

## Determinants of Financial Performance in the Indonesian Banking Sector for the 2022–2024 Period

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### ABSTRACT

*This research investigates the impact of Firm Size, operational efficiency, and credit risk on the financial performance of commercial banks listed on the Indonesia Stock Exchange from 2022 to 2024. Financial performance is assessed by Return on Assets (ROA), Firm Size is quantified by the natural logarithm of total assets, operational efficiency is evaluated via the Operating Expenses to Operating Income ratio (BOPO), and credit risk is determined using the Non-Performing Loan ratio (NPL). The research employs secondary data derived from the yearly financial reports of 12 banks chosen via purposive sampling, culminating in a balanced panel of 36 bank-year observations. The analysis employed panel data regression to evaluate the Common Effect Model, Fixed Effect Model, and Random Effect Model. According to the Chow and Hausman tests, the Random Effect Model was deemed the most suitable model. The findings indicate that Firm Size exhibits a positive albeit statistically inconsequential correlation with ROA. BOPO and NPL exhibit adverse and statistically significant correlations with ROA. The three independent variables concurrently exhibit a substantial correlation with ROA, reflected by a Marginal R<sup>2</sup> value of 0.803. These results suggest that the profitability of banks in the post-pandemic era is more significantly linked to operational efficiency and credit quality rather than merely the scale of assets.*

**Keywords:** firm size; BOPO; NPL; ROA; panel data regression.

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### INTRODUCTION

The post-pandemic performance of Indonesian commercial banks did not move in a uniform direction. Data from Otoritas Jasa Keuangan (OJK) show that Return on Assets (ROA) increased from 2.43% in 2022 to 2.74% in 2023, but subsequently declined to 2.69% in 2024. During the same period, the gross Non-Performing Loan (NPL) ratio improved from 2.44% in 2022 to 2.19% in 2023 and 2.08% in 2024. In contrast, the Operating Expenses to Operating Income ratio (BOPO) increased from 78.65% in 2022 to 78.92% in 2023 and 81.30% in 2024 (Otoritas Jasa Keuangan, 2022, 2023, 2024).

This pattern raises an important empirical issue. The continued improvement in credit quality was not followed by a sustained increase in profitability, while the rise in BOPO indicates increasing pressure on operational efficiency. This condition suggests that the financial performance of banks cannot be explained solely by credit risk or the amount of assets owned. It is therefore necessary to examine whether firm size, operational efficiency, and credit risk jointly explain changes in banking profitability during the post-pandemic period.

The banking sector plays a crucial role in the economy because it performs an intermediary function: raising funds from the public and channeling them back in the form of loans and financing. This function makes the banking industry one of the sectors that influences financial system stability and economic growth. A bank's financial performance serves as a key indicator for assessing its ability to manage assets, generate profits, maintain operational efficiency, and control risks arising from its business activities (Athanasoglou et al., 2008; Dietrich & Wanzenried, 2011). In this study, financial performance is proxied by Return on Assets (ROA) because ROA reflects a bank's ability to generate profits based on its total assets (Nurjanah et al., 2025).

One internal factor that can influence financial performance is firm size. In the banking sector, firm size generally reflects the magnitude of a bank's assets. Banks with larger assets tend to have greater operational capacity, better access to funding, and a stronger ability to diversify risk (Dietrich & Wanzenried, 2011). Theoretically, large-scale companies have the opportunity to achieve efficiency through economies of scale. However, a large company size does not always guarantee increased profitability if it is not accompanied by efficient asset and cost management (Berger & Mester, 1997). Thus, the effect of Firm Size on financial performance still needs to be further examined, particularly in the context of the Indonesian banking sector.

Operational efficiency is also a key factor in explaining a bank's financial performance. In this study, operational efficiency is proxied by the Operating Expense to Operating Income Ratio (BOPO). The BOPO ratio indicates a bank's ability to control operating expenses relative to its operating income (Otoritas Jasa Keuangan, 2023). The higher the BOPO value, the greater the operating costs the bank must bear, which can lead to a decline in profits. Conversely, a low BOPO reflects more efficient operations and has the potential to increase profitability. Findings by Tan and Floros (2013) as well as Sutrisno and Widarjono (2022) indicate that operational efficiency is closely related to bank profitability.

In addition to firm size and operational efficiency, credit risk is also a factor that influences banks' financial performance. Credit risk in this study is proxied by non-performing loans (NPLs). NPLs indicate the proportion of non-performing loans relative to the total loans disbursed by a bank (Otoritas Jasa Keuangan, 2023). An increase in NPLs can reduce interest income, increase credit loss provision expenses, and decrease bank profits (Dendawijaya, 2009; Kasmir, 2019). Thus, credit risk management is a critical aspect of maintaining the profitability and sustainability of the banking sector's financial performance.

Previous studies have examined banking profitability under different institutional, economic, and methodological settings. Athanasoglou et al. (2008) analyzed profitability by considering bank-specific, industry-specific, and macroeconomic factors, while Dietrich and Wanzenried (2011) examined Swiss banks before and during the global financial crisis. Tan and Floros (2013) focused on the relationship between risk, capital, and efficiency in the Chinese banking industry. In the Indonesian context, Sutrisno and Widarjono (2022) examined Islamic banks, whereas Wahyuni (2023) analyzed the relationship between credit risk and profitability in conventional commercial banks.

Although these studies discuss similar determinants, their findings cannot be directly generalized to the same banking context. Differences in banking systems, ownership structures, types of banks, economic conditions, observation periods, sample characteristics, and estimation methods may produce different relationships between firm size, operational efficiency, credit risk, and profitability. Evidence obtained from foreign banking systems, financial-crisis periods, or Islamic banking samples may not fully describe the performance of publicly listed commercial banks in Indonesia during the post-pandemic recovery period.

The practical state of Indonesian banking suggests that the correlation between credit risk and profitability is complex. Between 2022 and 2024, the gross non-performing loan ratio consistently decreased; nevertheless, the enhancement in credit quality did not correlate with a sustained rise in return on assets. ROA increased in 2023 but declined again in 2024, while BOPO showed increasing pressure on operational efficiency (Otoritas Jasa Keuangan, 2022, 2023, 2024). This divergence indicates that profitability cannot be explained by credit risk alone. It is necessary to examine firm size, BOPO, and NPL simultaneously to determine whether banking performance is more strongly associated with asset scale, operational efficiency, or credit-risk management.

The novelty of this study does not rely solely on the use of the 2022–2024 observation period. This study addresses the divergence between improving credit quality and fluctuating banking profitability during the post-pandemic period. It integrates three internal banking dimensions in a single analytical framework: Firm Size as an indicator of resource and asset scale, BOPO as an indicator of operational efficiency, and NPL as an indicator of credit quality. By examining these variables simultaneously, the study evaluates whether a large asset base is sufficient to improve profitability or whether the efficiency and quality of asset management play more decisive roles.

This research additionally enhances methodology by utilizing panel data regression and contrasting the Common Effect Model, Fixed Effect Model, and Random Effect Model. This methodology enables the examination of temporal variations alongside unrecognized disparities among financial institutions. This research intends to investigate the impact of Firm Size, BOPO, and NPL on the ROA of banking firms listed on the Indonesia Stock Exchange from 2022 to 2024. Theoretically, the findings are expected to strengthen the explanation of banking profitability from the perspectives of scale, efficiency, and credit risk. Practically, the results may provide a basis for bank management to determine whether profitability should be improved through asset expansion, operational cost control, credit-risk management, or a combination of these strategies.

## **THEORETICAL FOUNDATION AND HYPOTHESIS DEVELOPMENT**

### **Financial Intermediation Theory**

Financial Intermediation Theory is used as the main theoretical foundation of this study. The theory explains that banks act as intermediaries between parties with surplus funds and parties that require financing. Banks collect funds from depositors, evaluate prospective borrowers, distribute loans, and monitor loan repayment. Through this role, banks reduce information asymmetry and monitoring costs between fund providers and borrowers (Diamond, 1984).

The intermediation process allows banks to generate income, but it also creates operating expenses and credit risk. Therefore, banking profitability does not depend solely on the amount of assets controlled by a bank. It also depends on how effectively the bank converts those assets into earning activities, controls the costs of its operations, and maintains the quality of its loan portfolio. Inefficient operations reduce the portion of operating income that can be retained as profit, while problematic loans reduce interest income and increase credit-loss provisions.

Within this theoretical framework, Firm Size represents the scale of resources available to conduct financial intermediation. A larger asset base may expand a bank's capacity to provide loans, diversify its activities, and generate income. However, the benefit of a large asset base will not necessarily improve profitability when it is accompanied by high operating expenses or poor credit quality. BOPO represents the efficiency of the intermediation process because it shows the proportion of operating income absorbed by operating expenses. NPL represents the quality of credit allocation and borrower monitoring because it reflects the proportion of loans that encounter repayment problems.

ROA is positioned as the financial outcome of the intermediation process because it measures the bank's ability to generate profit from the total assets under its management. Based on Financial Intermediation Theory, banking financial performance is therefore determined by the interaction between the scale of assets, operational efficiency, and credit quality. This theoretical relationship provides the basis for examining the effects of Firm Size, BOPO, and NPL on ROA.

Financial performance is a measure used to assess a company's ability to manage its resources and generate profits. In the banking industry, financial performance is often associated with a bank's ability to maintain profitability, efficiency, and asset quality. Return on Assets (ROA) is used as a financial performance indicator because this ratio reflects a bank's ability to generate profits from its total managed assets (Athanasoglou et al., 2008; Nurjanah et al., 2025). A high ROA indicates that a bank is able to effectively utilize its assets to generate profits, whereas a low ROA may reflect suboptimal asset management or high operating expenses.

Firm Size reflects the scale of resources controlled by a bank and is commonly measured using the natural logarithm of total assets. From the perspective of Financial Intermediation Theory, a larger asset base increases a bank's capacity to collect and allocate funds, extend credit, develop banking services, and diversify its sources of income. Larger banks may also have broader access to funding and a greater ability to spread fixed operating costs across a larger volume of transactions (Athanasoglou et al., 2008; Dietrich & Wanzenried, 2011).

The expected positive relationship between Firm Size and ROA arises from economies of scale. When the volume of banking activities increases faster than operating costs, the average cost of providing financial services may decline, allowing a larger proportion of income to be retained as profit. Larger banks may also diversify their loan portfolios across customers, industries, and geographic areas, thereby reducing their dependence on a limited source of income or credit exposure.

However, the advantage of scale is not automatic. An increase in assets may also create organizational complexity, higher monitoring costs, and broader risk exposure. If additional assets are not allocated to productive activities or are accompanied by inefficient operations, the benefit of bank size may not be reflected in higher profitability (Berger & Mester, 1997). Nevertheless, when assets are managed productively and supported by effective cost and risk management, a larger bank is theoretically expected to generate higher returns from its resources. Therefore, the following hypothesis is proposed:

**Hypothesis 1: Firm size has a positive effect on banking financial performance.**

Operational efficiency reflects a bank's ability to generate operating income while controlling the costs incurred in carrying out its intermediary activities. In this study, operational efficiency is measured using the Operating Expenses to Operating Income ratio (BOPO). This ratio shows the proportion of operating income that is absorbed by operating expenses. Therefore, BOPO does not merely describe the amount of costs incurred by a bank, but also indicates how efficiently the bank converts its operating activities into earnings (Otoritas Jasa Keuangan, 2023).

From the perspective of Financial Intermediation Theory, banks incur costs when collecting funds, assessing borrowers, distributing credit, maintaining payment systems, monitoring loans, and providing banking services. When operating expenses increase faster than operating income, a larger proportion of the bank's revenue is used to finance its operations, leaving a smaller amount available as profit. Consequently, an increase in BOPO is expected to reduce Return on Assets because the bank generates less profit from the assets under its management.

Conversely, a lower BOPO indicates that the bank is able to conduct its operations with a relatively smaller cost burden. Operational efficiency may be achieved through effective cost control, productive use of assets, efficient business processes, and appropriate use of technology. Previous studies also indicate that differences in operational efficiency are closely related to differences in banking profitability (Tan & Floros, 2013; Sutrisno & Widarjono, 2022). Based on this economic mechanism, the following hypothesis is proposed:

**Hypothesis 2: BOPO has a negative effect on banking financial performance.**

Credit risk arises when borrowers are unable to repay loan principal or interest according to the agreed terms. In this study, credit risk is measured using the Non-Performing Loan (NPL) ratio, which compares non-performing loans with the total loans distributed by a bank. Therefore, NPL reflects the quality of the bank's loan portfolio and the effectiveness of its credit-risk management (Otoritas Jasa Keuangan, 2023).

From the perspective of Financial Intermediation Theory, banks are responsible for screening prospective borrowers and monitoring their ability to repay loans. An increase in NPL may indicate that part of the credit distributed by a bank is no longer generating the expected cash inflows. This condition reduces interest income and requires the bank to allocate additional provisions for potential credit losses. Banks may also incur additional monitoring, collection, and loan-restructuring costs when dealing with problematic borrowers (Diamond, 1984; Dendawijaya, 2009; Kasmir, 2019).

These consequences reduce the amount of profit generated from the bank's assets. Thus, when NPL increases, ROA is expected to decline because a larger proportion of the loan portfolio becomes less productive and creates additional financial burdens. Previous empirical findings also indicate that higher credit risk is associated with lower banking profitability (Hertina et al., 2022; Wahyuni, 2023). Based on this theoretical and economic mechanism, the following hypothesis is proposed:

**Hypothesis 3: NPL has a negative effect on banking financial performance.**

Firm Size, BOPO, and NPL represent three interrelated dimensions of banking intermediation: resource scale, operational efficiency, and credit quality. Firm Size reflects the amount of resources available to support lending and other income-generating activities. However, a large asset base will not produce optimal returns when a substantial proportion of operating income is absorbed by operating expenses or when the loans generated from those assets become problematic.

From the perspective of Financial Intermediation Theory, banking profitability is determined by the ability of banks to allocate their resources productively, conduct intermediary activities efficiently, and control the risk arising from credit distribution (Diamond, 1984). A bank may possess large assets, but high BOPO can reduce the income retained as profit, while high NPL can reduce interest income and increase credit-loss provisions. Therefore, the effect of bank size on financial performance must be considered together with operational efficiency and credit risk.

The simultaneous examination of these variables provides a more comprehensive explanation of banking performance than examining each factor separately. Firm Size describes the capacity of the bank, BOPO describes how efficiently that capacity is operated, and NPL describes the quality of the assets generated through lending activities. Based on this relationship, the following hypothesis is proposed:

**Hypothesis 4: Firm Size, BOPO, and NPL simultaneously affect banking financial performance.**

#### Conceptual Framework

The theoretical structure of this research identifies Return on Assets (ROA) as the dependent variable indicative of banking financial performance. Firm Size, BOPO, and NPL are designated as independent variables. The magnitude of a firm is anticipated to positively influence ROA, since an expanded resource pool may enhance the bank's ability to produce revenue. BOPO is anticipated to adversely impact ROA since increased operating costs diminish the share of income preserved as profit. NPL is anticipated to adversely impact ROA since troubled loans diminish interest revenue and elevate credit-loss reserves. The associations between the variables are illustrated in Figure 1.

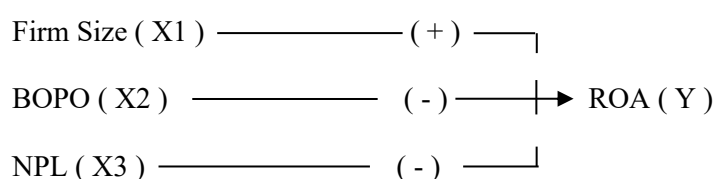


Figure 1. Conceptual Framework  
 Source: Developed by the Authors, 2026

#### RESEARCH METHODOLOGY

This research utilizes a quantitative methodology through an associative technique. A numerical methodology was selected due to the data under examination comprising quantitative values and being evaluated through statistical methods. An associative approach was chosen as this research seeks to assess the impact of company size, operational efficiency, and credit risk on the financial performance of banks. In this research, financial performance is represented by Return on Assets (ROA).

The cohort of this research comprises commercial banking firms registered on the Indonesia Stock Exchange for the years 2022 to 2024. The sample was chosen through purposive sampling as the panel data analysis necessitates that each bank furnish consistent and comparable data for each year of observation. Accordingly, the selection was based on the relevance and completeness of the financial data required to measure the research variables.

A financial institution was incorporated into the sample upon fulfilling the subsequent criteria: (1) It was persistently listed on the Indonesia Stock Exchange from 2022 to 2024; (2) it issued comprehensive annual financial reports for every year within the observation timeframe; and (3) its financial reports supplied the necessary data to compute total assets, ROA, BOPO, and NPL utilizing uniform metrics. Banks that did not provide complete observations for all three years or did not disclose one or more required variables were excluded from the sample.

Following the filtration procedure, 12 identified commercial banks satisfied all sample requirements. The utilization of these banks generated a balanced panel including 36 bank-year observations, derived from 12 banks monitored over a three-year period. The sample includes banks with different asset sizes and operating characteristics, allowing the analysis to capture variations among listed commercial banks. However, the findings are limited to the characteristics of publicly listed commercial banks that met the data-completeness criteria and are not intended to represent all banking institutions in Indonesia.

Table 1. Sample Selection Process

| Stage | Selection Criterion                                                                                                                                           | Result                         |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 1     | Commercial banking companies listed on the Indonesia Stock Exchange during the 2022–2024 observation period                                                   | Initial sampling frame         |
| 2     | Banks that were continuously listed throughout 2022–2024                                                                                                      | Eligible for further screening |
| 3     | Banks that published complete annual financial statements for 2022, 2023, and 2024                                                                            | Eligible for data collection   |
| 4     | Banks with complete and consistently measurable data on total assets, net income, operating expenses, operating income, non-performing loans, and total loans | Eligible for inclusion         |
| 5     | Banks that met all selection criteria and were included in the final dataset                                                                                  | 12 banks                       |
| 6     | Observation period                                                                                                                                            | 3 years                        |
| 7     | Total bank-year observations                                                                                                                                  | 36 observations                |

Source: Sample selection process developed by the authors, 2026.

The sample-filtering process was conducted to obtain a balanced panel in which every bank had complete and comparable observations for the entire 2022–2024 period. Banks were retained only when the researcher was able to verify all data required to calculate Firm Size, BOPO, NPL, and ROA consistently for each year. Based on this process, 12 listed commercial banks were included, resulting in 36 bank-year observations.

The selected banks vary in terms of asset size, ownership, and operating characteristics, which allows the analysis to capture differences among the listed commercial banks included in the study. Nevertheless, the sample is not claimed to represent all banking institutions in Indonesia. The interpretation and generalization of the findings are limited to the listed commercial banks that met the study's data-completeness and comparability criteria.

Table 2. List of Banks Included in the Final Sample

| No | Bank                                    |
|----|-----------------------------------------|
| 1  | PT Bank Central Asia Tbk.               |
| 2  | PT Bank Rakyat Indonesia (Persero) Tbk. |
| 3  | PT Bank Mandiri (Persero) Tbk.          |
| 4  | PT Bank Negara Indonesia (Persero) Tbk. |
| 5  | PT Bank Tabungan Negara (Persero) Tbk.  |
| 6  | PT Bank CIMB Niaga Tbk.                 |
| 7  | PT Bank Danamon Indonesia Tbk.          |
| 8  | PT Bank Maybank Indonesia Tbk.          |
| 9  | PT Bank Mega Tbk.                       |
| 10 | PT Bank OCBC NISP Tbk.                  |
| 11 | PT Bank Pan Indonesia Tbk.              |
| 12 | PT Bank BTPN Tbk.                       |

Source: Annual reports of the sample banks, processed by the authors, 2026.

The data used in this study is secondary data. The data was obtained from the annual financial reports of banking companies published on the official website of the Indonesia Stock Exchange and the official websites of the respective banks. The data collected includes total assets, operating expenses, operating income, non-performing loans, total loans, and net income. Data collection was conducted using the documentation method, which involves gathering and recording data from the annual financial statements of banking companies during the study period.

The variables were selected to represent three fundamental dimensions of banking activities: resource scale, operational efficiency, and credit quality. Return on Assets (ROA) was selected as the dependent variable because banking companies operate by managing a large asset base, particularly loans and other earning assets. ROA therefore provides a relevant measure of how effectively bank management converts the assets under its control into profit (Athanasoglou et al., 2008; Nurjanah et al., 2025).

Firm Size was selected to represent the scale of resources and operating capacity available to a bank. Total assets reflect the bank's capacity to distribute credit, develop financial services, obtain funding, and diversify its activities. Because the nominal value of bank assets is relatively large and varies considerably among banks, Firm Size is measured using the natural logarithm of total assets.

BOPO was selected because it directly reflects the efficiency of a bank's operational activities. The ratio indicates how much operating income is absorbed by operating expenses. A higher BOPO means that a larger proportion of operating income is used to finance operational activities, leaving a smaller proportion available as profit. BOPO is calculated by dividing operating expenses by operating income and multiplying the result by 100% (Otoritas Jasa Keuangan, 2023).

NPL was selected because lending represents one of the principal activities and sources of income for commercial banks. The ratio reflects the quality of the loan portfolio and the level of credit risk faced by the bank. A higher NPL indicates that a larger proportion of distributed loans has encountered repayment problems, potentially reducing interest income and increasing credit-loss provisions. NPL is calculated by dividing non-performing loans by total loans and multiplying the result by 100% (Otoritas Jasa Keuangan, 2023).

Taken together, Firm Size, BOPO, and NPL enable this study to examine whether banking profitability is primarily associated with the scale of resources, the efficiency of operating those resources, or the quality of the credit generated through banking intermediation.

The data analysis technique used in this study is panel data regression. Panel data regression was used because the research data consists of a combination of cross-sectional data—specifically, 12 banking companies—and time-series data—specifically, the 2022–2024 period. The panel data regression model in this study is formulated as follows:

$$ROA_{it} = \alpha + \beta_1 FS_{it} + \beta_2 BOPO_{it} + \beta_3 NPL_{it} + \varepsilon_{it}$$

Notes: ROA represents financial performance, FS represents firm size, BOPO represents operational efficiency, NPL represents credit risk,  $\alpha$  is a constant,  $\beta_1$  through  $\beta_3$  are regression coefficients,  $i$  denotes the firm,  $t$  denotes the time period, and  $\varepsilon$  is the error term.

The data analysis was conducted in several stages. First, descriptive statistics were used to examine the distribution and general characteristics of ROA, Firm Size, BOPO, and NPL. Second, the Common Effect Model, Fixed Effect Model, and Random Effect Model were estimated. The Chow test was then used to compare the Common Effect Model and the Fixed Effect Model, while the Hausman test was used to compare the Fixed Effect Model and the Random Effect Model.

Diagnostic tests were also conducted to evaluate the statistical characteristics of the regression model. The normality test was used to examine whether the residuals followed a normal distribution. The multicollinearity test was used to determine whether strong correlations existed among the independent variables by examining the Variance Inflation Factor and tolerance values. Heteroscedasticity was evaluated using a residual plot to assess whether the variance of the residuals remained relatively constant. Autocorrelation was examined using the Durbin–Watson test to determine whether residuals from different observations were correlated.

The diagnostic tests were used as an evaluation of the estimated model and as a basis for interpreting the regression results cautiously. The results indicate that the model did not exhibit multicollinearity or a strong heteroscedasticity pattern. However, the residuals were not normally distributed and positive autocorrelation was detected. These conditions are disclosed as methodological limitations and are considered when interpreting the findings.

Hypothesis testing was conducted using the partial significance test, simultaneous model test, and coefficient of determination. All statistical analyses were performed using jamovi version 2.6.44 and the GAMLj module (Gallucci, 2019; The jamovi project, 2024).

## RESULTS AND DISCUSSION

This research employs 36 data points from 12 financial institutions during the 2022–2024 timeframe. The factors examined in this research include Return on Assets (ROA) as the dependent variable, alongside Firm Size, BOPO, and NPL as independent variables. ROA assesses the financial performance of banks, Firm Size evaluates the magnitude of a corporation, BOPO gauges operational efficiency, and NPL quantifies credit risk.

Table 3. Descriptive Statistics of the Research Variables

| Variable  | N  | Mean  | Median | Standard<br>Deviation | Minimum | Maximum |
|-----------|----|-------|--------|-----------------------|---------|---------|
| ROA       | 36 | 2.40  | 2.32   | 1.00                  | 0.83    | 4.03    |
| BOPO      | 36 | 70.80 | 72.20  | 12.30                 | 41.70   | 89.60   |
| NPL       | 36 | 2.28  | 2.15   | 0.74                  | 0.97    | 3.53    |
| Firm Size | 36 | 19.90 | 19.50  | 0.97                  | 18.70   | 21.60   |

Source: Data processed using jamovi version 2.6.44, 2026.

According to Table 3, the mean ROA of 2.40 signifies that the banking firms in the study sample typically managed to yield a profit of 2.40% from their total assets. The lowest ROA score of 0.83 and the highest value of 4.03 reflect variations in profitability across banks over the research period. The standard deviation of ROA, measured at 1.00, indicates that the disparity in ROA between banks remains comparatively minimal.

The BOPO metric possesses a mean value of 70.80. This figure signifies that, on average, banks' operational expenditures constitute 70.80% of their operational revenue. The minimum BOPO value of 41.70 indicates the presence of banks with very good operational efficiency, while the maximum value of 89.60 indicates the presence of banks with relatively high operating expenses. The NPL variable exhibits an average value of 2.28, suggesting that the non-performing loan ratio among the sampled banks is at a relatively controllable level. In the interim, the average Firm Size is 19.90, suggesting that the banks within the sample own rather substantial asset amounts.

The panel data regression model was chosen by the use of the Chow test and the Hausman test. The Chow test was employed to determine the superior model between the Common Effect Model and the Fixed Effect Model, whereas the Hausman test was utilized to identify the optimal model between the Fixed Effect Model and the Random Effect Model.

Table 4. Results of the Regression Model Selection for Panel Data

| Testing      | Models Compared | Sig.    | Selected Model      |
|--------------|-----------------|---------|---------------------|
| Chow Test    | CEM vs FEM      | < 0.001 | Fixed Effect Model  |
| Hausman Test | FEM vs REM      | 0.115   | Random Effect Model |

Source: Data processed using jamovi version 2.6.44, 2026.

According to Table 4, the Chow test results indicate a significance level of less than 0.001. This number is below 0.05, indicating that the Fixed Effect Model is preferable than the Common Effect Model. Additionally, the outcomes of the Hausman test indicate a significance level of 0.115. Given that this value exceeds 0.05, the Random Effect Model is deemed more suitable than the Fixed Effect Model. Consequently, the optimal panel data regression model employed in this research is the Random Effect Model.

Table 5. Results of the Random Effect Model

| Variable  | Coefficient | SE      | t-value | Sig.    | Description            |
|-----------|-------------|---------|---------|---------|------------------------|
| Intercept | 2.3997      | 0.16004 | 14.99   | < 0.001 | Significant            |
| BOPO      | -0.0779     | 0.00563 | -13.85  | < 0.001 | Significantly negative |
| Firm Size | 0.1838      | 0.14927 | 1.23    | 0.238   | Not significant        |
| NPL       | -0.1421     | 0.05536 | -2.57   | 0.017   | Significantly negative |

Source: Data processed using jamovi version 2.6.44, 2026.

According to Table 5, the Firm Size variable exhibits a positive coefficient of 0.1838, accompanied with a significant value of 0.238. The p-value surpasses 0.05, thus Hypothesis 1 lacks support. Statistically, the result indicates that differences in the asset scale of the sample banks were not consistently associated with differences in ROA during 2022–2024. Although the coefficient is positive, it should not be interpreted as reliable evidence that an increase in bank assets will automatically improve profitability.

This result has an important economic implication. The expansion of total assets may increase a bank's lending capacity and operating resources, but additional assets do not necessarily generate proportional income. Assets may be placed in instruments with different rates of return, while asset expansion may also be accompanied by higher funding, administrative, technological, and monitoring costs. Therefore, bank management should not treat asset growth as an independent objective. Asset expansion needs to be accompanied by productive allocation, cost control, and appropriate credit-risk management. This finding supports the argument that organizational scale alone is insufficient to explain profitability (Berger & Mester, 1997; Ozili & Uadiale, 2017).

BOPO exhibits a coefficient of  $-0.0779$ , accompanied by a significance level below 0.001. Consequently, Hypothesis 2 is validated. Maintaining Firm Size and NPL constant, a one percentage point rise in BOPO correlates with a reduction of roughly 0.0779 percentage points in ROA. In contrast, a decrease of one percentage point in BOPO correlates with an enhancement of roughly 0.0779 percentage points in ROA, assuming all other variables are held constant.

The exceedingly low p-value and substantial absolute t-value suggest that BOPO exhibits the most robust statistical correlation with ROA among the independent variables in the analyzed model. However, the raw coefficient alone should not be used to conclude that BOPO is the most dominant determinant because the variables are measured on different scales. A greater BOPO indicates that a larger share of operational income is absorbed by operating expenses prior to its transformation into profit. Bank management should prioritize the efficiency of operational expenses instead than simply cutting costs arbitrarily. Efficiency improvements may include optimizing branch and administrative expenses, improving transaction processes, evaluating the productivity of digital investments, and aligning operating costs with income-generating activities. This discovery aligns with the assertions of Tan and Floros (2013) and Sutrisno and Widarjono (2022), who highlight the significance of efficiency in elucidating bank profitability.

NPL demonstrates a value of  $-0.1421$  with a significance threshold of 0.017. As a result, Hypothesis 3 is validated. With Firm Size and BOPO held constant, an increase of one percentage point in NPL is associated with a decrease of approximately 0.1421 percentage points in ROA. This coefficient indicates that changes in loan quality have an economically meaningful relationship with banking profitability.

An increase in NPL reduces the proportion of productive loans that generate scheduled interest income. Problematic loans may also require additional impairment provisions, collection activities, restructuring processes, and monitoring costs. These consequences reduce the profit generated from the assets controlled by the bank. Accordingly, bank management should strengthen credit assessment, early-warning systems, portfolio diversification, borrower monitoring, and loan-recovery procedures. The findings align with Hertina et al. (2022) and Wahyuni (2023), who discovered that declining credit quality correlates with reduced bank profitability.

The simultaneous examination resulted in a significant value of under 0.001, demonstrating that Firm Size, BOPO, and NPL together elucidate variations in ROA. The Marginal  $R^2$  value of 0.803 reveals that 80.3% of the fluctuations in ROA are accounted for by the three banking attributes incorporated in the model, with the residual 19.7% linked to other influences beyond the model's scope. These other factors may include capital adequacy, liquidity, interest margins, income diversification, governance, inflation, interest rates, and broader macroeconomic conditions.

Overall, the findings indicate that profitability during the study period was more closely associated with the quality and efficiency of asset management than with the amount of assets alone. The insignificant Firm Size result, combined with the significant BOPO and NPL results, demonstrates that having a large asset base does not guarantee higher ROA when operating costs are high or loan quality deteriorates. This finding supports Financial Intermediation Theory by showing that the performance of banks depends not only on their capacity to collect and allocate funds, but also on their ability to perform the intermediation process efficiently and control the risks arising from credit distribution.

The traditional assumption evaluations demonstrate that the model lacks multicollinearity, with all independent variables presenting VIF values under 10 and tolerance values exceeding 0.10. The outcomes of the normality assessment reveal that the residuals do not follow a normal distribution, whilst the Durbin-Watson test suggests the existence of positive autocorrelation. The outcomes of the heteroscedasticity assessment via a residual plot do not exhibit a pronounced pattern of heteroscedasticity, yet the distribution of the residuals warrants careful interpretation. The findings of this research must be understood in light of the restricted number of observations and the attributes of the panel data employed.

## CONCLUSION

This study examines the effects of Firm Size, BOPO, and NPL on the financial performance of 12 commercial banks listed on the Indonesia Stock Exchange during 2022–2024. Based on the panel data model-selection tests, the Random Effect Model was selected as the most appropriate estimation model. The results show that Firm Size has a positive but statistically insignificant relationship with ROA. In contrast, BOPO and NPL have negative and statistically significant relationships with ROA. Firm Size, BOPO, and NPL also jointly have a significant relationship with banking financial performance.

These findings indicate that the amount of assets controlled by a bank does not automatically determine its ability to generate profit. A large asset base will provide economic benefits only when the assets are allocated productively, operating expenses are controlled effectively, and loan quality is maintained. During the post-pandemic period examined in this study, banking profitability was therefore more closely associated with operational efficiency and credit-risk management than with asset scale alone.

Theoretically, this study contributes to Financial Intermediation Theory by demonstrating that the performance of financial intermediation depends not only on a bank's capacity to collect and distribute funds, but also on the efficiency and quality of that process. Firm Size represents the scale of available resources, BOPO represents the efficiency with which those resources are operated, and NPL represents the quality of the credit generated through intermediary activities. The insignificant effect of Firm Size and the significant effects of BOPO and NPL support the argument that resource scale must be accompanied by efficient operations and effective borrower monitoring to produce higher profitability.

From a practical perspective, bank management should not pursue asset growth without considering the productivity and risk characteristics of the additional assets. Management should prioritize operating-cost productivity, evaluate the effectiveness of branch and digital-banking expenditures, strengthen borrower screening and loan monitoring, and improve early-warning and loan-recovery systems. Investors and other users of financial statements should also consider BOPO and NPL alongside asset size when evaluating banking performance because a larger bank is not necessarily a more profitable bank. This study is subject to several limitations. The sample consists of only 12 listed commercial banks and the observation period covers three years, which limits the generalization of the findings to all banking institutions in Indonesia.

The residuals were not normally distributed and positive autocorrelation was detected, so the estimated relationships should be interpreted cautiously. In addition, the study uses observational financial data; therefore, the findings indicate statistical associations and should not be interpreted as definitive causal effects.

Future studies should use a longer observation period and a broader sample that may include additional categories of commercial banks. Further research may also incorporate other internal determinants, such as capital adequacy, liquidity, net interest margin, income diversification, credit growth, and corporate governance. Macroeconomic variables, including inflation, economic growth, and interest rates, may also be included to provide a more comprehensive explanation of banking profitability. Future researchers may apply alternative panel-data estimators or robust standard errors to address potential autocorrelation and other residual-related problems.

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