



Liquidity, Capital Adequacy, and Operational Efficiency as Determinants of Bank Profitability: Evidence from Indonesian Conventional Commercial Banks

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ABSTRACT

Looking at conventional commercial banks listed on the Indonesia Stock Exchange from 2020 to 2024, this study aims to find out how ROA is affected by CAR, LDR, and BOPO, the profitability metric. This quantitative study uses secondary data from traditional commercial banks' annual financial statements. The data analysis process included model selection, classical assumptions, and hypothesis testing, conducted in EViews 13 using panel data regression. Evidence suggests that LDR, CAR, and BOPO all significantly impact ROA. In particular, LDR has a considerable and positive impact on ROA, CAR has a positive but small effect, and BOPO has a negative and large impact. Stakeholders and investors use revealed financial ratios as performance indicators, which Signalling Theory theoretically supports. Given the weaker negative impact of BOPO compared to CAR's negligible impact, operational efficiency seems to be a more important factor in determining a bank's profitability than capital adequacy. Optimal lending practices and strict cost control should be top priorities for bank management in their pursuit of greater profitability. Focusing on the years after the pandemic (2020–2024), this research adds to the existing literature by showing that operational efficiency, rather than capital sufficiency, is the most important factor in predicting a bank's profitability.

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1. INTRODUCTION

The COVID-19 outbreak and recovery years that followed had a profound effect on Indonesia's economy in recent years. Economic contraction, falling credit demand, rising financing risk, and the need for banks to fortify their loss reserves were among the most significant challenges faced by the banking industry from 2020 to 2024 (Pramitasari, 2023). Despite this, the banking industry showed remarkable structural resilience by implementing policies to loosen regulations, modifying risk management techniques, and speeding up the digitisation of services (Rachmawati & Ambarwati, 2024). Traditional banks have been compelled to shore up their financial foundations and increase efficiency in response to digital transformation, shifting consumer tastes, and fierce competition from online banks and financial technology companies (Rani & Kiryanto, 2025). These days, ROA is the main indicator of a bank's profitability (Erlinda Sholihah, 2021; Sulistiyana et al., 2025), which in turn determines the bank's capacity to extract profits from its whole asset base. As a measure of overall asset-management efficiency, return on assets (ROA) is a common metric for evaluating a bank's financial performance. According to Ardyani et al. (2025), a higher ROA indicates that the bank is adept at profitable asset management, while a lower ROA indicates that the bank is less adept at this. The Financial Services Authority (/OJK) has created a system known as the Risk-Based Bank Rating (RBBR) to evaluate the stability of banks. According to OJK (2025) and Peraturan BPK (2016), this framework prioritises profitability and measures a bank's profits using metrics such as Net Interest Margin (NIM), Operating Expenses to Operating Income (BOPO), and Return on Assets (ROA).

Traditional commercial banks trading on the Indonesia Stock Exchange had their return on assets (ROA) vary from 2020 to 2024 as a result of macroeconomic and industry-specific factors. The initial decline in ROA was caused by the COVID-19 pandemic, but the subsequent increase throughout the recovery period indicated improved asset quality, more effective operations, and more profit-generating optimisation of asset usage (Amrina et al., 2021). The Operating Expenses to (BOPO), the (CAR), and the (LDR) are important internal considerations that impact this profitability. A greater LDR indicates that funds are being allocated more optimally and might result in higher revenue for the bank, according to studies undertaken by Al et al. (2024), Mohamed & Youssef (2022), and Mufitasari et al. (2025). By contrast, if the LDR is too high, the bank may have less cash on hand and be more likely to fail to pay its short-term bills. The capital adequacy ratio (CAR) is a way to assess a bank's capacity to withstand credit, market, and operational risk as well as its resilience in challenging economic times (Sugiarto & Sriyatun, 2024; Yuliana & Listari, 2021). Using the ratio of operational expenditures to operating revenue, BOPO is a metric for operational efficiency that has been proposed by Oktariani and Meliza (2024) and Setyowati (2019). Operating performance is improved with a lower BOPO; however, profitability may be negatively impacted by a larger BOPO due to the increased cost burden.

There is an empirical vacuum that has to be filled, because previous studies on the impacts of LDR, CAR, and BOPO on ROA have shown contradictory results. According to Ramadana (2022), LDR significantly increases ROA; however, research by Pratama & Isyнуwardhana (2019), Hariemufti et al. (2016), and Maulana and Kristanti (2018)

demonstrates that operational efficiency, credit quality, and macroeconomic conditions determine the efficacy of lending activities. While Andini and Yunita (2015) and Harsono & Kodrat (2024) did not find a significant association between CAR and ROA, Kurnia et al. (2025) and Cahyani et al. (2022) observed a favourable impact. Adha & Reviandani (2024), Chairunisa & Isyanto (2025), Fahlevi et al. (2023), and Rizkika et al. (2017) all find that BOPO has a negative impact on ROA, although the exact amount of this effect differs between banks based on their digitisation strategies and operational factors. These contradictory findings highlight the need to reevaluate the effects of LDR, CAR, and BOPO on profitability in traditional commercial banks in light of current market circumstances.

The behaviour of LDR, CAR, BOPO, and ROA is affected by regulatory changes, technological developments, the post-pandemic economic recovery, and changing intermediation dynamics from 2020 to 2024, a period of transition for the banking industry in Indonesia. Traditional commercial banks listed on the Indonesia Stock Exchange during and after the pandemic have not had their ROA re-examined in studies that look at what makes a bank successful. Based on the present economic recovery and the growing competitive pressure from digital banking and financial technology, this research reexamines these links within that specific era, adding to the previous empirical data on the issue. These findings highlight the importance of operational efficiency, capital sufficiency, and liquidity in determining a bank's profitability.

From 2020 to 2024, conventional commercial banks listed on the Indonesia Stock Exchange will be studied to determine the effect of the following ratios on profitability, as measured by (ROA): (BOPO), (LDR), also (CAR). The following goal underpins the study's hypotheses: Three theories have been put forward to explain the correlation between ROA and other financial metrics. One theory proposes that LDR significantly and positively affects ROA. According to the alternative theory, CAR indirectly affects ROA in a positive but negligible way. In conclusion, according to the third hypothesis, BOPO significantly reduces ROA.

2. METHODS

The associative research design and quantitative methodology are used in the research analysing links and impacts of independent factors on bank profitability. The study is based on the positivist paradigm, which holds that correlations between variables can be empirically tested and that objective measurements may be taken. As a method, the study used secondary data culled from publicly accessible financial papers to conduct an empirical assessment of traditional commercial banks trading on the IDX. Because no new data was added to or altered throughout the course of the study, the researcher could sit back and observe without interfering. This naturalistic research approach guaranteed that data were gathered in an authentic setting, which strengthened the credibility of the empirical results.

For the years 2020–2024, the sample population includes all 43 conventional commercial banks that were listed on IDX. The study sample was selected using the purposive sampling technique. Parameters for selection were as follows: (1) Conventional Commercial Banks listed IDX 2020–2024, so sample is relevant to current banking conditions; (2) no

delisting or changes to listing status during the observation periods, so the data is consistent; (3) all financial data for (LDR), (CAR), (BOPO), also (ROA) is complete, so there are no missing values that complicate analysis; and (4) all financial reports published by the banks throughout the study period are comprehensive, so the data is comprehensive and accurate. An analysis of 38 banks over 5 years yielded a panel dataset with 190 observations, as these criteria were used to determine eligibility.

The data used for the secondary analysis came from a variety of reputable sources, including the following: the official website of the Indonesia Stock Exchange (www.idx.co.id), published financial statements and annual reports of Conventional Commercial Banks, the websites of the individual banks, journals, and textbooks. The data were gathered using a two-pronged approach: first, a literature review that scoured scholarly journals, books, and magazines for information on what factors affect profitability; and second, a documentation technique that painstakingly extracted financial data from yearly reports and financial statements released between 2020 and 2024.

This study's variables are defined and described using the following terms: Dependent Variable: Return on Assets (ROA) = $(\text{Net Income} / \text{Total Assets}) \times 100\%$. As the gold standard for profitability metrics in banking research, return on assets (ROA) assesses how well banks turn their total assets into profit. Independent Variables: (1) Loan to Deposit Ratio (LDR) = $(\text{Total Loans} / \text{Total Deposits}) \times 100\%$. LDR measures the proportion of customer deposits deployed as loans, reflecting intermediation function performance. (2) Capital Adequacy Ratio (CAR) = $(\text{Tier 1 Capital} + \text{Tier 2 Capital} / \text{Risk-Weighted Assets}) \times 100\%$. CAR measures the bank's capacity to absorb credit, market, and operational losses. (3) Operating Expenses to Operating Income (BOPO) = $(\text{Total Operating Expenses} / \text{Total Operating Income}) \times 100\%$. BOPO measures operational efficiency; lower values indicate superior efficiency.

This information is a panel dataset that has both cross-sectional (38 banks) and time-series (2020–2024) aspects. Panel data regression in EViews 13 was used for the analysis, following standard econometric techniques. To analyse the distribution of the data, descriptive statistics were used. The mean, standard deviation, minimum, and maximum values for each variable were determined. The regression model was validated by doing four classical assumption tests. To start, checked whether the residuals followed a normal distribution using the Jarque-Bera normality test. Secondly, to identify any possible multicollinearity among independent variables, the VIF test was used. A VIF value > 10 suggests the presence of multicollinearity. The next step in examining heteroscedasticity was to use the Glejser test, which checks whether the residual variance stayed constant. Lastly, autocorrelation among residuals was detected by the DW statistic. Three different regression models using panel data: Pooled OLS, Model (FEM), and REM. By selecting the model based on:

- Chow Test: To determine whether FEM is superior to pooled OLS
- Hausman Test: For choosing among FEM and REM based on error correlation with regressors
- Lagrange Multiplier (LM) Test: For the purpose of conducting supplementary testing of specifications

To test the hypothesis, ran an F-test to see if all of the independent variables were statistically significant, a t-test to see if each variable was statistically significant on its own, and an R-squared analysis to see how well the model explained the data.

3. RESULTS AND DISCUSSION

Descriptive Statistical Analysis

The research focuses on listed firms in the banking subsector on the IDX from 2020 to 2024 and seeks to analyse the impact of the following ratios on ROA: LDR, CAR, and BOPO. Averages, medians, and ranges, as well as standard deviations, are some of the descriptive statistics used to provide a picture of the study data.

Table 1. Descriptive Statistics Results for LDR (X1)

Descriptive Statistics (Before Transformation)					
Description	ROA (Y)	LDR (X1)	CAR (X2)	BOPO(X3)	Description
Mean	0.011301	0.923966	0.380268	0.887607	Mean
Maximum	0.058500	5.279100	2.883800	2.878600	Maximum
Minimum	-0.136000	0.123500	0.105000	0.341300	Minimum
Std. Dev.	0.023861	0.546955	0.338018	0.320361	Std. Dev.

Source: Result of data processing, 2026

The descriptive statistics show that the ROA variable has a mean of 0.011301 and a standard deviation of 0.023861. The most recent ROA number was -0.136000, achieved by PT Bank Raya Indonesia Tbk (AGRO) in 2021; the most recent was 0.058500, recorded by PT Bank Amar Indonesia Tbk (AMAR) in 2024. A standard deviation of 0.546955 and a mean value of 0.923966 are associated with the LDR variable. For LDR values, PT Krom Bank Indonesia Tbk (BBSI) reached 5.279100 in 2023, and PT Bank Capital Indonesia Tbk (BACA) reached 0.123500 in 2021.

At 0.380268 with a standard deviation of 0.338018, CAR is a variable with a mean value. In 2022, PT Krom Bank Indonesia Tbk (BBSI) recorded the highest CAR value of 2.883800, while in 2024, PT Bank Mayapada Internasional Tbk (MAYA) had the lowest value of 0.105000. As for the BOPO variable, it's standard deviation is 0.320361, and its mean is 0.887607. With a BOPO of 0.341300 in 2021, PT Krom Bank Indonesia Tbk (BBSI) had the lowest value, while PT Bank Raya Indonesia Tbk (AGRO) had the highest. Operating efficiency among banking businesses is likely to be more consistent, as these results show that ROA has the most variance among the variables and BOPO has the least.

Classical Assumption Tests

Normality Test

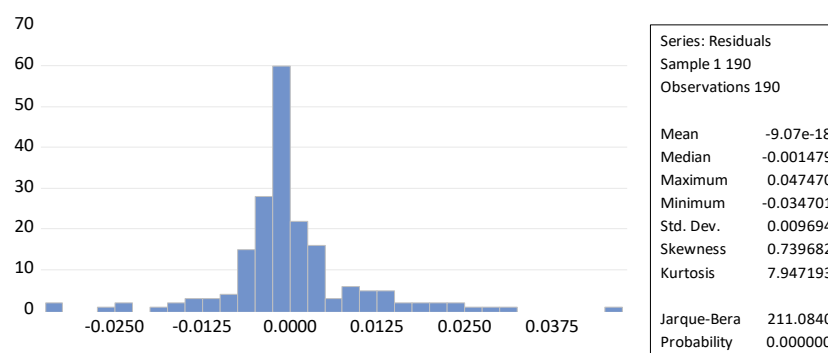


Figure 1. Normality Test Results
Source: Result of data processing, 2026

In order to ensure that everything was normal, the Jarque-Bera Test was used. With a probability value of 0.000000, the first test results revealed a Jarque-Bera statistic of 2,110.840. The residuals were not normally distributed, as the p-value was < 0.05.

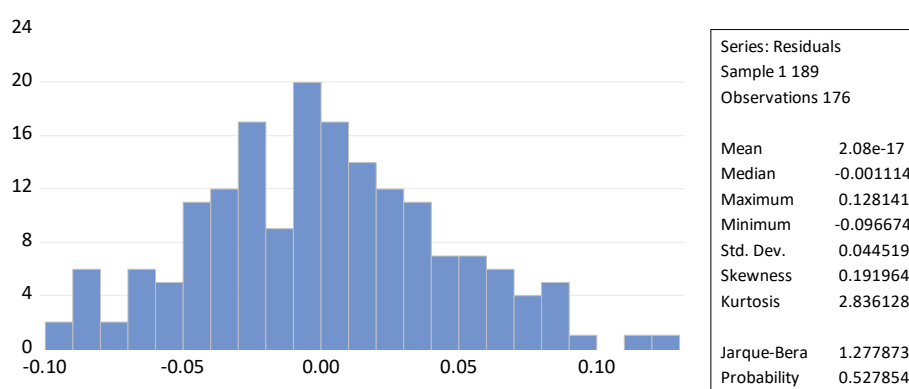


Figure 2. Normality Test Results after Data Transformation
Source: Result of data processing, 2026

The study variables were transformed using a natural logarithm (Ln) to solve this problem. The Jarque-Bera statistic dropped to 1.277873 with a probability of 0.527854 after the modification. The model met the normality requirement since the residuals were normally distributed and the p-value was > 0.05.

Multicollinearity Test

Table 2. Multicollinearity Test Results

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	6.91E-05	6.478985	NA
LNx1	6.93E-05	1.470447	1.196662
LNx2	3.97E-05	6.290051	1.168001
LNx3	0.000170	1.645313	1.044855

Source: Result of data processing, 2026

Using VIF, the multicollinearity test was carried out. Centred VIF values of 1.196662, 1.168001, and 1.044855 for LDR, CAR, and BOPO, respectively, were shown in the findings. All Centred VIF values were below the 10-point threshold, indicating that the independent variables in the regression model don't exhibit multicollinearity.

Heteroscedasticity Test

Table 3. Heteroscedasticity Test Results (Glejser Test)

F-statistic	1.790356	Prob. F(3,172)	0.1508
Obs*R-squared	5.329550	Prob. Chi-Square(3)	0.1492
Scaled explained SS	5.606685	Prob. Chi-Square(3)	0.1324

Source: Result of data processing, 2026

This study used the Glejser Test to look for heteroscedasticity. The calculated probabilities were as follows: Scaled Explained SS = 0.1324, Probability of Chi-Square = 0.1492, and Probability of F = 0.1508. The regression model lacked heteroscedasticity, as shown by all probability values above 0.05. Since the model is homoscedastic, it may be utilized further analysis.

Autocorrelation Test

Table 4. Durbin–Watson Test Results

R-squared	0.788580	Mean dependent var	0.115719
Adjusted R-squared	0.728395	S.D. dependent var	0.052056
S.E. of regression	0.027129	Akaike info criterion	-4.180594
Sum squared resid	0.100832	Schwarz criterion	-3.462820
Log likelihood	409.9826	Hannan-Quinn criter.	-3.889493
F-statistic	13.10255	Durbin-Watson stat	1.850164
Prob(F-statistic)	0.000000		

Source: Result of data processing, 2026

To test for autocorrelation, the DW statistic was used. The Durbin-Watson value was 1.850164, according to the findings. This value's proximity to 2 supports the absence of substantial autocorrelation in the regression model. Given this, we may say that the residuals are independent of the time intervals under consideration.

Panel Data Regression Model Selection

Chow Test

Table 5. Chow Test Results

Effects Test	Statistic	d.f.	Prob.
Cross-section F	5.473766	(36,137)	0.0000
Cross-section Chi-square	157.76477	36	0.0000

Source: Result of data processing, 2026

By comparing the two models, the Chow Test was utilised to find the best fit among FEM and CEM. Results for the Cross-section Chi-Square and Cross-section F statistics both came out at 0.0000. Because neither of these numbers was > 0.05, deemed that (FEM) was more applicable than (CEM).

Hausman Test

Table 6. Hausman Test Results

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	13.330920	3	0.0040

Source: Result of data processing, 2026

Between (FEM) and (REM), the most appropriate model was determined using the Hausman Test. An analysis of variance yielded a Chi-Square value of 13.330920 and a p-value of 0.0040. It was decided that (FEM) should be used instead of the REM since the probability value was less. Thus, this research used the FEM.

Regression Results and Model Fit

Table 7. Fixed Effects Model Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.130746	0.012477	10.47925	0.0000
LN _{X1}	0.042148	0.010337	4.077459	0.0001
LN _{X2}	0.014264	0.008995	1.585854	0.1151
LN _{X3}	-0.044879	0.022097	-2.030962	0.0442
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.788580	Mean dependent var		0.115719
Adjusted R-squared	0.728395	S.D. dependent var		0.052056
S.E. of regression	0.027129	Akaike info criterion		-4.180594
Sum squared resid	0.100832	Schwarz criterion		-3.462820
Log likelihood	409.9826	Hannan-Quinn criteria		-3.889493
F-statistic	13.10255	Durbin-Watson stat		1.850164
Prob(F-statistic)	0.000000			

Source: Result of data processing, 2026

The panel data regression analysis utilising (FEM) generated the following regression equation:

$$Y = 0,1307 + 0,0421LN_{X1} + 0,0143LN_{X2} - 0,0449LN_{X3} + e$$

Description:

Y = ROA

X₁ = LDR measured as Natural Logarithm

X₂ = CAR measured as Natural Logarithm

X₃ = Operating Expenses to Operating Income Ratio measured as Natural Logarithm

e = Error term

Interpretation of Regression Results

Keeping all independent variables constant results in an estimated ROA of 0.1307, as shown by the constant coefficient of 0.1307, and a probability value of 0.0000 (< 0.05). At the 5% level of significance, the constant term is shown to be statistically significant. The likelihood of the regression coefficient for LDR being less than 0.05 is 0.0001, and it is 0.0421. Assuming all other factors stay the same, this finding suggests that ROA improves by 0.0421 units for every unit increase in LDR. Hence, LDR significantly and positively affects ROA. With a probability of 0.1151 (> 0.05), the regression coefficient for CAR is 0.0143. Despite a positive coefficient, the impact is not statistically significant. Based on this, CAR has little to no effect on ROA.

The likelihood value for the regression coefficient of BOPO is 0.0442 (< 0.05), and it is -0.0449. With all other factors held equal, this result shows that ROA drops 0.0449 units for every one-unit rise in BOPO. Statistical analysis confirms that BOPO reduces ROA. As a whole, the regression findings show that LDR positively affects ROA, BOPO negatively affects ROA, and CAR does not affect ROA at all, at least not at the 5% level of significance. The independent variables included in the model explain 72.8% of the variance in ROA, whereas other factors not included in the model account for the remaining 27.2%. This conclusion is drawn from the Adjusted R-squared value of 0.728. With an R-squared value of 0.788580, the three independent variables—LDR, CAR, and BOPO—are able to explain 78.85% of the variance in ROA. The findings indicate that operational efficiency, capital sufficiency, and banking intermediation all play a role in determining a bank's profitability.

The concurrent significance test yielded a Prob(F-statistic) value of 0.000000, which is less than the significance level of 0.05. The results show that ROA is significantly affected by LDR, CAR, and BOPO simultaneously. Results of the partial significance test based on the Fixed Effect Model (FEM) panel data regression estimate are as follows: The coefficient value of the LDR-representing variable LNX1 is 0.0421, and its probability value is 0.0001 (< 0.05). The data show that LDR increases ROA in a favourable and statistically significant way. Secondly, in terms of CAR, the LNX2 variable has a 0.0143 coefficient and a 0.1151 probability (> 0.05). The impact of CAR on ROA is not statistically significant, despite the positive coefficient.

Lastly, the probability is 0.0442 (< 0.05), and the coefficient is -0.0449 for the variable LNX3, which stands for BOPO. Evidence like this suggests that BOPO significantly reduces ROA. Put simply, as operational expenditures rise in comparison to operating revenue, the profitability of banks tends to decline.

The Effect of Loan to Deposit Ratio (LDR), Capital Adequacy Ratio (CAR), and BOPO on Return on Assets (ROA)

The Prob(F-statistic) value is 0.000000, which is lower than the significance threshold of 0.05, according to the findings of the simultaneous significance test (F-test) provided in Table 7. It follows from these results that H_a is accepted and the null hypothesis (H_0) is rejected. It follows that ROA is significantly impacted by the LDR, CAR, and BOPO ratios (Operating Expenses to Operating Income) working in tandem.

From what can be told, financial intermediation efficacy, capital sufficiency, and operational efficiency are the three main factors that affect bank profitability. These three variables impact a bank's bottom line. Not only that, but the independent variables accounted for 78.85% of the variance in ROA, as shown by the coefficient of determination (R-squared) of 0.788580. Unaccounted-for variables account for the remaining 21.15 per cent. A high Adjusted R-squared value of 0.728395, which takes into consideration all of the independent variables, further confirms the study model's robust explanatory ability.

The Effect of Loan to Deposit Ratio (LDR) on Return on Assets (ROA)

A regression coefficient of 0.042148 and a probability value of 0.0001 were found for the Loan to Deposit Ratio (LDR) according to the findings of the partial significance test. It is statistically certain that LDR increases ROA, since the likelihood value is less than the 0.05 threshold of significance. After controlling for all other factors, the coefficient shows that higher LDR leads to more profitable banks. Profitability seems to be better for banks that are good at directing money from other parties into loans that really create income. A higher return on assets (ROA) is a result of more lending operations, which means more interest revenue for banks. For managers, the key to maximising profits while keeping liquidity stable is keeping lending at an appropriate level.

These results are in line with those of Ramadana (2022) and Pradigdo et al. (2025), who also discovered that LDR favourably affects banking sector profitability. Banking institutions may enhance their financial performance by increasing the distribution of credit, according to this research, where fund intermediation is efficient. Theoretically, this suggests that LDR supports Signalling Theory, which proposes that companies signal their performance and future prospects to stakeholders and investors through financial disclosures. Financial performance and investor confidence may be boosted by a greater LDR as long as it remains within a reasonable range. This indicates that the bank is making good use of client deposits to produce income-producing assets.

Moreover, the LDR's beneficial impact from 2020 to 2024 mirrors the financial sector's slow but steady recovery from the COVID-19 pandemic. Banks' capacity to enhance lending operations during the post-pandemic recovery period was boosted by better economic activity and higher credit demand, which in turn led to profitability expansion.

The Effect of Capital Adequacy Ratio (CAR) on Return on Assets (ROA)

The Capital Adequacy Ratio (CAR) has a regression coefficient of 0.014264 and a probability value of 0.1151, according to the findings of the partial significance test. With a probability value higher than the significance threshold of 0.05 and a positive coefficient, CAR does have a positive influence on ROA, but it is not statistically significant. While the positive coefficient does indicate a potential association between capital adequacy and profitability, the strength of this relationship was insufficient to be statistically proven throughout the observation period.

During the post-pandemic recovery era of 2020–2024, the Indonesian banking system faced unusual circumstances, which may explain the minimal influence of CAR. There was

significant economic uncertainty at this time; therefore, many banks kept large capital reserves to strengthen financial resilience and meet regulatory requirements. There was a lack of consistent use of extra funds toward the creation of productive assets or the expansion of lending operations, both of which may have substantially boosted profits. Therefore, greater capital adequacy did not automatically lead to higher ROA.

This result contradicts what Kurnia et al. (2025) found: CAR does increase bank profits. Their research indicates that banks with better capital positions are better equipped to increase their profitability via expanding their commercial operations and successfully absorbing risks. The current research agrees with the results of Andini and Yunita (2015); however, they also found no significant impact of CAR on profitability. They said that rising profits cannot be achieved only by keeping capital levels high; effective allocation of capital to productive activities is also essential.

From a theoretical standpoint, the outcome may be clarified by looking at the regulatory structure that controls the banking industry and Signalling Theory. A high CAR indicates that a bank is strong and can withstand losses, which is good news for creditors, investors, and regulators. Capital sufficiency, efficient use of funds, and operational success are three factors that affect profitability; hence, a good signal does not always result in higher profitability. Also, to ensure economic stability, the Otoritas Jasa Keuangan mandated that banks maintain a certain amount of capital on hand. With the majority of the banks in the sample having previously fulfilled or exceeded these regulatory standards, variances in CAR had less of an impact on explaining profitability. Therefore, capital adequacy from 2020 to 2024 was more of a tool for stability and regulatory compliance than a direct driver of profit development.

The Effect of Operating Expenses to Operating Income Ratio (BOPO) on Return on Assets (ROA)

With a probability of 0.0442 and a regression coefficient of -0.044879, the results of the partial significance test show that (BOPO) is the most noteworthy. As the probability value is lower than the acceptability threshold of 0.05, BOPO has a negative and statistically significant effect on ROA. A one-unit increase in BOPO decreases ROA by 0.044879 units, all other factors being equal. Higher BOPO has a detrimental effect on the bank's ability to turn its assets into profit, as shown by this outcome.

The negative coefficient indicates that operational efficiency is a key component in determining a bank's profitability. The greater BOPO ratio indicates that operational expenditures were not effectively managed, which in turn led to lower net income and profitability. Better financial performance, on the other hand, is accompanied by a lower BOPO ratio, which suggests that banks are more adept at managing operational costs and improving resource use. This being the case, prioritising operational efficiency is crucial for the banking industry to achieve more profitability.

Our conclusion is consistent with many studies showing that BOPO drastically lowers ROA (Fahlevi et al., 2023; Pratama & Isyuardhana, 2019; Rachmawati & Ambarwati, 2024; Wibowo et al., 2013). The research indicates that a drop in profitability may be in store if

operational expenses outpace operating income. Historical data is consistent with the present, supporting the premise that operational efficiency remains an important component of banking profitability regardless of economic conditions.

Among the independent variables examined in this study, the most striking finding is BOPO's statistically strong negative influence on ROA, overshadowed by CAR's lack of significance. Given that the absolute value of the BOPO coefficient (-0.044879) is much greater than that of CAR (0.014264), it seems that operational efficiency has a greater influence on profitability than capital adequacy does during the post-pandemic recovery period.

With a larger absolute value for the BOPO coefficient than for CAR, operational efficiency is the more important component in explaining profitability from 2020 to 2024. Operational effectiveness, rather than capital adequacy, determines bank profitability in the post-pandemic recovery period, proving the study's exclusivity.

This conclusion lends theoretical credence to Signalling Theory, the hypothesis that states that stakeholders and investors may learn about a company's performance and future prospects by analysing its financial measures. With better cost management and more efficient operations, a lower BOPO ratio shows a greater ability to make sustained profits. Moreover, stakeholders may lose faith in a bank's capacity to turn a profit if the BOPO ratio is high, as it might indicate inefficient operations and poor financial performance.

Findings suggest that, practically speaking, bank management should focus on techniques for optimising operations and controlling costs in order to increase profitability. Cutting costs and increasing operational efficiency is possible with the aid of digital transformation, process automation, better cost management, and effective resource allocation. Profitability and competitiveness in the ever-changing banking industry necessitate that banks prioritise operational efficiency improvements.

4. CONCLUSION

BOPO, CAR, and LDR all have a substantial impact on ROA from 2020 to 2024, according to results from traditional commercial banks listed on the Indonesia Stock Exchange. Since LDR has a positive and statistically significant effect on ROA, banks may increase profits by making better use of capital through lending activities. It is clear that having enough capital is not enough to guarantee higher profits, since CAR has a positive but insignificant effect on ROA. However, according to BOPO, ROA is negatively and statistically significantly affected, indicating that less efficient operations lead to lower profits for banks. The findings show that capital adequacy is not as crucial as operational efficiency and liquidity management when it comes to a bank's profitability.

These findings are corroborated by prior research: BOPO's negative effect aligns with Al et al. (2024), Pratama & Isyнуwardhana (2019), and Wibowo et al. (2013); LDR's positive effect supports Pradigdo et al. (2025). However, CAR's non-significance notably contradicts Rachmawati & Ambarwati (2024) and Cahyani et al. (2022), who reported significant CAR effects. This discrepancy constitutes the study's primary novelty: during post-pandemic recovery (2020-2024), operational efficiency and lending effectiveness supersede capital

adequacy as profitability drivers. This contextual finding suggests that variable relationships depend not merely on model specification but significantly on macroeconomic conditions. The study's power derives from methodological rigour (panel data, regression techniques), temporal relevance (post-pandemic recovery), theoretical grounding (Signalling Theory), and practical applicability. Bank management should prioritise operational optimisation and lending strategies over capital accumulation to enhance profitability.

5. REFERENCES

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