

DOI: <https://doi.org/10.38035/snefr>.<https://creativecommons.org/licenses/by/4.0/>

Evaluation of the Effect of Firm Size, LDR, NPL, and BOPO on the Profitability of Conventional Commercial Banks in Indonesia for the 2021-2024 Period

Muhammad Dhafa¹, Nurhidayati Dwiningsih²

¹Management Study Program, Faculty of Economics, Business and Humanities, Universitas Trilogi, Jakarta, Indonesia, muhammaddhafa270@gmail.com

²Management Study Program, Faculty of Economics, Business and Humanities, Universitas Trilogi, Jakarta, Indonesia, nurhidayati@trilogi.ac.id

Corresponding Author: muhammaddhafa270@gmail.com¹

Abstract: This study aims to evaluate the influence of Firm Size, Loan to Deposit Ratio (LDR), Non-Performing Loans (NPL), and Operating Expenses to Operating Income (BOPO) on profitability (Return on Assets) of conventional commercial banks in Indonesia for the period 2021-2024. The study population comprised all conventional commercial banks listed on the Indonesia Stock Exchange, with 30 banks selected as samples using a purposive sampling technique, resulting in 120 panel data observations. Secondary data, in the form of annual financial reports, was analyzed using panel data regression with the Random Effects Model (REM) as the selected estimation model. The results indicate that LDR has a positive and significant effect on ROA, while BOPO has a negative and significant effect on ROA. Firm Size and NPL did not significantly influence ROA. Simultaneously, all four independent variables were shown to have a significant effect on ROA. The Adjusted R-squared value was recorded at 91.29%, indicating the model's high capacity to explain variations in bank profitability. These findings confirm that operational efficiency and the credit intermediation function are the primary determinants of the profitability of conventional commercial banks in Indonesia.

Keyword: Return on Assets, Firm Size, Loan to Deposit Ratio, Non-Performing Loan, BOPO, Conventional Commercial Banks.

Indonesian Abstract: Penelitian ini bertujuan untuk mengevaluasi pengaruh Ukuran Perusahaan (Firm Size), Loan to Deposit Ratio (LDR), Non-Performing Loans (NPL), dan Beban Operasional terhadap Pendapatan Operasional (BOPO) terhadap profitabilitas (Return on Assets) bank umum konvensional di Indonesia periode 2021–2024. Populasi penelitian mencakup seluruh bank umum konvensional yang terdaftar di Bursa Efek Indonesia, dengan 30 bank terpilih sebagai sampel menggunakan teknik purposive sampling, sehingga menghasilkan 120 observasi data panel. Data sekunder berupa laporan keuangan tahunan dianalisis menggunakan regresi data panel dengan Random Effects Model (REM) sebagai model estimasi yang terpilih. Hasil penelitian menunjukkan bahwa LDR berpengaruh positif

dan signifikan terhadap ROA, sedangkan BOPO berpengaruh negatif dan signifikan terhadap ROA. Ukuran Perusahaan dan NPL tidak berpengaruh signifikan terhadap ROA. Secara simultan, keempat variabel independen terbukti berpengaruh signifikan terhadap ROA. Nilai Adjusted R-squared tercatat sebesar 91,29%, yang menunjukkan kapasitas model yang tinggi dalam menjelaskan variasi profitabilitas bank. Temuan ini mengonfirmasi bahwa efisiensi operasional dan fungsi intermediasi kredit merupakan determinan utama dari profitabilitas bank umum konvensional di Indonesia.

Kata Kunci: Return on Assets, Firm Size, Loan to Deposit Ratio, Non-Performing Loan, BOPO, Bank Umum Konvensional.

INTRODUCTION

The banking sector makes a highly crucial contribution to supporting economic development through the implementation of financial intermediation functions. As financial institutions, banks function to raise funds from the public and then channel them to business actors and parties in need of financing (Sudarmanto et al., 2021). This function is in line with the provisions of Law Number 7 of 1992 as amended by Law Number 10 of 1998, which emphasizes that banks carry out fund-raising activities through deposits, which are then channeled in the form of credit as a step to improve public welfare (Otoritas Jasa Keuangan, 2016).

In assessing a bank's financial performance, there are a number of financial ratios that serve as key indicators, including liquidity, profitability, and solvency ratios (Fauzi et al., 2023). Among these ratios, profitability is the most frequently used because it shows how well a bank generates profit from its resources (Jirwanto et al., 2024). Return on Assets (ROA) is one of the ratios most widely applied in measuring profitability because it reflects the effectiveness of management in optimizing assets to obtain net profit (Kirana & Waluyo, 2022; Supiyadi & Novita, 2023).



Source: <https://ojk.go.id/id/Default.aspx> (Diolah kembali)

Figure 1. ROA Bank Umum Konvensional

The profitability level of Indonesian conventional commercial banks showed considerable variation between 2021 and 2024. The ROA of the conventional commercial banking industry reached 1.85% in 2021, during the post-COVID-19 economic recovery, while the credit restructuring policy from the Financial Services Authority (OJK) was still in effect

(Otoritas Jasa Keuangan, 2020). The industry's ROA then rose to 2.45% in 2022 and peaked at 2.78% in 2023, before declining to 2.72% in 2024, indicating that the increase in profitability had not been sustained continuously.

Based on these conditions, this study selects conventional commercial banks as the object of study, because during the 2021-2024 period this group of banks showed more prominent profitability dynamics and superior ROA achievement compared with Islamic commercial banks. Based on 2024 OJK data, Conventional Commercial Banks (BUK) recorded total assets of Rp11,769 trillion with Third-Party Funds (DPK) reaching Rp8,326 trillion, far greater than Islamic Commercial Banks, which had total assets of only Rp665 trillion (Otoritas Jasa Keuangan, 2024). The large scale of these assets shows that conventional commercial banks still dominate the national banking industry, making them more representative in reflecting banking conditions in Indonesia.

One of the internal variables believed to influence bank profitability is bank size (Firm Size). In general, there is a positive correlation between bank size and profitability, because banks with larger total assets are generally better able to handle complex financial operations and utilize economies of scale more effectively (Handriani, 2025). However, empirical findings remain mixed: Sasongko et al. (2025) and Pham et al. (2022) found that Firm Size had a positive and significant effect on profitability, while Supiyadi & Novita (2023) found no significant effect, and Rosita (2021) found a negative and significant effect.

Liquidity management is also a highly crucial aspect of banking performance (Supiyadi & Novita, 2023). The Loan to Deposit Ratio (LDR) reflects how large a portion of public funds is allocated for credit disbursement in order to generate income. A high LDR indicates optimization of fund disbursement, which has the potential to increase profitability, although accompanied by an increase in liquidity risk (Saragih, 2023). Empirical research results are also not entirely consistent: Zakiyatun et al. (2024) and Saragih (2023) found a positive effect of LDR on profitability, while Supiyadi & Novita (2023) and Lutfi et al. (2022) found the opposite result.

In addition to liquidity, credit quality also affects bank profitability. An increase in non-performing loans, reflected in the Non-Performing Loan (NPL) ratio, has the potential to reduce interest income while increasing the risk of loss, which in turn reduces profitability (Setiawan et al., 2024). Sasongko et al. (2025), Zakiyatun et al. (2024), and Rosita (2021) found that NPL had a negative effect on profitability, while Setiawan et al. (2024) found a negative but not significant effect.

Operational efficiency, as measured by the ratio of Operating Expenses to Operating Income (BOPO), is also a crucial factor. A higher BOPO value indicates lower operational efficiency, which ultimately has a negative impact on bank profitability (Kirana & Waluyo, 2022). Lutfi et al. (2022), Pratama et al. (2022), and Aulia et al. (2024) found that BOPO had a negative effect on profitability.

Although a number of studies have been conducted since the COVID-19 outbreak, the results of studies on the effect of internal bank factors on profitability are still not entirely consistent, and the 2021-2024 period, as a time of post-pandemic economic recovery and stabilization, caused banking conditions to undergo fairly dynamic changes. Based on the description above, the research questions proposed in this study are: 1) does Firm Size affect banking profitability (ROA) in Indonesia; 2) does LDR affect banking profitability (ROA) in Indonesia; 3) does NPL affect banking profitability (ROA) in Indonesia; and 4) does BOPO affect banking profitability (ROA) in Indonesia.

Referring to these research questions, the purpose of this study is to analyze the effect of Firm Size, LDR, NPL, and BOPO on the profitability of conventional commercial banks in Indonesia during the 2021-2024 period. This study is expected to make a practical contribution to bank management in strategic decision-making related to asset management, credit

disbursement, and operational effectiveness, as well as a theoretical contribution to the development of empirical research in the banking sector.

METHOD

This study uses a quantitative approach with a causal-associative research type, focused on testing the cause-and-effect relationship between the independent and dependent variables (Sugiyono, 2023). The data used is panel data sourced from secondary data, namely the annual financial reports of conventional commercial banks listed on the Indonesia Stock Exchange (IDX) for the 2021-2024 period.

The study population includes all conventional commercial banks listed on the IDX during the 2021-2024 period. Sample selection was carried out using a purposive sampling technique based on the following criteria: (1) commercial banks listed on the stock exchange and operating as conventional commercial banks; (2) having no problematic data during the 2021-2024 period; (3) not banks operating under an Islamic (sharia) operational system; and (4) not digital banks or banks that underwent significant business transformation. Based on these criteria, 30 conventional commercial banks were obtained as the research sample, resulting in a total of 120 panel data observations analyzed (30 banks x 4 years).

Data collection was carried out using a documentation technique, utilizing secondary data from annual financial reports published on the official websites of the IDX, OJK, and each bank's official website. The dependent variable in this study is profitability, proxied by ROA, while the independent variables consist of Firm Size, LDR, NPL, and BOPO.

Tabel 1. Operasionalisasi Variabel Penelitian

Variabel	Definisi Operasional	Indikator/Rumus	Skala
ROA (Y)	Kapasitas bank dalam mengelola aset untuk menghasilkan laba	$ROA = \text{Laba Bersih} / \text{Total Aset} \times 100\%$	Rasio
Firm Size (X1)	Skala usaha bank berdasarkan total aset yang dimiliki	$\text{Firm Size} = \text{Ln} (\text{Total Aset})$	Ln
LDR (X2)	Perbandingan kredit yang disalurkan dengan dana pihak ketiga yang dihimpun	$LDR = \text{Total Kredit} / \text{Total DPK} \times 100\%$	Rasio
NPL (X3)	Proporsi kredit bermasalah terhadap total kredit yang disalurkan	$NPL = \text{Kredit Bermasalah} / \text{Total Kredit} \times 100\%$	Rasio
BOPO (X4)	Perbandingan beban operasional terhadap pendapatan operasional	$BOPO = \text{Beban Operasional} / \text{Pendapatan Operasional} \times 100\%$	Rasio

Source: Precessed data (2026)

Data analysis was carried out using panel data regression techniques with the EViews 13 application. The analysis stage began with descriptive statistics to obtain an overview of the mean, median, maximum, minimum, and standard deviation values of each variable (Sugiyono, 2023).

Panel data regression estimation was carried out through three approaches, namely the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM), with the following general equation:

$$ROA_{it} = \alpha + \beta_1 \text{Firm Size}_{it} + \beta_2 \text{LDR}_{it} + \beta_3 \text{NPL}_{it} + \beta_4 \text{BOPO}_{it} + \epsilon_{it} \quad (1)$$

where ROA is profitability as measured by Return on Assets; Firm Size, LDR, NPL, and BOPO are the independent variables; α is the constant; β_1 through β_4 are the regression coefficients of each variable; and ε is the error term. In FEM, the intercept α is differentiated for each individual (α_i) through the Least Squares Dummy Variable approach, while in REM the Generalized Least Squares (GLS) method is used with a combined error component $V_{it} = \varepsilon_{it} + \mu_i$ (Sugiyanto et al., 2022).

The selection of the most appropriate panel data regression model was carried out through three stages of testing. The Chow Test is used to determine the best model between CEM and FEM based on the Cross-section F probability value; if the p-value < 0.05 , then FEM is selected. The Hausman Test is used to determine the best model between FEM and REM based on the Cross-section Random probability value; if the p-value < 0.05 , then FEM is selected, and if the p-value > 0.05 , the analysis proceeds to the Lagrange Multiplier (LM) Test to determine the choice between REM and CEM based on the Breusch-Pagan probability value (Sugiyanto et al., 2022).

Hypothesis testing was carried out using the F Test to examine the simultaneous effect of all independent variables on the dependent variable, and the t Test to examine the partial effect of each independent variable, with a significance level of 0.05 (Basuki, 2018). In addition, an analysis of the coefficient of determination (Adjusted R-squared) was carried out to determine the model's capacity to explain the variation in the dependent variable (Sugiyanto et al., 2022).

RESULTS AND DISCUSSION

Data analysis in this study was carried out in stages using the EViews 13 application, beginning with descriptive statistics, followed by the selection of a panel data regression model through the Chow Test, Hausman Test, and Lagrange Multiplier Test, then hypothesis testing through the t Test and F Test, as well as an analysis of the coefficient of determination (R^2).

Descriptive Statistics

This section presents the descriptive statistics results for the ROA, Firm Size, LDR, NPL, and BOPO variables of conventional commercial banks in Indonesia for each observation year, with 30 observations per year.

Tabel 2. Statistik Deskriptif Tahun 2021

	ROA	Firm Size	LDR	NPL	BOPO
Mean	0.011157	18.19048	0.71296	0.034257	0.871833
Median	0.01	18.5117	0.71555	0.03295	0.87735
Maximum	0.0431	21.2688	1.342	0.1409	1.5833
Minimum	-0.0294	15.8595	0.1235	0	0.517
Std. Dev.	0.014365	1.665607	0.237638	0.025067	0.194512
Observations	30	30	30	30	30

Source: Precessed data (2026)

In 2021, the average ROA was recorded at 1.12%, with a standard deviation higher than the mean, indicating that the distribution of profitability among banks was quite heterogeneous, as some banks experienced losses during that period. The average Firm Size was recorded at

18.19 with a relatively homogeneous distribution, while the average LDR of 71.30% indicates a relatively conservative intermediation function amid the post-pandemic economic recovery. The average NPL of 3.43% was still below the regulatory maximum limit (5%), and the average BOPO of 87.18% indicates relatively low operational efficiency during the pandemic recovery period.

Tabel 3. Statistik Deskriptif Tahun 2022

	ROA	Firm Size	LDR	NPL	BOPO
Mean	0.014717	18.23009	0.77813	0.029567	0.81348
Median	0.0136	18.58705	0.80045	0.028	0.81375
Maximum	0.04	21.4127	1.4606	0.0945	1.5594
Minimum	-0.0346	15.7928	0.2053	0.0017	0.461
Std. Dev.	0.014813	1.694106	0.231509	0.019374	0.197393
Observations	30	30	30	30	30

Source: Precessed data (2026)

In 2022, the average ROA increased to 1.47%, indicating an improvement in profitability in line with the recovery of the national economy. The average LDR increased to 77.81%, indicating an improvement in the intermediation function, while the average NPL improved to 2.96% and the average BOPO improved to 81.35%, indicating an overall increase in banking operational efficiency.

Tabel 4. Statistik Deskriptif Tahun 2023

	ROA	Firm Size	LDR	NPL	BOPO
Mean	0.015943	18.28992	0.84438	0.025843	0.806863
Median	0.01315	18.5786	0.85035	0.02345	0.8223
Maximum	0.0403	21.4999	1.3673	0.0936	1.0336
Minimum	0.0004	15.7326	0.4094	0.0007	0.437
Std. Dev.	0.011563	1.691445	0.208793	0.016718	0.141711
Observations	30	30	30	30	30

Source: Precessed data (2026)

In 2023, the average ROA reached its peak at 1.59% with the most homogeneous distribution during the study period, indicating a full recovery in banking profitability. The average LDR increased to 84.44%, the average NPL improved to 2.58%, and the average BOPO reached its best point at 80.69% throughout the study period.

Tabel 5. Statistik Deskriptif Tahun 2024

	ROA	Firm Size	LDR	NPL	BOPO
Mean	0.015407	18.38357	0.868353	0.024317	0.819197
Median	0.01315	18.5786	0.85035	0.02345	0.8223
Maximum	0.039	21.61	1.47	0.0753	1.2013
Minimum	-0.0143	15.8372	0.3268	0.0006	0.417
Std. Dev.	0.011977	1.678951	0.231443	0.013797	0.147477
Observations	30	30	30	30	30

Source: Precessed data (2026)

In 2024, the average ROA slightly decreased to 1.54%, indicating that the increase in profitability had not been fully sustained consistently. The average Firm Size reached 18.38 (the highest during the study period), the average LDR reached 86.84% (the highest during the study period), the average NPL improved to 2.43% (the lowest during the study period), but the average BOPO slightly increased to 81.92%, indicating a slight decrease in average operational efficiency compared with the previous year.

Panel Data Regression Model

This study estimates three panel data regression approaches, namely the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM), as an initial stage before determining the most appropriate model to use.

Table 6. Common Effect Model Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.009275	0.005161	-1.797284	0.0749
FIRM_SIZE	0.000513	0.000281	1.826080	0.0704
LDR	0.003167	0.001244	2.545923	0.0122
NPL	-0.000837	0.000360	-2.324864	0.0218
BOPO	-0.056311	0.002225	-25.30828	0.0000
R-squared	0.905223	Mean dependent var		0.014306
Adjusted R-squared	0.901926	S.D. dependent var		0.013222
S.E. of regression	0.004141	Akaike info criterion		-8.095076
Sum squared resid	0.001972	Schwarz criterion		-7.978930
Log likelihood	490.7045	Hannan-Quinn criter.		-8.047908
F-statistic	274.5926	Durbin-Watson stat		0.420568
Prob(F-statistic)	0.000000			

Source: Data processed using EViews 13 (2026)

Based on these estimation results, the Common Effect Model regression form is as follows:

$$ROA_{it} = -0.009275 + 0.000513 \text{ Firm Size}_{it} + 0.003167 \text{ LDR}_{it} - 0.000837 \text{ NPL}_{it} - 0.056311 \text{ BOPO}_{it} + \varepsilon_{it}$$

Table 7. Fixed Effect Model Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.015534	0.034340	-0.452354	0.6522
FIRM_SIZE	0.000866	0.001890	0.458039	0.6481
LDR	0.002338	0.001210	1.932136	0.0566
NPL	-0.000140	0.000337	-0.414200	0.6798
BOPO	-0.067153	0.002185	-30.73350	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.985449	Mean dependent var	0.014306	
Adjusted R-squared	0.979866	S.D. dependent var	0.013222	
S.E. of regression	0.001876	Akaike info criterion	-9.485645	
Sum squared resid	0.000303	Schwarz criterion	-8.695855	
Log likelihood	603.1387	Hannan-Quinn criter.	-9.164908	
F-statistic	176.4980	Durbin-Watson stat	2.273398	
Prob(F-statistic)	0.000000			

Source: Data processed using EViews 13 (2026)

The Fixed Effect Model regression form obtained is as follows:

$$ROA_{it} = -0.015534 + 0.000866 \text{ Firm Size}_{it} + 0.002338 \text{ LDR}_{it} - 0.000140 \text{ NPL}_{it} - 0.067153 \text{ BOPO}_{it} + \varepsilon_{it}$$

Table 8. Random Effect Model Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001015	0.008135	0.124773	0.9009
FIRM_SIZE	-4.69E-05	0.000445	-0.105495	0.9162
LDR	0.002765	0.001056	2.619719	0.0100
NPL	-0.000340	0.000299	-1.137548	0.2577
BOPO	-0.064647	0.001964	-32.90773	0.0000
Effects Specification				
		S.D.	Rho	
Cross-section random		0.003828	0.8063	
Idiosyncratic random		0.001876	0.1937	
Weighted Statistics				
R-squared	0.915854	Mean dependent var	0.003405	
Adjusted R-squared	0.912927	S.D. dependent var	0.006450	
S.E. of regression	0.001903	Sum squared resid	0.000417	
F-statistic	312.9181	Durbin-Watson stat	1.682581	
Prob(F-statistic)	0.000000			

Source: Data processed using EViews 13 (2026)

The Random Effect Model regression form obtained is as follows:

$$ROA_{it} = 0.001015 - 0.0000469 \text{ Firm Size}_{it} + 0.002765 \text{ LDR}_{it} - 0.000340 \text{ NPL}_{it} - 0.064647 \text{ BOPO}_{it} + V_{it}$$

Panel Data Regression Model Selection Test

Determination of the most appropriate panel data regression model was carried out through the Chow Test, Hausman Test, and Lagrange Multiplier Test.

Table 9. Chow Test Results

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	16.350872	(29,86)	0.0000
Cross-section Chi-square	224.868295	29	0.0000

Source: Data processed using EViews 13 (2026)

The Cross-section F probability value in Table 9 was recorded at 0.0000 (< 0.05), so H0 is rejected and H1 is accepted. This finding indicates that FEM is more appropriate to use than CEM, so the analysis proceeds with the Hausman Test.

Table 10. Hausman Test Results

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	7.346421	4	0.1187

Source: Data processed using EViews 13 (2026)

The Cross-section Random probability value in Table 10 was recorded at 0.1187 (> 0.05), so H0 is accepted. This finding indicates that REM is more appropriate to use than FEM, so the analysis proceeds with the Lagrange Multiplier Test to determine the choice between REM and CEM.

Table 11. Lagrange Multiplier Test Results

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	96.96331 (0.0000)	1.167243 (0.2800)	98.13055 (0.0000)

Source: Data processed using EViews 13 (2026)

The Breusch-Pagan probability value in the Cross-section column was recorded at 0.0000 (< 0.05), so H0 is rejected and H1 is accepted. Based on the results of these three tests, REM was determined to be the most appropriate regression model to use in this study.

Analysis of the Selected Panel Data Regression Model

Referring to the Random Effect Model estimation results, regression analysis results were obtained showing the relationship between the dependent variable Profitability (ROA) (Y) and the independent variables Firm Size (X1), LDR (X2), NPL (X3), and BOPO (X4) of conventional commercial banks during the 2021-2024 period, with the following regression equation:

$$ROA_{it} = 0.001015 - 0.0000469 \text{ Firm Size}_{it} + 0.002765 \text{ LDR}_{it} - 0.000340 \text{ NPL}_{it} - 0.064647 \text{ BOPO}_{it} + V_{it}$$

The constant value of 0.001015 shows that ROA is 0.001015 when the Firm Size, LDR, NPL, and BOPO variables are assumed to be zero. The Firm Size coefficient of -0.0000469 indicates that a one-unit increase in Firm Size is accompanied by a decrease in ROA of 0.0000469, assuming other variables are constant. The LDR coefficient of 0.002765 shows that each one-unit increase in LDR will increase ROA by 0.002765. The NPL coefficient of -0.000340 shows that each one-unit increase in NPL is accompanied by a decrease in ROA of

0.000340. The BOPO coefficient of -0.064647 shows that each one-unit increase in BOPO will decrease ROA by 0.064647, assuming other factors are constant.

The Random Effect Model estimation results yielded an F-statistic of 312.9181 with Prob(F-statistic) of 0.000000 (< 0.05), indicating that Firm Size, LDR, NPL, and BOPO simultaneously have a significant effect on Return on Assets.

The partial test results (t Test) show that the Firm Size variable has a probability value of 0.9162 (> 0.05), so it does not have a significant effect on ROA; the LDR variable has a probability value of 0.0100 (< 0.05) with a positive coefficient, so it has a positive and significant effect on ROA; the NPL variable has a probability value of 0.2577 (> 0.05), so it does not have a significant effect on ROA; and the BOPO variable has a probability value of 0.0000 (< 0.05) with a negative coefficient, so it has a negative and significant effect on ROA. The Adjusted R-squared value of 0.912927, or 91.29%, shows that the research model has a high capacity to explain the variation in ROA, while the remaining 8.71% is explained by other factors outside the model.

Discussion

This section describes the results of the panel data regression that evaluates the role of each independent variable in explaining the variation in ROA of banking companies, accompanied by a review of the annual development of descriptive statistics for each variable during the 2021-2024 period.

Effect of Firm Size on Return on Assets

Based on the Random Effect Model test results, Firm Size has a probability value of 0.9162 (> 0.05) with a coefficient of -0.0000469, indicating that Firm Size does not have a significant effect on Return on Assets (ROA), so the hypothesis is rejected. Descriptively, this is shown by the average Firm Size, which continued to increase consistently from 2021 to 2024 (18.19048 in 2021; 18.23009 in 2022; 18.28992 in 2023; and 18.38357 in 2024), but was not followed by a corresponding movement in ROA. The average ROA increased from 1.12% in 2021, 1.47% in 2022, and 1.59% in 2023, before eventually decreasing to 1.54% in 2024.

This condition shows that asset size growth does not automatically result in increased profitability if the assets are not managed effectively and productively by management to generate income. Viewed from Signaling Theory, although asset size signals to external parties regarding the bank's operational capacity and scale, the size of assets alone is not sufficient to explain changes in the bank's ability to generate profit. This finding reinforces the research of Supiyadi & Novita (2023), which states that Firm Size does not have a significant effect on ROA, but differs from Sasongko et al. (2025) and Pham et al. (2022), who found a significant positive effect, as well as Rosita (2021) and Saragih (2023), who obtained a significant negative effect.

Effect of LDR on Return on Assets

The Random Effect Model test results show that the Loan to Deposit Ratio (LDR) has a positive and significant effect on Return on Assets (ROA), with a probability value of 0.0100 (< 0.05) and a coefficient of 0.002765, so the hypothesis is accepted. Descriptively, this improvement in the intermediation function is seen from the average LDR, which rose gradually from 71.30% in 2021, 77.81% in 2022, 84.44% in 2023, to 86.84% in 2024, with the maximum LDR value recorded quite high at 134.20% (2021), 146.06% (2022), 136.73% (2023), and 147.00% (2024). This development is directly proportional to the increase in average ROA from 1.12% (2021), 1.47% (2022), and 1.59% (2023), although it slightly decreased to 1.54% in 2024. This empirical picture proves that an increase in credit disbursement balanced with liquidity management is directly related to an increase in the bank's ability to earn profit.

Viewed from Signaling Theory, an increase in LDR provides positive information to external parties regarding the effectiveness of management in converting third-party funds into productive income-generating assets. The finding that intermediation effectiveness is a determinant of profitability reinforces the research of Sasongko et al. (2025), Zakiyatun et al. (2024), and Saragih (2023), who found a positive and significant effect. However, this result differs from Supiyadi & Novita (2023) and Lutfi et al. (2022), who found a significant negative effect, as well as Pratama et al. (2022) and Aulia et al. (2024), who stated that LDR does not have a significant effect on ROA.

Effect of NPL on Return on Assets

Based on the Random Effect Model estimation results, Non-Performing Loan (NPL) has a probability value of 0.2577 (> 0.05) with a coefficient of -0.000340, indicating that NPL does not have a significant effect on Return on Assets (ROA), so the hypothesis is rejected. Descriptively, the credit quality of the sample banks generally improved, as shown by the decrease in average NPL from 3.43% in 2021, 2.96% in 2022, 2.58% in 2023, to 2.43% in 2024. This decrease in NPL initially moved in the same direction as the increase in average ROA, namely 1.12% (2021), 1.47% (2022), and 1.59% (2023), but in 2024 ROA actually decreased slightly to 1.54% even though NPL continued to improve. This proves that variations in NPL are not statistically strong enough to explain changes in profitability, and that ROA is also influenced by factors other than NPL.

Viewed from Signaling Theory, the decrease in average NPL provides a positive signal regarding the improvement in the quality of productive assets and a decrease in credit risk, but the regression results show that this information has not been able to significantly explain changes in ROA. This finding is consistent with the research of Pratama et al. (2022), which states that NPL does not have a significant effect on ROA. Conversely, this result differs from the findings of Sasongko et al. (2025), Rosita (2021), Zakiyatun et al. (2024), and Setiawan et al. (2024), who found that NPL had a significant effect in reducing ROA.

Effect of BOPO on Return on Assets

The Random Effect Model estimation results show that Operating Expenses to Operating Income (BOPO) has a negative and significant effect on Return on Assets (ROA), with a probability value of 0.0000 (< 0.05) and a coefficient of -0.064647, so the hypothesis is accepted. Descriptively, this trade-off relationship is clearly seen from the average BOPO, which decreased successively from 87.18% in 2021, 81.35% in 2022, to 80.69% in 2023, during which period the average ROA actually increased from 1.12% (2021), 1.47% (2022), to 1.59% (2023). Conversely, in 2024, when the average BOPO rose again to 81.92%, the average ROA immediately decreased to 1.54%. This consistent relationship proves that changes in operational efficiency have a far clearer and more dominant influence on changes in profitability compared with Firm Size and NPL.

The higher the BOPO ratio, the greater the proportion of income absorbed to cover operating expenses, thereby suppressing the bank's profit, while a decrease in BOPO reflects management's success in reducing operating costs. Viewed from Signaling Theory, the BOPO ratio provides transparent information to external parties regarding the level of management efficiency, where a decrease in BOPO signals improving operational performance. The finding that operational efficiency is the primary determinant of profitability reinforces previous research by Zakiyatun et al. (2024), Lutfi et al. (2022), Pratama et al. (2022), and Aulia et al. (2024), who also stated that BOPO has a negative and significant effect on ROA.

Joint Effect of Firm Size, LDR, NPL, and BOPO on Return on Assets

The F Test results show an F-statistic value of 312.9181 with a probability of 0.000000 (< 0.05), indicating that Firm Size, LDR, NPL, and BOPO simultaneously have a significant effect on Return on Assets. The Adjusted R-squared value of 0.912927, or 91.29%, shows that

this research model has a high capacity to explain the variation in ROA of conventional commercial banks in Indonesia, while the remaining 8.71% is explained by other factors outside this research model.

CONCLUSION

This study aims to evaluate the impact of Firm Size, LDR, NPL, and BOPO on the profitability of conventional commercial banks in Indonesia during the 2021–2024 period. Based on the panel data regression analysis using the Random Effect Model, it is concluded that profitability (ROA) is not significantly influenced by Firm Size; this indicates that a bank's total asset size does not necessarily correlate positively with higher profitability, implying that asset growth must be accompanied by efficient management to contribute to profit increases.

LDR was found to have a positive and significant effect on profitability, demonstrating that a higher proportion of disbursed loans relative to collected third-party funds enhances a bank's capacity to generate profit through interest income. Conversely, NPL did not significantly affect profitability, indicating that conventional commercial banks during the study period were able to manage credit risk effectively, such that fluctuations in non-performing loan levels did not immediately impact their profit-generating capacity.

Meanwhile, BOPO was found to have a negative and significant effect on profitability, underscoring that operational efficiency is a crucial predictor of bank profitability; high operational expenses incurred to generate operating income directly erode bank profits. Collectively, the four independent variables significantly influenced ROA with high explanatory power, as evidenced by an Adjusted R-squared value of 91.29%.

Based on these findings, bank management is advised to prioritize operational efficiency for instance, by optimizing labor costs, digitizing banking services, and improving the efficiency of the cost of funds to lower the BOPO ratio while also maintaining loan disbursement at an optimal level: expansive enough to drive interest income yet compliant with safe liquidity limits established by Bank Indonesia or the OJK. Future research is recommended to build upon these findings by using different research subjects such as Sharia banks, digital banks, or Rural Banks extending the observation period, and broadening the scope of research variables. This could involve adding external factors (e.g., exchange rates, interest rates, inflation, and economic growth) as well as other internal factors (e.g., Net Interest Margin and Capital Adequacy Ratio) to gain a more comprehensive understanding of the determinants of bank profitability.

REFERENCE

- Akbar, T. (2019). *Kajian Kinerja Profitabilitas Bank pada Perspektif Bank Umum Berdasarkan Kegiatan Usaha: Studi Empiris Pada Momen Penurunan Profitabilitas Bank-Bank di Indonesia*.
- Andrianto, Fatihuddin, D., & Firmansyah, A. (2019). *Manajemen Bank* (1st ed.). CV. Penerbit Qiara Media.
- Aulia, S. R., Thamrin, K. M. H., & Muthia, F. (2024). Analisis Pengaruh Kinerja Keuangan terhadap Profitabilitas pada Bank Umum Konvensional di Indonesia. *Al-Kharaj: Jurnal Ekonomi, Keuangan & Bisnis Syariah*, 6(4), 4153-4174. <https://doi.org/10.47467/alkharaj.v6i4.922>
- Basuki, A. T. (2018). *Ekonomika Pengantar (Dilengkapi Penggunaan Eviews)* (1st ed.). Danisa Media.
- Brigham, E. F., & Houston, J. F. (2019). *Fundamentals of Financial Institution Management*. Cengage Learning.

- Fauzi, Sumtaki, A., Sibua, N., & Wiranata, A. (2023). *Buku Referensi Manajemen Keuangan Pengambilan Keputusan Berdasarkan Analisis Rasio* (1st ed.). PT. Literasi Nusantara Abadi Grup.
- Fauziah, F. (2017). *Kesehatan Bank, Kebijakan Dividen, dan Nilai Perusahaan: Teori dan Kajian Empiris*. RV Pustaka Horizon.
- Febriana, H., Rismanty, V. A., Bertuah, E., Permata, S. U., Anismadiyah, V., Sembiring, L. D., Dewi, N. S., Jamaludin, Jatmiko, N. S., Inrawan, A., Astuti, W., & Dewi, I. K. (2020). *Dasar-Dasar Analisis Laporan Keuangan*. CV. Media Sains Indonesia.
- Goh, T. S. (2023). *Monograf: Financial Distress*. Indomedia Pustaka.
- Handriani, E. (2025). An Analysis of Firm-Specific, Industry Specific, and Macroeconomic Determinants Influencing Bank Profitability in Indonesia. *Jurnal Studi Manajemen Organisasi*, 22(1), 58-88. <https://doi.org/10.14710/jsmo.v22i1.72650>
- Jirwanto, H., Aqsa, M. A., Agusven, T., Herman, H., & Sulfitri, V. (2024). *Manajemen Keuangan*. CV. Azka Pustaka.
- Kasmir. (2019). *Analisis Laporan Keuangan (ALK)*. PT RajaGrafindo Persada.
- Kirana, P. A., & Waluyo, D. E. (2022). Pengaruh NPL, LDR, BOPO terhadap ROA pada Bank yang Terdaftar di Bursa Efek Indonesia Periode 2012-2021. *Capital: Kebijakan Ekonomi, Manajemen & Akuntansi*, 4(2), 46-63.
- Lutfi, N. O., Setiawan, I., & Pakpahan, R. (2022). Pengaruh LDR dan BOPO terhadap ROA pada Bank Umum yang Terdaftar di BEI Tahun 2010-2020. *Indonesian Journal of Economics and Management*, 2(1), 73-80. <https://doi.org/10.35313/ijem.v2i1.3101>
- Otoritas Jasa Keuangan. (2016). *Peraturan Otoritas Jasa Keuangan Nomor 18/POJK.03/2016 tentang Penerapan Manajemen Risiko bagi Bank Umum*. OJK Republik Indonesia.
- Otoritas Jasa Keuangan. (2020). *Restrukturisasi Kredit/Pembiayaan terkait Dampak COVID-19*. <https://www.ojk.go.id>
- Otoritas Jasa Keuangan. (2024). *Laporan Surveillance Perbankan Indonesia Triwulan IV 2024*.
- Pham, N. H., Hoang, T. M., & Pham, N. T. H. (2022). The Impact of Capital Structure on Bank Profitability: Evidence From Vietnam. *Cogent Business and Management*, 9(1), 1-25. <https://doi.org/10.1080/23311975.2022.2096263>
- Pratama, M. S., Afriansyah, R., & Mubaroh, S. (2022). Analisis Kinerja Keuangan Menggunakan Regresi Data Panel pada Sektor Perbankan di Indonesia. *Inovasi: Jurnal Ekonomi, Keuangan dan Manajemen*, 18(3), 686-692.
- Rohman, M. M., Sinaga, J., Yuliawati, Asmara, A., Sari, T. P., Musa, Ramadhan, A. R., Yustitia, V., Agit, A., Suhendi, Hidayati, N., Dewi, N. P. S., Sukandi, P., & Saputri, P. S. (2023). *Metodologi Penelitian Kualitatif dan Kuantitatif*. Deepublish.
- Rosita, Y. (2021). Faktor-Faktor yang Memengaruhi Profitabilitas Bank: Studi Komparatif pada Bank Umum Konvensional dan Bank Umum Syariah di Indonesia. *Jurnal Stieyasaanggana*, 18(1), 1-6.
- Saragih, A. B. (2023). Determinant Factors Analysis of Bank Profitability: Study on Indonesian Banks Period 2019-2022. *Journal Integration of Management Studies*, 2(1), 1-17. <https://doi.org/10.58229/jims.v1i2.118>
- Sasongko, S., Manurung, A. H., & Rahayu, S. (2025). Pengaruh Faktor Internal dan Eksternal terhadap Kinerja Keuangan Bank BUMN di Indonesia: Pendekatan Regresi Panel 2014-2024. *Journal of Capital Markets and Banking (JCMB)*, 13(3), 32-54. <https://doi.org/10.63607/jcmb.v13i3>
- Setiawan, I., Zulbetti, R., & Perwito. (2024). The Indonesian Commercial Banks' Profitability and Credit Risk. *Jurnal Ilmu Keuangan dan Perbankan (JIKA)*, 14(1), 41-54.
- Sobana, D. H. (2017). *Manajemen Keuangan Syariah* (1st ed.). CV Pustaka Setia.
- Sudarmanto, E., Astuti, Kato, I., Basmar, E., Yuningsih, H. M. P. S., Wisnujati, N. S., & Siagian, V. (2021). *Manajemen Risiko Perbankan* (1st ed.). Yayasan Kita Menulis.

- Sugiyanto, E. K., Subagyo, E., Adinugroho, W. C., Jacob, J., Berry, Y., Nuraini, A., Sudjono, & Syah, S. (2022). *Konsep dan Praktik Ekonometrika Menggunakan Eviews*. Academia Publication.
- Sugiyono. (2023). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Alfabeta.
- Supiyadi, D., & Novita, I. (2023). The Effect of Firm Size, Credit Risk, Interest Rates, and Liquidity on Bank Profitability: Study on State-Owned Banks in Indonesia. *Jurnal Ilmu Keuangan dan Perbankan (JIKA)*, 13(1), 33-44. <https://doi.org/10.34010/jika.v13i1.10374>
- Warae, Y., Hartono, P. G., Karystin, Y., Suade, M., Rahayu, D. H., & Tinungki, G. M. (2024). *Buku Ajar Manajemen Keuangan*. PT. Sonpedia Publishing Indonesia.
- Yunita, N. A. (2018). *Analisis Tingkat Kesehatan Bank dengan Menggunakan Metode CAMELS dan PEARLS pada Bank Umum di Indonesia*. CV. Sefa Bumi Persada.
- Zakiyatun, A., Khomsatun, S., Ersyafdi, I. R., Ulfa, F., Prabowo, M. A., Aryani, H. F., & Fauziyyah, N. (2024). The Effect of Financial Ratios and Share Ownership on Profitability in Indonesia Banking Industry. *Equilibrium: Jurnal Ilmiah Ekonomi, Manajemen dan Akuntansi*, 13(1), 256-273. <https://doi.org/10.35906/equili.v13i1.1960>