance as seen from the Return on Assets side at conventional commercial banks nationally during the research period, namely 2019 to 2023, as follows:

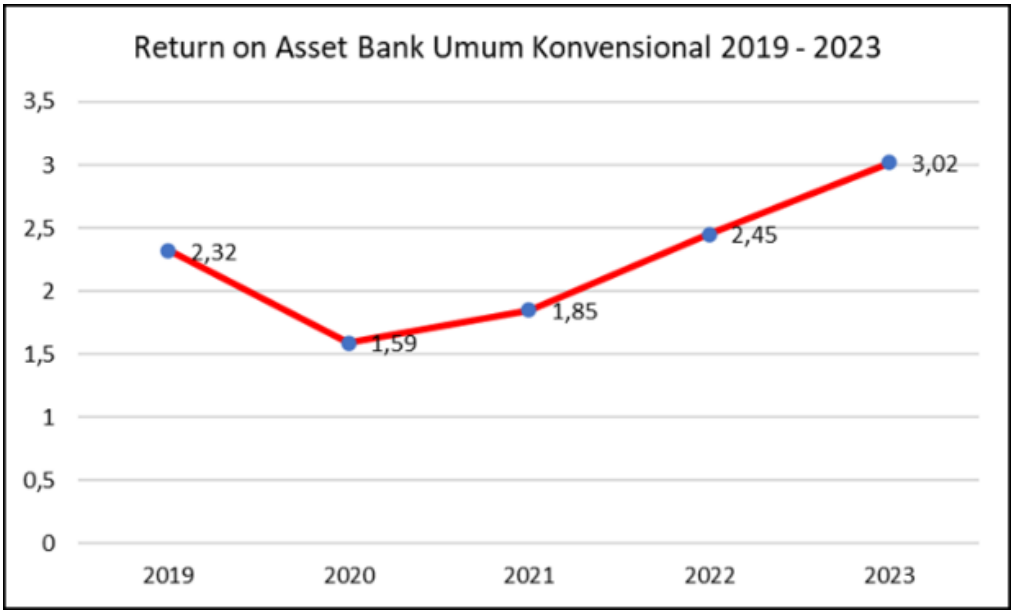

Figure 1. Return on Assets of Conventional Commercial Banks for the Period 2019–2023
Source: Indonesian Banking Statistics (2024)

Based on Figure 1. above, Return on Assets (ROA) decreased from 2.32% in 2019 to 1.59% in 2020 due to economic conditions affected by the COVID-19 pandemic in early 2020, which put pressure on the global economy, including the Indonesian economy. Data from the Central Statistics Agency (BPS) shows that in August 2020, Indonesia's economic growth in the second quarter of 2020 was negative and had a negative impact on almost all industrial sectors in Indonesia, one of which was the banking sector (Seto & Septianti, 2021). This also caused a decline in interest income, which is the main source of bank revenue. However, ROA began to increase again afterwards, reaching 1.85% in 2021, then 2.45% in 2022 and 3.02% in 2023, indicating a strong recovery in banking performance.

The author conducted a search of Indonesian Banking Statistics data to identify the banking risks in conventional commercial banks nationwide that occurred from 2019 to 2023 to strengthen the background of this study, as follows:

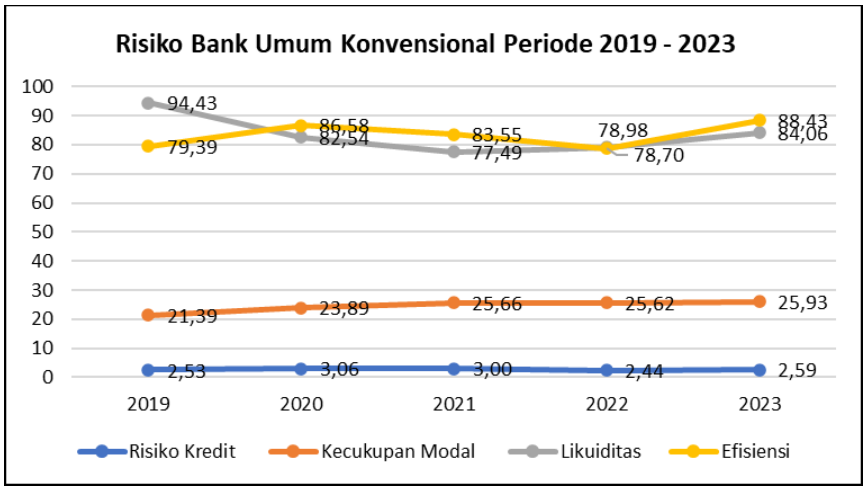

Figure 2 Risks of Conventional Commercial Banks for the Period 2019 - 2023
Source: Indonesian Banking Statistics (2024)

Based on Figure 2 above, it can be seen that there were fluctuating changes in conventional commercial bank risks during the 2019-2023 period. Credit risk increased in 2019 from 2.53% to 3.06% in 2020, indicating an increase in credit risk. However, NPL then gradually decreased to 3.00% in 2021, 2.44% in 2022, and 2.59% in 2023, indicating an improvement in credit quality. In addition, the adequacy of bank capital continued to increase from 21.39% in 2019, 23.89% in 2020, 25.66% in 2021, 25.62% in 2022, and 25.93% in 2023. This shows that banks are strengthening their capital position to deal with potential risks. Liquidity declined in 2020 to 82.54%, possibly due to banks' caution in lending during the Covid-19 pandemic. However, in 2021, the LDR decreased to 77.49%. However, the LDR increased again in 2022 to 78.98% and reached 84.06% in 2023, indicating an increase in lending activity. Operating Expenses to Operating Income, which shows an indicator of operational efficiency, increased in 2020 from 79.39% to 86.58%, reflecting a decline in bank operational efficiency during the pandemic. After that, despite a decline in 2021 and 2022, BOPO rose again to 88.43% in 2023, indicating challenges in controlling operating costs. Overall, banking performance in the 2019-2023 period shows a significant impact from external conditions, particularly the pandemic, but also shows strong recovery efforts in various aspects.

The development of banking is very evident when there are unstable economic conditions, as shown in Figures 1 and 2. Therefore, banking performance still needs special attention and further research to achieve more optimal banking performance. In implementing risk management, banks must be able to identify risks and understand all inherent risks (Ikatan Bankir Indonesia, 2014). Risk management is an effort to manage risks so that opportunities for profit can be realized in a sustainable manner. Risk management is an effort to manage risks so that opportunities for profit can be realized in a sustainable manner. Referring to OJK Regulation Number 18/POJK.03/2016 and OJK Circular Letter Number 34/SEOJK.03/2016 concerning the Implementation of Risk Management for Commercial Banks, there are eight risks that banks must manage, namely credit risk, market risk, operational risk, liquidity risk, compliance risk, legal risk, reputational risk, and strategic risk.

The first aspect to be discussed is credit risk. Credit risk is the risk of loss due to the failure of a counterparty to fulfill its obligations (Rohmiati et al., 2019). The second aspect is capital adequacy. Capital is one of the important variables as a measure of a bank's success. The third aspect is liquidity. Liquidity in this study is proxied using the Loan to Deposit Ratio (LDR). LDR refers to the total loans disbursed by banks to third parties divided by total Third Party Funds (TPF). The fourth aspect is Efficiency. Banking operational efficiency is the ability of banks to produce maximum output in line with expected performance and results.

This study is a reference from a study entitled "Do Firm-Specific Risks Affect Bank Performance?" conducted by (Hunjra et al., 2020). The differences from the previous study are the different time periods, namely, first, this study covers the years 2019 to 2023. Second, this study only uses Return on Assets (ROA) as a measure to assess banking financial performance. Third, this study was only conducted on conventional commercial banks listed on the Indonesia Stock Exchange.

The contribution of this study is the addition of capital adequacy variables proxied by the Capital Adequacy Ratio (CAR) and efficiency proxied by BOPO (Operating Expenses to

Operating Income). By adding CAR and BOPO as variables, this study will be more comprehensive because these two variables are important indicators that affect the profitability, stability, and operational efficiency of banks. This helps strengthen the analysis of how credit and liquidity risk factors, which have been analyzed previously, can affect banking financial performance in a broader context. Therefore, researchers are interested in analyzing the influence of other supporting variables on banking financial performance in Indonesia during the research period from 2019 to 2023.

Several findings from previous studies indicate the existence of research gaps and certain phenomena, thus necessitating further research to identify factors that may affect banking performance in Indonesia during the period 2019 to 2023. The author is interested in examining the determinants of banking profitability due to the persistent inconsistencies found in prior empirical studies, which create both theoretical and practical research gaps. First, credit risk theory suggests that higher levels of non-performing loans should reduce profitability because of increased impairment costs; however, several empirical studies have reported insignificant or even positive effects, indicating that banks may be able to offset rising credit risk through effective provisioning or collateral management. Second, capital adequacy theory argues that stronger capital buffers enhance financial stability and support profitability, yet contradictory findings show that higher capital levels do not always translate into improved returns, implying inefficiencies in capital allocation or underutilized lending capacity. Third, liquidity management theory posits that optimal liquidity strengthens profitability by supporting effective intermediation, but empirical results remain mixed—some studies suggest that excess liquidity depresses returns due to idle funds. Fourth, efficiency theory traditionally maintains that lower operational costs improve financial performance; however, differences in cost structures, ongoing digital transformation, and post-pandemic operational adjustments have produced divergent empirical outcomes. These theoretical contradictions underscore the need for an updated empirical investigation using recent data, particularly because the 2019–2023 period encompasses both the economic shock of the COVID-19 pandemic and the subsequent recovery phase. Such analysis is essential to obtain a clearer understanding of how key financial indicators influence banking performance within the Indonesian context.

According to (Godfrey et al., 2010), this refers to signals given by companies to external parties to reveal their future prospects. This theory covers two types of signals, namely positive and negative signals. These signals can provide an overview or information that shows that a company has superior performance compared to its competitors. This can influence the views and assessments of external parties towards the company. Therefore, in this study, signaling theory is used as a basis for explaining the impact of credit risk, capital adequacy, liquidity, and efficiency on banking performance in Indonesia. Signaling theory emphasizes the importance of information presented in financial reports. Financial reports reflect the current and future conditions of a company, so they must be presented in a complete and relevant manner. One important piece of information presented is the company's profit, which can be seen in the income statement. This reported information is very important to support investment decision-making. According to (Godfrey et al., 2010), when reports show positive signals, companies tend to report their performance accurately. However, if the signals shown are negative,

companies tend to delay reporting their performance. Therefore, the signaling theory in corporate performance reporting can affect profitability, as positive and negative signals will impact external parties' views of the company. More recent studies reinforce the relevance of signalling theory in understanding corporate and banking performance. Azmi et al. (2019) highlight profitability ratios as strategic signals that attract investor confidence, while Nguyen & Bui (2020) show that liquidity levels function as stability signals in the banking sector. Rahman & Ismail (2021) demonstrate that capital adequacy disclosures serve as resilience signals during periods of economic uncertainty, and (Hossain & Miah, 2023) find that transparent credit risk reporting can influence investor reactions positively or negatively depending on the quality of disclosure.

According to Law Number 10 of 1998 (revision of Law Number 7 of 1992), a bank is a business entity that collects funds from the public in the form of deposits and distributes them to the public in the form of credit with the aim of improving the welfare of the people. The first banking activity is collecting funds from the general public, commonly known as funding. Banks collect funds from the public by implementing various strategies to encourage people to invest their funds in the form of deposits (checking accounts, savings accounts, time deposits, and certificates of deposit).

Performance is an important parameter for the banking sector because it can measure the level of success of banks resulting from funding and lending activities and can be used as a basis for comparison for future periods as a reference for evaluating banking performance. This states that banking performance is a measurement indicator used to assess the extent to which a company is able to generate profits during a certain period by managing the assets and capital owned by the bank. Good bank performance will improve interbank qualifications and increase the trust of the public and external parties. The reason for using ROA is because bank performance is related to the total net income achieved from the assets used to achieve banking profitability (Sparta, 2017). Each bank group will produce different ROAs due to competition between banks, especially among similar banks. Thus, external parties will see how well the bank manages its assets to generate profits.

The banking sector in Indonesia has experienced various economic cycles, both progress and decline. On January 9, 2004, Bank Indonesia launched the Indonesian Banking Architecture (API) as a comprehensive framework for the direction of policy development for the Indonesian banking industry to be more advanced in the future. The API establishes six pillars as a program to create a healthy banking industry, one of which is to create a strong and highly competitive banking industry that is resilient in the face of risk. This is in line with the pillar, which means that the application of risk management in banking is very important in creating a healthy and integrated banking industry (Ikatan Bankir Indonesia, 2014). OJK Regulation Number 18/POJK.03/2016 and OJK Circular Letter Number 34/SEOJK.03/2016 explain that the application of risk management for commercial banks in bank operational activities involves eight risks, namely market risk, credit risk, liquidity risk, operational risk, compliance risk, strategic risk, legal risk, and reputational risk.

According to (Saunders & Cornett, 2017), "credit risk is the risk that the promised cash flows from loans and securities held by financial institutions may not be paid in full". Credit risk is

the risk of a debtor's failure to fulfill their obligation to repay a loan to a bank. Credit risk in this study is proxied using Non-Performing Loans (NPL). NPL is the ratio of non-performing loans to total loans. NPLs are non-current loans or bad debts that are not followed by repayment of the principal or as required in the loan agreement. The reason for using NPL is that NPL itself is classified as a non-performing loan that falls into category 3 (substandard), 4 (doubtful), and 5 (loss) (Jarwani et al., 2023).

Capital adequacy, commonly referred to as the Capital Adequacy Ratio (CAR), is a ratio that shows the extent to which all of a bank's risk-bearing assets (loans, investments, securities , and receivables from other banks) are financed from the bank's own capital, in addition to funds obtained from sources outside the bank. CAR is an indicator of a bank's ability to cover a decline in its assets as a result of losses caused by risky assets (Hunjra et al., 2020).

According to (Subramanyam, 2014) "liquidity is the ability to convert assets into cash or to obtain cash to meet short-term obligations". According to (Saunders & Cornett, 2017) "liquidity risk is generally defined as the risk that a financial institution will be unable to meet its short-term financial obligations when they come due, without incurring unacceptable losses". Liquidity risk is a financial ratio that describes liquidity indicators and/or measures a bank's ability to meet its obligations. Liquidity risk can be caused by a bank's inability to generate cash flow from productive assets or from the sale of assets, including liquid assets, or from public fund collection, interbank transactions, or loans received (Ikatan Bankir Indonesia, 2015).

In carrying out its operational activities, banks incur interest expenses and overhead costs (Ikatan Bankir Indonesia, 2015). Bank efficiency can be explained as the minimum cost at which a bank can produce output with the actual costs incurred by the bank (Sparta, 2017). Banking efficiency is divided into two types, namely technical efficiency and allocative efficiency (Sparta, 2017). Efficiency is proxied using a traditional approach to measuring efficiency, namely the Cost to Income Ratio (CIR), which can be measured using operating costs against operating income. BOPO is a ratio that describes the comparison between operating costs and operating income. Operating costs are measured based on the total interest expense and total operating expenses. Meanwhile, operating income is measured based on the total interest income and other operating income (Jarwani et al., 2023)

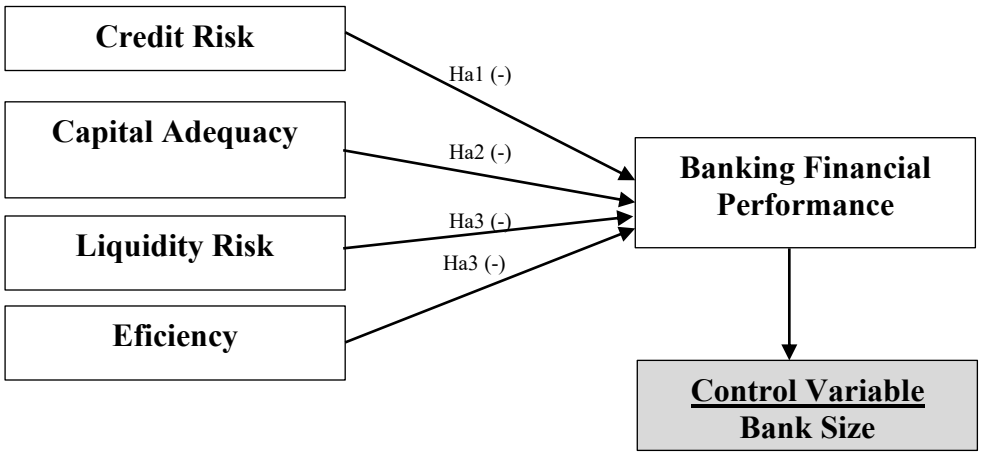

Figure 3. Conceptual Framework

According to (Million et al., 2015), Non-Performing Loans (NPLs) are one of the indicators commonly used to measure credit risk. NPLs describe the extent to which loans have the potential to cause default risk. Currently, loans dominate banks' productive assets, while the main source of bank funding comes from third-party funds. Therefore, if there is a significant increase in credit risk, it will have an impact on bank profitability and lower the bank's health rating (Ikatan Bankir Indonesia, 2015). The lower the NPL ratio, the greater the profits that can be obtained by banks. Conversely, if the NPL ratio increases, bank profits will decrease. This shows that banks suffer losses due to bad or uncollectible loans, which ultimately reduce profits.

Research conducted by (Million et al., 2015), (Cahyani & Amirudin, 2024), (Kinanti & Putra, 2024) and (Sadie & Nyale, 2024) states that credit risk proxied using NPL has a negative effect on ROA. Furthermore, this is in line with the research on the , according to (Abiola & Olausi, 2014), (Anindiansyah et al., 2020), (Hunjra et al., 2020), and (Sari et al., 2024), which has a positive effect on ROA. Therefore, the hypothesis used in this study is: **H1: Credit risk has a negative effect on return on assets in Indonesian banks for the period 2019–2023**

Capital adequacy in this study is measured by the Capital Adequacy Ratio (CAR), which indicates a bank's ability to maintain sufficient capital and the ability of bank management to identify, measure, monitor, and control risks that may affect the amount of bank capital (Kessek et al., 2024). Therefore, the higher the CAR, the better the company is able to manage its capital in order to finance risky assets, thereby minimizing losses. The ideal figure or value set for the CAR ratio is a minimum of 8%. This is because if the CAR ratio is less than 8%, it indicates that the management of the bank is not performing well in managing capital properly in order to finance risky assets, thereby minimizing losses (Septiana et al., 2024).

Research conducted by (Febriyanti et al., 2023), (Azizah, 2024) and (Kessek et al., 2024) states that capital adequacy proxied using CAR has a positive effect on ROA. Meanwhile, research conducted by states that capital adequacy proxied using CAR, (Sparta, 2017), (Pinasti & Mustikawati, 2018), (Sadie & Nyale, 2024), and (Kinanti & Putra, 2024) has a negative effect on ROA. Therefore, the hypothesis used in this study is: **H2: Capital adequacy has a positive effect on return on assets in Indonesian banks for the period 2019–2023.**

LDR is an important indicator in measuring liquidity risk and plays an important role in maintaining the operational sustainability of banks. A high or low LDR ratio must be in accordance with the tolerance limits set by Bank Indonesia. The higher the LDR ratio, the greater the funds disbursed in the form of credit, which has the potential to increase interest income and maintain bank liquidity. Conversely, a low LDR indicates that the bank is experiencing difficulties in maintaining its liquidity, which could ultimately affect the bank's profitability.

Research conducted by (Irawati & Ismadi, 2019), (Sadie & Nyale, 2024) and (Sari et al., 2024) states that liquidity proxied using LDR has a positive effect on ROA. Meanwhile, research conducted by. (Abdurrohman et al., 2020), (Asysidiq & Sudiyatno, 2022), and (Kinanti & Putra, 2024) states that liquidity has a negative effect on ROA. Therefore, the hypothesis used in this study is: **H3: Liquidity has a positive effect on return on assets in Indonesian banks for the period 2019–2023**

This study of operational efficiency is measured using the ratio of operating expenses to operating income (BOPO). According to (Taswan, 2010), BOPO is a ratio that describes the comparison between operating expenses and operating income. The smaller the BOPO ratio, the more efficient the bank is in carrying out its activities, so that profits will increase because the bank is able to reduce operational costs. Conversely, if the BOPO ratio is larger, it indicates that the bank is inefficient in managing its available resources. This indicates that the bank's profits are declining.

Research conducted by (Sparta, 2017), (Irawati & Ismadi, 2019) and (Hunjra et al., 2020) states that operational efficiency proxied using BOPO has a positive effect on ROA. Furthermore, this is in line with the research according to (Ichsan et al., 2021) and (Parenrengi & Hendratni, 2018), which has a positive effect on ROA. Meanwhile, studies conducted by (Irawati & Ismadi, 2019), (Dae & Sidik, 2024), (Septiana et al., 2024) and (Yola & Satrianto, 2024) have a negative effect on ROA. The hypotheses used in this study are: **H4: Operational efficiency has a positive effect on return on assets in Indonesian banks for the period 2019–2023**

RESEARCH METHODS

The research object is conventional commercial banks listed on the Indonesia Stock Exchange (IDX) www.idx.co.id during the research period of 2019 to 2023, totaling 37 banks. This study uses four independent variables and one dependent variable, namely NPL, CAR, LDR, and BOPO, on the return on assets of banks in Indonesia. Additionally, there is a control variable, namely bank size. The research design used is quantitative research with a causality or cause-and-effect research method (Sanusi, 2017).

The type of data in this study is secondary data. Secondary data is data that is already available in the form of financial reports issued by companies. Secondary data can be obtained through Bank Indonesia, the banks' own websites, and the Indonesia Stock Exchange (IDX). The secondary data used to test credit risk, capital adequacy, liquidity, and efficiency are the financial reports of conventional commercial banks for the period 2019 to 2023.

The data collection method used in this study is documentation and literature study. The researcher used documentation data to analyze and collect data that was needed and relevant to this study. The documentation data method was taken from data published by the Indonesia Stock Exchange (IDX) through the website www.idx.co.id, the Financial Services Authority through the website www.ojk.go.id, Bank Indonesia through the website www.bi.go.id, and the banks' own websites. The literature study method is taken from journals, books, and internet research that contain various information relevant to the topic of this research. The data collected is financial report data from conventional commercial banks that have been audited for the 2019 to 2023 period.

The sampling technique used in this study is purposive sampling. The criteria for sampling are as follows: [1] Conventional commercial banks that are registered and report their financial statements audited by independent auditors during the research period, namely 2019–2023, on the Indonesia Stock Exchange. [2] Banks that had not conducted an Initial Public Offering (IPO) during the research period were excluded. [3] Non-conventional banks were excluded.

[4] Financial reports that presented all data required to calculate the variables during the observation period.

Table 1. Table of Variable Operationalization

VARIABLE	DEFINITION	MEASUREMENT	MEASUREMENT SCALE
DEPENDENT VARIABLE			
Return on Assets	A ratio that indicates a bank's ability to generate profits using its total assets	$ROA = \frac{Laba\ Bersih}{Total\ Aset}$ (Ross et al., 2022)	Ratio
INDEPENDENT VARIABLE			
Credit Risk	This ratio reflects the failure of debtors to fulfill their obligations to repay loans to banks by comparing non-performing loans with total loans granted	$NPL = \frac{Kredit\ Bermasalah}{Total\ Kredit}$ (Hunjra et al., 2020)	Ratio
Capital Adequacy	This ratio shows the extent to which all of the bank's risk-bearing assets (loans, investments, securities, receivables from other banks) are financed from the bank's own capital, in addition to funds obtained from sources outside the bank.	$CAR = \frac{Modal\ Bank}{ATMR}$ (Hunjra et al., 2020)	Ratio
Liquidity Risk	This ratio reflects a bank's ability to meet its obligations by comparing loans granted with funds received	$LDR = \frac{Kredit\ Yang\ Diberikan}{Dana\ Pihak\ Ketiga}$ (El-Chaarani et al., 2022)	Ratio
Efficiency	This ratio reflects the level of efficiency and the bank's ability in its operational activities	$BOPO = \frac{Total\ Beban\ Operasional}{Total\ Pendapatan\ Operasio}$ (Setiawan & Diansyah, 2018)	Ratio
CONTROL VARIABLES			
Bank Size	A scale of the size of a company based on total sales, total assets, total income, taxes, and employees. Bank size uses company size measurements.	$Bank\ Size = Ln\ (Total\ Aset)$ (Sparta, 2017)	Ratio

Sources: (Ross et al., 2022), Hunjra et al., 2020, El-Chaarani et al., 2022, Setiawan & Diansyah, 2018, Sparta, 2017

In this study, the researcher analyzed using descriptive statistics, panel data analysis, classical assumption tests, and hypothesis testing, as well as using Eviews 9, 2019 and Microsoft Excel software in data processing. To test the hypothesis, the explanation was carried out by applying multiple linear regression testing.

The results of descriptive statistical analysis can be presented in the form of median, mean, maximum, minimum, standard deviation, sum, skewness, kurtosis, and range. This analysis was conducted to determine the maximum and minimum values, mean, median, and standard deviation (Sanusi, 2017).

This study will use Eviews analysis software and multiple linear regression to test the

hypothesis. Panel data is a combination of time series and cross-sectional data. Time series data is used because this study covers a five-year period from 2019 to 2023. Cross-sectional data is used because this study takes data from companies. Therefore, this study has one regression model. The following is the first regression model of this study:

$$\mathbf{ROA}it = \alpha + \beta\mathbf{1NPL}it + \beta\mathbf{2CAR}it + \beta\mathbf{3LDR}it + \beta\mathbf{4BOPO}it + \beta\mathbf{5BANK\_SIZE}it + \mathbf{\mathfrak{E}}it$$

Where, ROAit: Return on Assets (ROA) of the bank$i$ at time$t$; α: Constant; β 1β 2β 3β 4β 5; Regression Coefficient; NPLit: Bank Credit Risk$i$ at time$t$; CARit: Bank Capital Adequacy$i$ at time$t$; LDRit: Bank Liquidity Risk$i$ at time$t$; BOPOit: Bank Efficiency$i$ at time$t$; Bank Sizeit: Bank Size$i$ at time$t$; Ɛ: Error terms

Coefficient of Determination (R^2) is also known as Adjusted R-squared. This coefficient of determination aims to describe the influence of independent variables on dependent variables (Sanusi, 2017). The value of R2 ranges from 0 to 1 and is interpreted as a percentage to see how much of the total dependent variable is explained by the independent variable.

The panel data regression analysis method has three approaches, namely the fixed effect model, common effect model, and random effect model. To select the model that best suits the available data, a test will be conducted as follows:

Chow Test. The standard used is that Ho is accepted if the cross-section Chi Square value is > 0.05 and Ha is accepted if the cross-section Chi Square value is < 0.05. If the test results show that Ho is accepted, it means that the common effect model is used. However, if the test results show that Ha is accepted, it means that the fixed effect model is used and can proceed to the next test, which is the Hausman test (Gujarati et al., 2016).

Hausman test. The standard used is that Ho is accepted if the cross-section random probability value is > 0.05 and Ha is accepted if the cross-section random probability value is < 0.05. If the test results show that Ho is accepted, it means that the random effect model is used. However, if the test results show that Ha is accepted, then the fixed effect model is used.

Lagrange Multiplier Test. The standard used is that Ho is accepted if the probability value is > 0.05 and Ha is accepted if the probability value is < 0.05. If the test results show that Ho is accepted, it means that the common effect model is used, but if the test results show that Ha is accepted, then the random effect model is used.

The normality test has a standard whereby if the Jarque-Bera probability value is > 0.05, the data is normally distributed. However, if the Jarque-Bera probability value is < 0.05, the data is not normally distributed, so it is necessary to perform data outlier analysis.

The multicollinearity test has a criterion that if the coefficient value is < 0.8, then the data does not have a multicollinearity problem. However, if the coefficient value is > 0.8, then the data has a multicollinearity problem and further treatment is needed.

The heteroscedasticity test has a standard, namely if the probability value is > 0.05, then the data does not have a heteroscedasticity problem. However, if the probability value is < 0.05, then there is a heteroscedasticity problem and further treatment is needed.

The autocorrelation test can be performed using the Durbin-Watson (d) test. The autocorrelation

test can be said to have passed if it meets the following criteria: 1) 0 < DW < dL, not affected by autocorrelation; 2) dL < DW < dU, no autocorrelation; 3) 4-dL < DW < 4, autocorrelation present; 4) 4-dU < DW < 4-dL, no autocorrelation and 5) dU < DW < 4-dU, no autocorrelation

This test is performed by comparing the calculated t-value with the value in the t-table. If the significance is < 0.05, the results indicate an effect, and if the significance is > 0.05, the results indicate no effect. A coefficient value of (-) indicates a negative effect, while a coefficient value of (+) indicates a positive effect.

RESULT AND DISCUSSION

The analysis in this study was conducted to determine the maximum, minimum, median, mean, and standard deviation of each variable used (see Table 2).

Table 2 Results of Descriptive Statistical Analysis

	ROA	NPL	LDR	CAR	BOPO	BANK_SIZE
Mean	1.090348	1.848871	86.39435	33.42022	93.42689	20.46343
Median	0.764122	1.441341	82.76799	25.58965	71.68700	19.16873
Maximum	5.591960	8.951548	376.0577	189.4470	1300.423	30.94107
Minimum	-2.397140	0.000172	8.09E-05	10.53578	12.19517	15.29243
Std.Dev	1.070767	1.695459	37.18761	25.77757	140.0617	4.167899
Observations	167	167	167	167	167	167

Source: Research data (processed), 2025

The results of the study of 167 sample data of the Return on Assets variable have a median value of 0.764122, an average (mean) value of 1.090348, and a standard deviation of 1.070767. These research results show: 1). The mean value is greater than the median, which means that conventional banks have a high ROA on average. 2). The standard deviation is lower than the mean value, which means that the ROA variable has a low data distribution (low upward or downward movement). In addition, the ROA variable has a minimum value of -2.397140 found at Bank Ganesha in 2022 and a maximum value of 5.591960 found at Bank KB Bukopin in 2022.

The results of the study of 167 sample data of the Capital Adequacy variable, measured by the CAR ratio, have a median value of 25.58965, an average (mean) value of 33.42022, and a standard deviation of 25.77757. The results of this study show that: 1) the mean value is greater than the median, which means that on average, conventional banks have a high CAR. 2) The standard deviation is lower than the mean value, which means that the CAR variable has a low data distribution (low upward or downward movement). In addition, the CAR variable has a minimum value of 10.53578 found at Bank Cimb Niaga in 2019 and a maximum value of 189.4470 found at Bank Multiarta Sentosa in 2019.

The results of the study of 167 sample data of the Credit Risk variable measured by the NPL ratio have a median value of 1.441341, an average (mean) value of 1.848871, and a standard deviation of 1.695459. The results of this study show: 1). The mean value is greater than the median, which means that on average, conventional banks have high NPLs. 2). The standard

deviation is lower than the mean value, which means that the CAR variable has a low data distribution (low upward or downward movement). In addition, the NPL variable has a minimum value of 0.000172 found at Bank Mandiri in 2023 and a maximum value of 8.951548 found at Bank of India Indonesia in 2021.

The results of the study of 167 sample data of the Liquidity variable, measured by the LDR ratio, have a median value of 82.76799, an average (mean) value of 86.39435, and a standard deviation of 37.18761. The results of this study show: 1). The mean value is greater than the median, which means that on average, conventional banks have a high LDR. 2). The standard deviation is lower than the mean value, which means that the LDR variable has a low data distribution (low upward or downward movement). In addition, the LDR variable has a minimum value of 8.09E-05 found at Bank Mestika Dharma in 2022 and a maximum value of 376.0577 found at Bank Amar Indonesia in 2023.

The results of the study of 167 sample data on the Efficiency variable, measured using the BOPO ratio, have a median value of 71.68700, an average (mean) value of 93.42689, and a standard deviation of 140.0617. These research results show that: 1). the mean value is greater than the median, which means that conventional banks have a high BOPO on average. 2). The standard deviation is higher than the mean value, which means that the BOPO variable has a high data distribution (high upward or downward movement). In addition, the BOPO variable has a minimum value of 12.19517 found at Bank IBK Indonesia in 2023 and a maximum value of 1300.423 found at Bank Jtrust Indonesia in 2020.

The results of the study of 167 sample data of the Bank Size variable, measured by the natural logarithm of total assets, have a median value of 19.16873, an average (mean) value of 20.46343, and a standard deviation of 4.167899. The results of this study show: 1). The mean value is greater than the median, which means that conventional banks have a high average number of assets. 2). The standard deviation is lower than the mean value, which means that the Bank Size variable has a high data distribution (low upward or downward movement).

Table 3. Chow Test Results

EFFECTS TEST	STATISTIC	D.F.	PROB.
Cross-section F	1.784894	(36,143)	0.0090
Cross-section Chi-square	68.655545	36	0.0008

Source: Research data (processed), 2025

Based on the Chow test results in Table 3, the cross-section chi-square probability value shows a value of 0.0008, which is smaller than the test criterion of 0.05. It can be concluded that Ha is accepted and the fixed effect model is used, which is considered better than the common effect model. After that, the research continued to the Hausman test.

Based on the Hausman test results the cross-section random probability value shows a value of 0.0000 or less than the test criterion of 0.05. It can be concluded that Ha is accepted and the fixed effect model is considered better than the random effect model. Therefore, this study does not proceed to the Lagrange multiplier test.

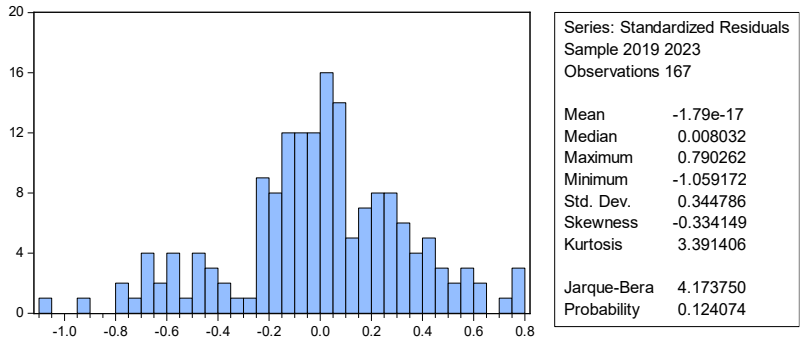

Figure 4. Normality Test Results – Jarque Bera Test

Sumber: Research data (processed), 2025

Figure 4. shows that the overall residual data of the regression model is normally distributed after outliers or data removal. This is evidenced by the Jarque-Bera probability value of 0.124074, which is greater than the test criterion of 0.05 with a total of 167 observations. It can be concluded that Ho is accepted and the data is normally distributed.

Table 4. Multicollinearity Test Results

	ROA	NPL	LDR	CAR	BOPO	Bank_Size
ROA	1.000000					
NPL	-0.282017	1.000000				
LDR	0.184861	-0.013416	1.000000			
CAR	0.038474	0.073023	0.241714	1.000000		
BOPO	0.060681	0.067714	-0.163660	-0.081436	1.000000	
Bank_Size	-0.171892	0.200138	0.037707	0.276883	0.114880	1.000000

Source: Research data (processed), 2025

Based on the correlation matrix output in Table 4, it shows that the correlation values between the independent variables in the study are below 0.8. It can be concluded that there is no multicollinearity.

Table 5 Results of the Heteroscedasticity Test

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	PROB.
C	0.544604	0.297711	1.829306	0.0697
CAR	0.000456	0.000718	0.635142	0.5265
NPL	0.001834	0.014417	0.127174	0.8990
LDR	-0.001289	0.000672	-1.917004	0.0575
BOPO	-2.47E-05	0.000132	-0.186520	0.8523
BANK_SIZE	-0.009411	0.013388	-0.702906	0.4834

Source: Research data (processed), 2025

Based on the results of the heteroscedasticity test in Table 5 above, it shows that the probability values of all independent variables are greater than 0.05. It can be concluded that there is no element of heteroscedasticity.

Table 6 Autocorrelation Test Results

K	**N**	**DURBIN-WATSON STAT**				
5	167	1.9107				
0	**dL**	**dU**	**2**	**4 - dU**	**4 - dL**	**4**
0	1.6857	1.8089	2	2.1911	2.3143	4
			1.9107			
Autocorrelation Positive	No Decision Zone Zona		**No Correlation**	No Decision Zone		Negative Autocorrelation

Source: Research data (processed), 2025

Based on the autocorrelation test results in Table 6, the Durbin-Watson stat value of this regression model is 1.9107. Looking at the DW table, the dL value is 1.6857 and the dU value is 1.8089. Next, the values of 4 – dU and 4 – dL can be obtained, which are 2.1911 and 2.3143, respectively. It can be concluded that Ho is rejected and there is no autocorrelation problem in this study because the DW stat value of 1.9107 lies between the dU and 4 – dU values.

This study uses a fixed effect model because after conducting the Chow test and the Hausman test, the fixed effect model was considered to be the best.

Table 7. Fixed Effect Model Results

VARIABLE	**REGRESSION EQUATION**				
	COEF.	**STD.ERROR**	**T-STATICTIC**	**PROB.**	**CONCLUSION**
C	6.079305	0.648247	9.378076	0.0000	-
CAR	0.002114	0.001563	1.352760	0.1786	Not Significant
NPL	-0.035168	0.031393	-1.120255	0.2648	Not Significant
LDR	0.003627	0.001464	2.477825	0.0146*	Significant
BOPO	0.001362	0.000288	4.729945	0.0000*	Significant
BANK_SIZE	-0.265607	0.029152	-9.111215	0.0000*	Significant
R-squared				0.896316	
Adjusted R-squared				0.862308	
F-statistic				26.35587	
Prob(F-statistic)				0.000000	
Durbin-Watson Stat				1.910783	
Note:					
*) $\alpha = 0.05$ atau 5%					

Source: Research data (processed), 2025

Based on Table 7. above, the adjusted R-squared for the research regression model is 0.862308 or 86.23%. This value explains that the variables of capital adequacy, credit risk, liquidity, and efficiency can explain the return on assets by only 86.23%, while 13.77% is explained by other factors not examined in this study.

The data analysis shows that credit risk, proxied by Non-Performing Loans (NPL), does not have a significant effect on the Return on Assets (ROA) of conventional commercial banks in Indonesia for the period 2019–2023. Although the relationship between NPL and ROA is negative, low NPL fluctuations (averaging 1.84% below BI's maximum limit of 5%) make its effect on ROA insufficiently strong. From a Signaling Theory perspective, an increase in NPL should be a risk signal that reduces investor confidence and impacts ROA, but this signal does not seem to be taken seriously by stakeholders.

Based on the data obtained, it is known that the average (mean) NPL value of conventional commercial banks in the 2019–2023 period is 1.848871 or 1.84%. Bank Indonesia regulations set a maximum NPL ratio limit of 5%. When compared to the average (mean) NPL value obtained in this study, it appears to be smaller than the maximum limit set. With an average NPL of 1.84%, the level of non-performing loans is still in the healthy category, so its effect on ROA is small and therefore insignificant.

These results are in line with the findings of Sari et al. (2024) and Anindiansyah et al. (2020), who stated that bank profitability is maintained thanks to good risk management, PPAP, and non-interest income. Conversely, these findings contradict the research by (Kinanti & Putra, 2024), which states that high NPLs can reduce ROA due to decreased income from non-performing loans.

The results show that capital adequacy, proxied by the Capital Adequacy Ratio (CAR), does not significantly affect the Return on Assets (ROA) of conventional commercial banks in Indonesia for the period 2019–2023. It can also be seen in Table 4.3 that the standard deviation value of CAR is smaller than the average value of CAR, indicating that CAR fluctuations are very small and therefore unable to significantly affect ROA (Setyarini, 2020).

Although in theory, according to Signaling Theory, a high CAR reflects capital stability and can increase customer confidence, in practice, this signal is not strong enough to significantly affect ROA. This is because CAR fluctuations are relatively small and most banks already have a high CAR, so the difference does not have a significant impact on profitability.

The results of this study are in line with the research conducted by (Wijaya & Tiyas, 2016), which states that CAR does not affect ROA. Banks do not fully optimize available capital for profit-generating activities because they must also calculate the possibility of an increase in ATMR (Risk-Weighted Assets). Research conducted by (Pinasti & Mustikawati, 2018) states that a higher CAR is not always followed by an increase in ROA because the capital owned by banks is invested in illiquid assets. Research conducted by (Anindiansyah et al., 2020) states that banks have high capital and high CAR levels, but if this is not balanced with good investment and fund distribution, then CAR has no effect on return on assets. Research conducted by (Kinanti & Putra, 2024) states that banks have sufficient capital, but the profits obtained are not always proportional to the amount of capital. Banks do not fully utilize their capital potential to increase ROA. In other words, there is capital potential that is not used efficiently to generate greater income for banks, but is only held without being disbursed.

The results of the study indicate that liquidity, proxied by the Loan to Deposit Ratio (LDR), has a significant positive effect on the Return on Assets (ROA) of conventional commercial banks

in Indonesia for the period 2019–2023. This finding indicates that the higher the LDR, the greater the interest income generated by banks, which ultimately increases ROA. From the perspective of Signaling Theory, a high LDR within the limits set by regulators reflects the success of banks in performing their intermediary function and sends a positive signal to investors and stakeholders regarding the bank's performance. This study shows that LDR affects ROA, which means that banks with a high LDR (within the limits set by regulators) send a signal that they are successful in performing their financial intermediary function well.

These results are consistent with the research by Sari et al. (2024) and Sadie & Nyale (2024), which states that good liquidity management and high credit distribution quality can increase ROA. The results of this study are in line with the research conducted by (Sari et al., 2024), which states that LDR has a significant positive effect on ROA. The higher the LDR level, as long as it remains within the limits specified by Bank Indonesia ( ) and is supported by good credit distribution quality by banks, the spread obtained by banks will increase, which will ultimately increase ROA. Research conducted by (Sadie & Nyale, 2024) states that LDR has a significant positive effect on ROA, as banks maximize the use of their funds to provide loans, which in turn generates higher interest income. If banks manage their liquidity well, they avoid liquidity risk and increase their business activities, which also has an impact on increasing ROA.

The results of the study show that efficiency, proxied by the ratio of Operating Expenses to Operating Income (BOPO), has a significant positive effect on the Return on Assets (ROA) of conventional commercial banks in Indonesia for the period 2019–2023. Although in theory a high BOPO reflects inefficiency, in the context of Signaling Theory, banks can still send a positive signal to the market that they are able to manage their business effectively even though operating costs have increased. This shows that an increase in BOPO does not always have a negative impact on ROA, especially if the increase in costs is due to strategic investments such as digitalization or business expansion, which in the long term actually increase revenue and profitability.

These results are in line with the findings of Ferly et al. (2023), who state that an increase in BOPO can still generate high ROA if operating income grows faster than costs. In addition, if operating income increases faster than operating costs, even if BOPO rises, profits will also continue to increase, thereby increasing ROA.

The results of the study indicate that the control variable of bank size has a significant negative effect on the Return on Assets (ROA) of conventional commercial banks in Indonesia for the period 2019–2023, indicating that asset growth is not always followed by an increase in profits, so that ROA tends to decline.

In the context of Signaling Theory, large bank size does not always send a positive signal to investors. In this study, bank size does not always send a positive signal. Large banks may have large assets but also high operating costs, resulting in smaller profit margins compared to smaller and more efficient banks. If two banks of different sizes have the same ROA, investors may prefer smaller banks because they are more efficient in managing their assets, while large banks that are less efficient may be considered to have an suboptimal cost structure.

These findings are in line with Sparta (2017) research, which shows that an increase in assets does not always increase ROA. However, these results contradict the research of Artikanaya (2024) and Ishak et al. (2024), which states that bank size has a significant positive effect on ROA because large banks are considered to have stronger operational and risk management capacities.

The study finds that even when NPLs increase, banks are still able to maintain their return on assets by strengthening provisions for non-performing assets and diversifying income through fee-based activities. From the perspective of signalling theory, transparency in risk management policies and the disclosure of effective mitigation strategies provide positive signals to investors and customers. Furthermore, improving credit analysis and enhancing borrower supervision are essential to ensure more selective credit distribution, allowing banks to sustain profitability even in the face of rising credit risk.

The results of the study show that adequate capital does not automatically increase return on assets if it is not managed optimally. Banks need to utilize capital for productive and low-risk investments, as well as use it effectively for business expansion that increases revenue. From a signaling theory perspective, credit expansion to the productive sector, the development of digital investment products, and clear communication regarding capital utilization strategies can be positive signals for investors and increase the attractiveness of bank shares in the capital market.

The results of the study show that good liquidity management can increase bank profitability. A healthy LDR ratio is a positive signal of the bank's operational reliability, while an LDR that is too low or too high can create a negative perception of credit distribution strategies and liquidity risk. Therefore, banks need to distribute credit carefully in accordance with market conditions and develop financial products that can attract more deposits to strengthen liquidity.

The results of the study show that the more efficient banks are in managing their operations, the higher their profitability. Operational efficiency is a positive signal to investors, regulators, and customers regarding the quality of bank management. To that end, banks need to invest in digital transformation, service automation, and technology utilization, while reducing non-essential costs and increasing commission-based income. This step will strengthen competitiveness and attract more customers.

The results of the study show that the larger the size of the bank, the more difficult it is to achieve optimal operational efficiency. The size of a bank is indeed an indicator of stability and capacity to deal with risk, but asset growth without efficiency can send a negative signal. Therefore, expansion must be accompanied by increased efficiency through digitization, process automation, and decentralization of decisions in order to maintain profitability.

CONCLUSION & SUGGESTION

Based on the analysis and discussion, the conclusion of this study shows that of the five variables analyzed, only LDR and BOPO have a significant effect on the ROA of conventional commercial banks in Indonesia for the period 2019–2023. Credit risk (NPL) and capital adequacy (CAR) have no significant effect on ROA, although NPL has a negative direction and

CAR has a positive direction. Meanwhile, LDR has a significant positive effect, indicating that good liquidity management can drive profitability. BOPO also has a significant positive effect, which means that operational efficiency contributes significantly to increasing ROA. These results reinforce the role of bank management in managing cost structure, credit distribution strategies, and effective capital utilization to keep banks competitive and profitable.

The limitations of this study indicate that it only discusses NPL, CAR, LDR, and BOPO to see their effect on Return on Assets in Indonesian banking. The object of this study is limited to conventional commercial banks in Indonesia, and the study period is limited to five years, from 2019 to 2023.

Based on the conclusions and limitations of this research, suggestions for further research include expanding the independent variables used, such as adding Net Interest Margin (NIM) to provide a more comprehensive understanding of the factors that influence ROA. Further research is also recommended to expand the scope of the object, for example by comparing conventional banks and Islamic banks or including non-bank financial institutions. In addition, extending the research period will help in seeing long-term patterns and the impact of macroeconomic policies on banking financial performance.

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