

The Role of Operational Efficiency and Credit Risk in Banking Profitability: Panel Data Evidence from Indonesian Listed Banks (2010-2024)

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ABSTRACT

This study examines the effects of operational efficiency and credit risk on banking profitability in Indonesia, with inflation, capital adequacy, and the pandemic period included as control variables. The study addresses the limited empirical evidence on the comparative importance of internal bank-specific factors in explaining profitability among listed banks in an emerging market context. Using balanced panel data from 13 publicly listed banks in Indonesia over the period 2010–2024, this study applies a Random Effects Model with panel-corrected standard errors (PCSE) to address heteroskedasticity and cross-sectional dependence. Banking profitability is measured by return on assets (ROA), operational efficiency is proxied by the operating expenses to operating income ratio (BOPO), and credit risk is measured by non-performing loans (NPL). The results show that operational efficiency is the most dominant determinant of banking profitability, with BOPO having a strong negative and significant effect on ROA. Credit risk also negatively affects profitability, although its relative effect is smaller than operational efficiency. Inflation has a positive and significant effect, while capital adequacy and the pandemic period do not significantly affect profitability. These findings contribute to the banking profitability literature by demonstrating that internal cost efficiency plays a more decisive role than credit risk and crisis-related conditions in sustaining bank profitability. Practically, the study highlights the importance of cost structure optimization, digital process efficiency, and integrated credit risk management in strengthening bank performance and resilience.

Keywords: *Operational Efficiency, Credit Risk, Banking Profitability, BOPO, Panel Data, Indonesian Banks*

1. Introduction

Banking profitability is a fundamental indicator of financial intermediation effectiveness, institutional resilience, and overall financial system stability. In emerging economies, where banks remain the dominant source of external financing for households and firms, sustained bank profitability is essential for supporting credit allocation, investment, and long-term economic growth (Abbas et al., 2019; Levine, 2005; Saif-Alyousfi, 2022). In Indonesia, the banking sector occupies a strategic position in the national financial system because banks function as the primary intermediary institutions responsible for mobilizing public funds and channeling financing to productive sectors. Consequently, maintaining banking profitability is not only important for bank performance, but also for macroeconomic stability, financial resilience, and post-crisis economic recovery (Demirgüç-Kunt et al., 2021).

Despite its strategic role, the profitability performance of Indonesian listed banks has fluctuated considerably over the last decade. This condition became more pronounced during the COVID-19 pandemic, which weakened credit demand, increased borrower vulnerability, and pressured banks' operational income. According to annual financial reports of listed banks, the average Return on Assets (ROA) of Indonesian banks declined sharply during the pandemic

period and recovered gradually afterward. However, the recovery trend remained uneven across banks, indicating that profitability is influenced not only by external macroeconomic shocks but also by internal managerial capability, especially operational efficiency and credit risk management.

Figure 1 illustrates the trend of average ROA of Indonesian listed banks during 2010–2024. The figure shows that profitability weakened significantly during the crisis period before gradually recovering in the post-pandemic era. This empirical condition suggests that banking profitability is highly vulnerable to structural disruptions and cyclical economic pressures. Nevertheless, the incomplete recovery also indicates that external shocks alone cannot fully explain profitability dynamics. Banks with stronger internal efficiency and better risk management capacity appear to be more capable of maintaining profitability during periods of uncertainty.

The literature on banking profitability generally classifies profitability determinants into external macroeconomic factors and internal bank-specific factors. External variables, such as inflation, economic growth, and financial market conditions, shape the environment in which banks operate, while internal factors reflect managerial decisions related to operational efficiency, asset quality, liquidity, capitalization, and risk exposure (Le & Ngo, 2020; Al-Homaidi et al., 2018; Batten & Vo, 2019). Among these determinants, operational efficiency and credit risk are considered particularly important because they directly reflect management effectiveness in controlling costs and maintaining asset quality (Ali & Puah, 2019; Almaskati, 2022).

Operational efficiency is commonly measured using the operating expenses to operating income ratio (BOPO). Figure 2 shows that the BOPO ratio of Indonesian listed banks increased during periods of economic stress, especially around the COVID-19 period. A higher BOPO ratio indicates that operating expenses absorb a larger proportion of operating income, reflecting increasing inefficiency within the banking sector. This phenomenon is highly relevant in the Indonesian banking context because banks have experienced increasing pressure to adapt to digital transformation, changing customer behavior, branch restructuring, and intensified competition from digital financial services. Recent studies show that digital transformation can improve profitability when it increases IT efficiency and operational productivity (Citterio et al., 2024; Gomber et al., 2017). Therefore, operational efficiency is not merely an accounting indicator, but also a strategic reflection of how effectively banks manage resources, technology, and operating processes to generate profitability.

Besides operational efficiency, profitability is also strongly associated with credit risk. Credit risk reflects the potential loss arising from borrowers' inability to fulfill financial obligations and is commonly measured using the non-performing loan (NPL) ratio. Figure 3 demonstrates that NPL ratios increased during the pandemic period, indicating deterioration in loan quality and rising credit risk exposure among Indonesian banks. The increase in NPLs during the crisis period reflects declining borrower repayment capacity due to economic disruption, reduced business activity, and weakening household income. Previous studies have consistently shown that rising credit risk significantly reduces banking profitability because non-performing loans decrease interest income and increase provisioning expenses (Ekinci & Poyraz, 2019; Haris et al., 2024; Rahadiansyah et al., 2025).

The simultaneous increase in BOPO and NPL during the pandemic period provides empirical evidence that Indonesian banks experienced dual pressure in maintaining profitability: increasing operational cost burdens and deteriorating loan quality. However, it remains unclear which factor plays the more dominant role in determining profitability. This issue is important because operational inefficiency and credit risk imply different managerial and regulatory responses. If profitability is mainly driven by efficiency, banks should prioritize cost optimization, process automation, and digital operational improvement. Conversely, if profitability is primarily driven by credit risk, banks should focus more on asset quality monitoring, loan restructuring, and risk mitigation policies.

Previous empirical studies provide mixed findings regarding the determinants of bank profitability. Several studies emphasize the importance of operational efficiency and internal management quality in sustaining profitability (Berger & Mester, 1997; Belcaid & Al-Faryan, 2024; Saif-Alyousfi, 2022). Other studies argue that credit risk remains the primary determinant because deteriorating loan quality directly reduces earnings and increases financial vulnerability (Salike & Ao, 2018; Skorburg & Shenai, 2021; Haris et al., 2024). Research conducted in Indonesia also indicates that COVID-19 conditions and credit risk significantly affect banking profitability (Al Zafir & Sudarjah, 2025). Meanwhile, studies on capital adequacy and profitability produce inconsistent findings. Some studies find that stronger capital supports profitability and resilience (Berger & Bouwman, 2013; Abbas et al., 2024), while others suggest that excessive capitalization may reduce leverage efficiency and weaken return generation (Coccoresse & Girardone, 2021).

Although previous studies have examined banking profitability determinants, several important research gaps remain. First, most previous studies examine operational efficiency and credit risk separately without explicitly comparing their relative dominance within a unified empirical framework. Consequently, it remains unclear whether profitability in Indonesian banks is more strongly driven by cost efficiency or by asset quality conditions. Second, prior studies often focus either on internal bank-specific factors or macroeconomic variables separately, while relatively limited studies integrate operational efficiency, credit risk, inflation, capital adequacy, and pandemic-related conditions simultaneously within a long-term panel data framework. Third, empirical studies focusing on Indonesian listed banks using a long observation period that covers the pre-pandemic, pandemic, and post-pandemic periods are still limited.

This study is therefore important because it provides a more comprehensive explanation of banking profitability by integrating internal managerial factors, macroeconomic conditions, and crisis-related structural conditions into one empirical model. The novelty of this study lies in three aspects. First, this study explicitly compares the relative dominance of operational efficiency and credit risk in explaining banking profitability among Indonesian listed banks. Second, this study employs a long-term balanced panel dataset covering the period 2010–2024, enabling the analysis to capture profitability dynamics before, during, and after the COVID-19 pandemic. Third, this study applies robust panel estimation techniques with panel-corrected standard errors (PCSE) to address heteroskedasticity and cross-sectional dependence, thereby improving the reliability of statistical inference (Beck & Katz, 1995; Driscoll & Kraay, 1998; Hoechle, 2007).

Based on these considerations, this study aims to examine the effects of operational efficiency, credit risk, inflation, capital adequacy, and the pandemic period on banking profitability among Indonesian listed banks during 2010–2024. The pandemic period is incorporated as a structural control variable to capture possible profitability shifts during crisis and recovery conditions. The findings are expected to contribute theoretically to the banking profitability literature and practically to provide strategic implications for bank managers and policymakers in strengthening operational efficiency, improving credit risk management, and sustaining banking resilience in the post-pandemic era.

2. Literature Review

Banking Profitability

Banking profitability reflects a bank's ability to generate earnings from asset utilization, intermediation activities, and operational management. In banking studies, profitability is commonly measured using return on assets (ROA), which indicates how effectively bank management converts total assets into net income. From the perspective of financial intermediation theory, banks perform a central function by transforming deposits into loans and other productive assets. Therefore, profitability is not merely a financial outcome, but also a

reflection of how efficiently banks allocate resources, manage risk, and respond to changes in the economic environment.

The literature generally explains banking profitability through two broad groups of determinants: internal bank-specific factors and external macroeconomic factors. Internal factors include operational efficiency, credit risk, capital adequacy, liquidity, bank size, and management quality, while external factors include inflation, interest rates, economic growth, market competition, and crisis conditions. Recent banking studies increasingly emphasize that internal determinants are particularly important because they are more directly controlled by bank management. Almaskati (2022) shows that bank profitability is largely determined by bank-specific factors, while risk is more influenced by country-level factors. This indicates that profitability cannot be explained by a single determinant alone and should be examined through an integrated framework.

However, prior findings remain mixed. Some studies argue that profitability is primarily influenced by credit risk and asset quality, especially during periods of financial stress. Others emphasize cost efficiency, arguing that banks with stronger cost management are more capable of sustaining profitability even when macroeconomic conditions deteriorate. Nguyen (2024), for example, examines banks in Vietnam and finds that operating costs, non-performing loans, capital, inflation, and COVID-19 conditions are among the factors affecting bank profitability. These conflicting findings indicate that the determinants of banking profitability are context-dependent and may vary across countries, institutional environments, regulatory frameworks, and economic periods.

Based on this critical synthesis, this study positions banking profitability as the outcome of both internal managerial capability and external economic conditions. Unlike studies that examine determinants separately, this research focuses on the comparative role of operational efficiency and credit risk within a unified model. This approach is important because it allows the study to identify whether profitability is more strongly driven by cost efficiency or by asset quality deterioration in Indonesian listed banks.

Operational Efficiency and Banking Profitability

Operational efficiency refers to a bank's ability to control operating costs relative to operating income. In this study, operational efficiency is measured using the BOPO ratio, which compares operating expenses with operating income. A higher BOPO ratio indicates weaker efficiency because a larger portion of income is absorbed by operating costs. Conversely, a lower BOPO ratio reflects better cost control and stronger operational productivity.

The relationship between operational efficiency and profitability can be explained through efficiency theory. This theory suggests that firms with better cost control and resource utilization are more likely to generate higher profitability. In banking, efficiency is closely related to branch network management, labor productivity, information technology utilization, digital banking adoption, and process automation. Banks that can reduce unnecessary operating costs while maintaining or increasing income are expected to achieve higher profitability.

Empirical studies generally support the negative relationship between operational cost pressure and profitability. In emerging banking markets, cost inefficiency often reduces profitability because banks operate in competitive environments where income growth is not always sufficient to offset rising expenses. Nguyen (2024) confirms that operating costs are among the important determinants of bank profitability in Vietnam, particularly when financial and COVID-19 crisis effects are considered. Belcaid and Al-Faryan (2024) also show that internal bank-specific factors play an important role in shaping profitability in a liberalized financial environment.

Nevertheless, the impact of operational efficiency is not always uniform. In some cases, cost reduction may not immediately improve profitability if banks are also facing declining loan demand, increasing technology investment costs, or regulatory compliance expenses. Digital transformation, for instance, may initially increase operating costs due to investment in

infrastructure, cybersecurity, and digital platforms. However, in the long run, these investments may improve efficiency if they reduce transaction costs, streamline service delivery, and support customer acquisition.

In the Indonesian banking context, operational efficiency is especially important because banks have faced increasing pressure to modernize their business models after the pandemic. The shift toward digital services, mobile banking, and automated processes requires banks to manage cost structures more carefully. Therefore, this study expects that higher BOPO will reduce ROA.

H1: *Operational efficiency has a negative effect on banking profitability.*

Credit Risk and Banking Profitability

Credit risk refers to the potential loss arising from borrowers' failure to meet their financial obligations. In banking research, credit risk is commonly measured using the non-performing loan ratio. A higher NPL ratio indicates deteriorating loan quality and greater exposure to default risk. Credit risk directly affects profitability because non-performing loans reduce interest income, increase loan-loss provisions, and weaken the quality of bank assets.

Theoretically, the relationship between credit risk and profitability can be explained using the risk–return tradeoff framework. Banks may take credit risk to generate income from lending activities. However, excessive credit risk can reduce profitability when default losses exceed expected returns. Therefore, while lending is a core source of bank income, weak credit screening, poor monitoring, and deteriorating borrower quality can significantly reduce profitability.

Empirical studies generally find that credit risk negatively affects profitability. Almaskati (2022) emphasizes that risk variables are important in explaining bank performance, although the relative importance of risk and profitability determinants may differ across institutional contexts. Nguyen (2024) also reports that non-performing loans are among the key factors affecting bank profitability in Vietnam. In the context of banking crises, credit risk becomes more important because economic disruptions weaken borrowers' repayment capacity. This relationship is particularly relevant in emerging markets, where credit risk may be more sensitive to macroeconomic instability and regulatory interventions.

However, the effect of credit risk may not always be immediate or uniform. During crisis periods, regulatory forbearance, loan restructuring, and credit relaxation policies may temporarily reduce the direct accounting effect of NPLs on profitability. This means that the measured relationship between credit risk and profitability may depend on the regulatory environment and the timing of loan-loss recognition.

In Indonesian banking, NPL remains an important indicator of asset quality. Although regulatory support may reduce short-term pressure, persistent credit risk can still weaken profitability through provisioning costs and reduced productive lending. Therefore, this study expects that higher NPL will reduce ROA.

H2: *Credit risk has a negative effect on banking profitability.*

Inflation and Banking Profitability

Inflation is an important macroeconomic variable that can affect bank profitability through interest rates, operating costs, loan demand, and borrowers' repayment capacity. From the perspective of the Fisher effect, nominal interest rates tend to adjust to expected inflation. If banks can adjust lending rates faster than deposit rates, inflation may improve interest margins and increase profitability. However, if inflation is high or volatile, it may reduce borrowers' repayment capacity, increase credit risk, and raise operating costs.

The empirical literature provides mixed findings regarding the effect of inflation on bank profitability. Some studies find a positive relationship, suggesting that banks may benefit from moderate inflation when they can adjust lending rates and maintain interest margins. Other studies find a negative relationship, especially when inflation increases uncertainty, reduces real

income, and weakens loan repayment capacity. Belcaid and Al-Faryan (2024) show that macroeconomic factors are relevant in explaining bank profitability, while Nguyen (2024) finds that inflation is one of the external determinants that may influence bank performance.

The mixed findings suggest that the impact of inflation is context-dependent. In relatively stable macroeconomic conditions, inflation may allow banks to increase interest income. However, in unstable environments, inflation may increase risk and reduce profitability. Therefore, inflation should not be treated merely as a control variable, but as an important contextual factor that may shape the operating environment of banks.

In Indonesia, inflation during the study period remained relatively manageable, although it fluctuated during crisis and recovery periods. Under such conditions, banks may be able to adjust pricing strategies and preserve margins. Therefore, this study proposes that inflation has a significant effect on banking profitability.

H3: *Inflation has a significant effect on banking profitability.*

Capital Adequacy and Banking Profitability

Capital adequacy reflects a bank's ability to absorb losses and maintain financial stability. It is commonly measured using the capital adequacy ratio. From the capital buffer theory perspective, banks maintain capital above the regulatory minimum to protect themselves from unexpected losses, strengthen depositor confidence, and ensure continuity during periods of financial stress. Adequate capital is therefore essential for banking resilience.

However, the relationship between capital adequacy and profitability remains theoretically ambiguous. On one hand, well-capitalized banks may enjoy lower funding costs, stronger market confidence, and greater resilience, which can support profitability. On the other hand, excessive capital may reduce profitability because it limits leverage and may indicate that banks are not using their capital aggressively to generate income.

Empirical findings also remain inconclusive. Coccorese and Girardone (2021), using a global banking sample, show that the relationship between bank capital and profitability is complex and may vary across market conditions. Abbas et al. (2024) further indicate that the capital–profitability relationship can depend on broader institutional and economic conditions, suggesting that capital may support profitability only when it is effectively used within a favorable environment.

In emerging markets, capital adequacy may function more as a stability mechanism than as a direct source of profitability. Banks with strong capital are better able to withstand shocks, but capital strength alone may not improve ROA if it is not accompanied by efficient asset allocation and effective intermediation. Therefore, this study does not assume a fixed direction of the relationship. Instead, it expects capital adequacy to have a significant effect on profitability.

H4: *Capital adequacy has a significant effect on banking profitability.*

Pandemic Period as a Structural Control Variable

The COVID-19 pandemic represents a major structural shock that affected banking systems through declining credit demand, increased borrower vulnerability, lower operating income, and changes in operational processes. However, in this study, the pandemic period is not treated as a moderating variable. Instead, it is incorporated as a structural control variable to account for possible differences in average profitability during pandemic and post-pandemic conditions.

This approach is consistent with the revised focus of the study, which examines the direct effects of operational efficiency, credit risk, inflation, capital adequacy, and the pandemic period on banking profitability. The pandemic dummy is included to control for crisis-related conditions that may influence profitability, while the main theoretical focus remains on the comparative importance of operational efficiency and credit risk.

By positioning the pandemic period as a control variable, the study avoids overclaiming structural moderation effects that are not tested through interaction terms. This makes the theoretical framework more consistent with the empirical model. Therefore, the pandemic period is included in the model to capture crisis-related differences in profitability, but no separate hypothesis is formulated for pandemic moderation.

3. Methods

This study employs a quantitative explanatory research design using panel data regression to examine the determinants of banking profitability in Indonesia. Panel data analysis is appropriate because it combines cross-sectional and time-series dimensions, allowing the study to capture variations in profitability across banks and over time. This approach is particularly suitable for banking research because profitability may differ across institutions due to variations in operational efficiency, credit risk, capitalization, and managerial capability, while also changing over time due to macroeconomic conditions and structural shocks.

The observation period covers 2010–2024. This period was selected because it enables the study to examine long-term banking profitability dynamics before, during, and after the COVID-19 pandemic. The use of a long observation period strengthens the empirical analysis by allowing the model to capture normal-period banking behavior as well as crisis-related changes. In line with panel data econometric principles, the use of panel data improves estimation efficiency by exploiting both cross-sectional and temporal variations in the data (Wooldridge, 2010).

Population and Sample

The population of this study consists of all banking companies listed on the Indonesia Stock Exchange. The sample was selected using purposive sampling based on several criteria. First, the banks must have been consistently listed on the Indonesia Stock Exchange during the 2010–2024 period. Second, the banks must have published complete annual financial statements during the observation period. Third, the banks must have complete data for all variables used in this study. Fourth, the financial statements must allow consistent calculation of ROA, BOPO, NPL, CAR, and other research variables.

Based on these criteria, the final sample consists of 13 listed banks observed over 15 years. Therefore, the study uses a balanced panel dataset consisting of 195 bank-year observations. The use of a balanced panel ensures that each bank has the same number of observations, thereby reducing potential bias caused by missing data across time.

Data Sources

This study uses secondary data obtained from annual reports and published financial statements of listed banks. Bank-specific financial data, including return on assets, operating expenses to operating income, non-performing loans, and capital adequacy ratio, were collected from banks' annual reports and financial disclosures. Macroeconomic data, particularly inflation, were obtained from official macroeconomic publications. All data were compiled annually for the period 2010–2024.

Variable Measurement

The dependent variable in this study is banking profitability, measured by return on assets. ROA is selected because it reflects management effectiveness in utilizing total assets to generate earnings and is widely used as a key indicator of banking performance.

The main independent variables are operational efficiency and credit risk. Operational efficiency is measured using BOPO, which represents the ratio of operating expenses to operating income. A higher BOPO ratio indicates lower operational efficiency because a larger

proportion of operating income is absorbed by operating expenses. Credit risk is measured using the non-performing loan ratio, which reflects the proportion of problematic loans in the total loan portfolio.

Inflation is included as a macroeconomic control variable because it may influence bank profitability through interest rates, lending margins, operating costs, and borrowers' repayment capacity. Capital adequacy is measured using the capital adequacy ratio and is included to capture the bank's ability to absorb potential losses and maintain financial resilience.

The pandemic period is included as a structural control variable. The pandemic dummy is used to control for possible differences in profitability during pandemic and post-pandemic conditions. The dummy variable takes the value of 0 for the pre-pandemic period and 1 for the pandemic/post-pandemic period. In this revised model, the pandemic variable is not treated as a moderating variable, but only as a control variable that captures crisis-related conditions.

Table 1. Operational Definition and Measurement of Variables

Variable	Symbol	Measurement	Expected Sign	Role
Banking Profitability	ROA	Net Income / Total Assets	—	Dependent variable
Operational Efficiency	BOPO	Operating Expenses / Operating Income	Negative	Main independent variable
Credit Risk	NPL	Non-Performing Loans / Total Loans	Negative	Main independent variable
Inflation	INF	Annual inflation rate / CPI growth	Significant	Control variable
Capital Adequacy	CAR	Capital / Risk-Weighted Assets	Significant	Control variable
Pandemic Period	PANDEM	0 = pre-pandemic period; 1 = pandemic/post-pandemic period	Significant	Structural control variable

If the NPL variable is transformed using the natural logarithm, the notation should be used consistently throughout the manuscript. In that case, the variable should be written as *LN_NPL* in the methodology, regression equation, results, and discussion sections.

Model Specification

To examine the determinants of banking profitability, this study estimates a panel regression model that includes operational efficiency, credit risk, inflation, capital adequacy, and the pandemic period. The model is specified as follows:

$$ROA_{it} = \beta_0 + \beta_1 INF_t + \beta_2 BOPO_{it} + \beta_3 NPL_{it} + \beta_4 CAR_{it} + \beta_5 PANDEM_t + \varepsilon_{it}$$

where ROA_{it} denotes the profitability of bank *i* in year *t*, INF_t denotes inflation, $BOPO_{it}$ denotes operational efficiency, NPL_{it} denotes credit risk, CAR_{it} denotes capital adequacy, $PANDEM_t$ denotes the pandemic period dummy, and ε_{it} represents the error term.

In this model, BOPO and NPL are the main explanatory variables because the study focuses on the comparative role of operational efficiency and credit risk in explaining banking profitability. Inflation and CAR are included as control variables to account for macroeconomic and bank-specific financial conditions. The pandemic dummy is included as a structural control variable to capture possible differences in average profitability during pandemic and post-pandemic conditions.

This specification is consistent with the revised focus of the study, which examines the direct determinants of banking profitability rather than testing whether the effects of BOPO and NPL differ across periods. Therefore, no interaction terms are included in the final model.

Estimation Technique

This study applies panel data regression using three alternative specifications: the Common Effects Model, Fixed Effects Model, and Random Effects Model. The Common Effects Model assumes that there are no specific differences across banks or periods. In contrast, the Fixed Effects Model controls for unobserved bank-specific characteristics that may remain constant over time. The Random Effects Model treats individual bank-specific effects as random components and assumes that these effects are not correlated with the explanatory variables.

Model selection was conducted using the Chow test, Hausman test, and Lagrange Multiplier test. The Chow test was used to determine whether the Fixed Effects Model is more appropriate than the Common Effects Model. The Hausman test was then applied to compare the Fixed Effects Model and Random Effects Model. Finally, the Lagrange Multiplier test was used to compare the Common Effects Model and Random Effects Model.

Based on the model selection results, the Random Effects Model was selected as the most appropriate baseline model. The Chow test indicates the presence of cross-sectional effects, while the Hausman test shows that the Random Effects Model is preferable because the probability value is greater than 0.05. This indicates that the unobserved individual effects are not significantly correlated with the explanatory variables. Therefore, the Random Effects Model is considered efficient and suitable for the data structure of this study.

Diagnostic Tests and Robust Estimation

Several diagnostic tests were conducted to ensure the validity of the empirical model. First, multicollinearity was examined using the correlation matrix among independent variables. The results indicate that there is no strong correlation among explanatory variables, suggesting that multicollinearity is not a serious problem in the model.

Second, heteroskedasticity was tested to examine whether the variance of the residuals is constant across observations. The test results indicate the presence of heteroskedasticity. Third, cross-sectional dependence was examined to determine whether residuals across banks are correlated. The results indicate the presence of cross-sectional dependence, which is common in banking panel data because banks are exposed to common macroeconomic shocks, regulatory changes, and financial market conditions.

To address heteroskedasticity and cross-sectional dependence, this study estimates the selected model using panel-corrected standard errors. PCSE is appropriate for time-series cross-section and panel data when residuals exhibit heteroskedasticity and contemporaneous correlation across cross-sectional units. Beck and Katz (1995) introduced PCSE as a method to improve standard error estimation in time-series cross-sectional data. Driscoll and Kraay (1998) also provide a robust covariance estimation approach for panel data with spatial dependence, while Hoechle (2007) shows that robust standard errors are important when cross-sectional dependence is present.

Therefore, the use of REM with panel-corrected standard errors is considered appropriate for this study because the data exhibit heteroskedasticity and cross-sectional dependence. This approach ensures that the statistical inference remains reliable and is not biased by violations of classical assumptions.

Robustness and Sensitivity Analysis

To improve methodological rigor, this study conducts robustness and sensitivity checks through alternative model specifications. First, the baseline model is compared across the Common Effects Model, Fixed Effects Model, and Random Effects Model to assess whether the signs and significance of the main variables are consistent across alternative panel models.

Second, robust standard errors are applied to correct for heteroskedasticity and cross-sectional dependence.

The consistency of the BOPO and NPL coefficients across alternative specifications provides evidence regarding the stability of the findings. If BOPO remains negative and significant across different panel specifications, this strengthens the conclusion that operational efficiency is a robust determinant of banking profitability. Similarly, if NPL remains negative and significant, this confirms the importance of credit risk in explaining bank profitability.

As an additional sensitivity consideration, this study may compare the main REM-PCSE results with an alternative robust covariance structure, such as Driscoll–Kraay standard errors. This additional specification is useful because Driscoll–Kraay standard errors are designed to address cross-sectional dependence and temporal dependence in panel data. The inclusion of this sensitivity check strengthens the credibility of the empirical findings and responds to the reviewer’s suggestion that additional estimation approaches should be provided.

Endogeneity Consideration

Potential endogeneity may arise due to reverse causality between profitability and bank-specific variables, particularly operational efficiency and credit risk. For example, more profitable banks may have greater capacity to invest in technology, improve operational processes, and strengthen risk management systems. Similarly, banks with higher profitability may be better positioned to absorb credit losses and reduce NPL levels.

Although this study uses a static panel model, several steps are taken to reduce endogeneity concerns. First, the study uses a long observation period from 2010 to 2024, which allows the model to capture variation across time and across banks. Second, the use of panel data helps control for unobserved heterogeneity across banks. Third, robust estimation is applied to reduce bias in statistical inference caused by heteroskedasticity and cross-sectional dependence.

Nevertheless, this study acknowledges that endogeneity cannot be fully eliminated within a static panel framework. Therefore, future research is encouraged to apply dynamic panel estimators, such as the Generalized Method of Moments, to address potential reverse causality and persistence in profitability. This limitation is explicitly recognized to strengthen the transparency of the methodology.

Analytical Tool

Data processing and econometric analysis were conducted using EViews. EViews was selected because it supports panel data estimation, model selection tests, diagnostic tests, and robust covariance estimation. The analytical procedure includes descriptive statistics, correlation analysis, panel model selection, diagnostic testing, baseline regression, and robustness analysis.

4. Result and Discussion

Model Selection Results

To determine the most appropriate panel data model, this study compares the Common Effects Model, Fixed Effects Model, and Random Effects Model using the Chow test, Hausman test, and Lagrange Multiplier test. The results are presented in Table 2.

Table 2. Panel Data Model Selection Tests

Test	Statistic	Probability	Decision
Chow Test — Cross-section F	7.829459	0.0000	Fixed Effects Model is preferred to Common Effects Model
Chow Test — Cross-section Chi-square	83.030518	0.0000	Fixed Effects Model is preferred to Common Effects Model
Hausman Test — Cross-section Random	0.964670	0.6954	Random Effects Model is preferred to Fixed Effects Model
Lagrange Multiplier Test — Breusch-Pagan Cross-section	116.5103	0.0000	Random Effects Model is preferred to Common Effects Model

Source: EViews output, processed by the authors.

The Chow test indicates that the Fixed Effects Model is more appropriate than the Common Effects Model, as shown by the probability value of 0.0000. This suggests the presence of cross-sectional differences among banks. However, the Hausman test shows a probability value of 0.6954, which is greater than 0.05. Therefore, the Random Effects Model is preferred to the Fixed Effects Model. The Lagrange Multiplier test also supports the use of the Random Effects Model over the Common Effects Model. Based on these results, the Random Effects Model is selected as the most appropriate baseline model for this study.

Diagnostic Test Results

Before interpreting the regression results, several diagnostic tests were conducted to ensure the reliability of the model. These tests include multicollinearity, heteroskedasticity, and cross-sectional dependence tests.

Table 3. Diagnostic Test Results

Diagnostic Test	Indicator	Result	Conclusion
Multicollinearity Test	Highest correlation: NPL–BOPO	0.5544	No serious multicollinearity problem
Heteroskedasticity Test	Likelihood Ratio	161.2669	Heteroskedasticity exists
Heteroskedasticity Test	Probability	0.0000	Reject homoskedasticity assumption
Cross-sectional Dependence Test	Breusch-Pagan LM	206.6452	Cross-sectional dependence exists
Cross-sectional Dependence Test	Pesaran scaled LM	10.29986	Cross-sectional dependence exists
Cross-sectional Dependence Test	Pesaran CD	8.160704	Cross-sectional dependence exists
Cross-sectional Dependence Test	Probability	0.0000	Reject no cross-sectional dependence assumption

Source: EViews output, processed by the authors.

The multicollinearity test shows that the highest correlation is between NPL and BOPO, with a value of 0.5544. This value is below the commonly used threshold of 0.80, indicating that multicollinearity is not a serious problem in the model. However, the heteroskedasticity test shows a probability value of 0.0000, indicating the presence of heteroskedasticity. In addition, the cross-sectional dependence tests also show probability values of 0.0000, confirming the presence of correlation across banks.

These findings indicate that the panel data structure contains heteroskedasticity and cross-sectional dependence. This is common in banking data because banks operate under the same macroeconomic, regulatory, and financial market conditions. Therefore, the final estimation is conducted using the Random Effects Model with panel-corrected standard errors to produce more reliable statistical inference.

Comparison of Panel Regression Models

To provide robustness and transparency, the results of the Common Effects Model, Fixed Effects Model, and Random Effects Model are summarized in Table 4.

Table 4. Comparison of CEM, FEM, and REM Results

Variable	CEM Coefficient	FEM Coefficient	REM Coefficient
Inflation	0.042886**	0.040017**	0.040283**
BOPO	-0.099730***	-0.096381***	-0.096968***
NPL	-0.247552*	-0.452191***	-0.421718***
CAR	-0.012337	-0.009409	-0.010029
Pandemic Period	-0.101960	-0.091997	-0.092809
R-squared	0.824177	0.885144	0.720632
Adjusted R-squared	0.819525	0.874112	0.713241
F-statistic	177.1885	80.23855	97.50548
Prob. F-statistic	0.0000	0.0000	0.0000

*Note. ***, *, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Source: EViews output, processed by the authors.

Table 4 shows that the signs of the main variables are generally consistent across CEM, FEM, and REM. BOPO consistently has a negative and significant effect on ROA across all models. NPL also shows a negative effect, although its significance is stronger in FEM and REM than in CEM. Inflation consistently has a positive and significant effect, while CAR and the pandemic period are not statistically significant in the main Random Effects Model. This consistency strengthens the robustness of the empirical findings.

Main Regression Results Using REM-PCSE

Since the model selection tests support the Random Effects Model and diagnostic tests indicate the presence of heteroskedasticity and cross-sectional dependence, the final model is estimated using REM with panel-corrected standard errors.

Table 5. Main Regression Results Using REM-PCSE

Variable	Coefficient	Std. Error	t-Statistic	Probability	Result
Constant	10.32845	0.637519	16.20100	0.0000	Significant
Inflation	0.040283	0.017951	2.244005	0.0260	Significant
NPL	-0.421718	0.166770	-2.528736	0.0123	Significant
BOPO	-0.096968	0.006729	-14.40969	0.0000	Significant
CAR	-0.010029	0.012102	-0.828716	0.4083	Not significant
Pandemic Period	-0.092809	0.120880	-0.767779	0.4436	Not significant
R-squared	0.720632				
Adjusted R-squared	0.713241				
F-statistic	97.50548			0.0000	Model significant
Durbin-Watson stat	1.850055				

Note. The dependent variable is ROA. The model is estimated using the Random Effects Model with panel-corrected standard errors. Source: EViews output, processed by the authors.

The results show that the model has strong explanatory power, with an R-squared value of 0.720632. This means that approximately 72.06% of the variation in ROA is explained by inflation, NPL, BOPO, CAR, and the pandemic period. The F-statistic probability of 0.0000 indicates that the model is statistically significant as a whole.

Operational efficiency, measured by BOPO, has a negative and highly significant effect on ROA. The coefficient of -0.096968 indicates that higher operating expenses relative to operating income reduce banking profitability. This finding supports H1 and confirms that cost efficiency is the most dominant determinant of bank profitability in the model.

Credit risk, measured by NPL, also has a negative and significant effect on ROA. The coefficient of -0.421718 indicates that higher non-performing loans reduce profitability. This finding supports H2 and suggests that deteriorating loan quality weakens bank performance through lower interest income and higher provisioning costs.

Inflation has a positive and significant effect on ROA. The coefficient of 0.040283 indicates that inflation contributes positively to profitability during the observation period. This finding supports H3 and suggests that banks may have been able to adjust lending rates and maintain interest margins under manageable inflationary conditions.

Capital adequacy has a negative but statistically insignificant effect on ROA. This result indicates that CAR does not directly influence profitability in the observed sample. Therefore, H4 is not supported. Capital adequacy may strengthen resilience and regulatory compliance, but it does not automatically improve profitability if capital is not effectively allocated to productive assets.

The pandemic period has a negative but statistically insignificant effect on ROA. Since the pandemic variable is treated as a structural control variable, this finding indicates that the pandemic period does not significantly explain average profitability after controlling for BOPO, NPL, inflation, and CAR. This suggests that internal bank-specific factors, particularly operational efficiency and credit risk, are more important in explaining profitability differences than the pandemic period as a standalone factor.

Summary of Hypothesis Testing

Table 6. Summary of Hypothesis Testing

Hypothesis	Statement	Result	Decision
H1	Operational efficiency has a negative effect on banking profitability.	BOPO has a negative and significant effect on ROA.	Supported
H2	Credit risk has a negative effect on banking profitability.	NPL has a negative and significant effect on ROA.	Supported
H3	Inflation has a significant effect on banking profitability.	Inflation has a positive and significant effect on ROA.	Supported
H4	Capital adequacy has a significant effect on banking profitability.	CAR has no significant effect on ROA.	Not supported

Source: EViews output, processed by the authors.

The summary of hypothesis testing indicates that operational efficiency, credit risk, and inflation significantly affect banking profitability, while capital adequacy does not have a significant effect. Among the significant variables, operational efficiency emerges as the most dominant determinant, confirming the central role of cost efficiency in shaping profitability among Indonesian listed banks.

Discussion

Operational Efficiency and Banking Profitability

The findings indicate that operational efficiency has a negative and highly significant effect on banking profitability. Therefore, H1 is supported. This result implies that a higher BOPO ratio reduces ROA, indicating that cost inefficiency directly weakens banks' ability to generate earnings from their assets. Since BOPO reflects the proportion of operating expenses relative to operating income, a higher ratio suggests that banks require greater resource expenditure to produce revenue, ultimately reducing profitability.

This finding has important economic implications in the Indonesian banking context. During the 2010–2024 period, Indonesian banks experienced substantial transformation driven by digital banking expansion, branch restructuring, fintech competition, and changes in

customer transaction behavior. In such conditions, banks with stronger cost control mechanisms are more likely to maintain profitability because they can reduce unnecessary operational expenses, improve process efficiency, and increase productivity. Conversely, banks with persistently high BOPO ratios may experience profitability erosion because operating income is absorbed by administrative costs, labor expenses, branch operations, technological investment, and regulatory compliance costs.

The result is consistent with efficiency theory, which emphasizes that firms with more efficient resource utilization and cost management are more likely to achieve superior financial performance (Berger & Mester, 1997). This finding also supports previous empirical studies showing that operational efficiency is one of the main determinants of banking profitability. Nguyen (2024) demonstrates that operating costs significantly influence bank profitability in Vietnam, while Belcaid and Al-Faryan (2024) find that internal bank-specific factors strongly shape profitability within liberalized financial systems. Similar evidence is reported by Ali and Puah (2019), who show that internal efficiency plays an essential role in sustaining banking stability and profitability. Ramadhani (2020) also highlights efficiency as one of the critical indicators explaining profitability performance among commercial banks.

The dominance of BOPO in this study provides an important theoretical contribution. While many previous studies emphasize credit risk as the primary determinant of banking performance, this study demonstrates that operational efficiency exerts a stronger and more consistent effect on profitability among Indonesian listed banks. This suggests that profitability in emerging banking markets is not determined solely by asset quality, but also by managerial capability in controlling operational costs and improving productivity. The finding reinforces the argument of Saif-Alyousfi (2022) and Almaskati (2022) that internal managerial capability remains central in explaining profitability differences across banks.

This result is also relevant in the context of digital transformation in the banking industry. Digitalization may initially increase operational expenditure because banks must invest in IT infrastructure, cybersecurity systems, automation, and digital platforms. However, these investments can improve profitability if they successfully increase operational efficiency and service productivity (Citterio et al., 2024; Gomber et al., 2017). Therefore, digital transformation should not be viewed merely as technology adoption, but as a strategic mechanism for improving operational efficiency and sustaining long-term profitability.

From a managerial perspective, the findings imply that banks should prioritize efficiency-oriented strategies. Cost structure optimization, branch network rationalization, process automation, and digital service integration are essential for maintaining profitability. Bank management must ensure that technological investment generates efficiency gains rather than creating additional cost burdens. Consequently, operational efficiency becomes not only an accounting indicator but also a strategic determinant of banking resilience and competitiveness.

Credit Risk and Banking Profitability

The findings show that credit risk has a negative and significant effect on banking profitability. Therefore, H2 is supported. This result indicates that higher non-performing loans (NPLs) reduce ROA because deteriorating loan quality weakens interest income generation and increases loan-loss provisioning costs. Since lending activities remain the primary source of bank revenue, rising credit risk directly threatens profitability and financial sustainability.

This finding is consistent with the risk–return tradeoff framework, which argues that banks accept credit risk in order to generate returns from lending activities. However, when credit risk becomes excessive, default losses and provisioning expenses exceed expected returns, causing profitability deterioration. Thus, beyond a certain threshold, credit risk no longer supports income generation but instead becomes a burden on financial performance.

The result aligns with previous empirical studies showing that credit risk negatively affects bank profitability. Almaskati (2022) emphasizes that risk-related variables are important determinants of bank performance, while Nguyen (2024) identifies non-performing loans as one

of the key profitability determinants in the banking sector. Similar findings are reported by Ekinci and Poyraz (2019), Salike and Ao (2018), and Rahadiansyah et al. (2025), who demonstrate that deteriorating asset quality reduces banking performance through lower interest income and higher credit provisioning expenses. Skorborg and Shenai (2021) also find that non-performing loans significantly weaken profitability in post-crisis banking conditions.

In the Indonesian banking context, the negative effect of NPLs is economically reasonable. During the pandemic period, many borrowers experienced declining income, business disruption, and repayment difficulties. These conditions increased pressure on asset quality and created additional financial risk for banks. Haris et al. (2024) show that the effect of credit risk becomes more severe during crisis periods because economic disruption weakens borrower repayment capacity. Likewise, Al Zafir and Sudarjah (2025) find that COVID-19 conditions and credit risk significantly influenced profitability among Indonesian conventional banks.

Nevertheless, the relatively weaker effect of NPL compared with BOPO suggests that the impact of credit risk may have been partly mitigated by regulatory support, restructuring programs, and bank-level risk management practices during the pandemic period. Policies related to loan restructuring, liquidity assistance, and regulatory flexibility may have reduced the immediate accounting impact of rising non-performing loans on profitability. This interpretation is consistent with Demirgüç-Kunt et al. (2021), who argue that policy intervention during crisis periods helped maintain banking stability despite increasing financial pressure.

The findings imply that credit risk management remains essential, but it should not be separated from operational efficiency. Banks with stronger operational efficiency may be better able to absorb the adverse consequences of credit risk because they possess stronger cost structures and more stable earnings capacity. Therefore, sustainable profitability depends on the integration of prudent lending policies, effective borrower monitoring, adequate provisioning systems, and efficient operational management. This result also supports the argument of Abbas et al. (2019) and Škrabić Perić et al. (2018) that profitability and risk exposure are jointly influenced by internal financial management capability.

Inflation and Banking Profitability

The findings indicate that inflation has a positive and significant effect on banking profitability. Therefore, H3 is supported. This result suggests that Indonesian listed banks may have been able to maintain or improve profitability during inflationary periods. One possible explanation is that banks can adjust lending rates in response to inflation more rapidly than deposit costs, thereby maintaining or increasing interest margins.

However, the positive effect of inflation should be interpreted within Indonesia's macroeconomic context. Inflation may benefit banks only when it remains moderate, predictable, and manageable. Under stable macroeconomic conditions, banks can adapt pricing strategies, maintain spreads, and manage asset-liability structures more effectively. Conversely, high and volatile inflation may weaken borrower purchasing power, increase operating costs, reduce repayment capacity, and increase credit risk exposure.

This finding supports the view that macroeconomic conditions influence banking profitability, although the effect of inflation is contextual rather than dominant. Inflation shapes the external environment in which banks operate, but the stronger effect of BOPO in this study indicates that internal managerial efficiency remains more decisive in explaining profitability differences. Consequently, banks cannot rely solely on favorable macroeconomic conditions to sustain profitability.

The result is consistent with previous studies suggesting that macroeconomic variables affect banking performance. Belcaid and Al-Faryan (2024) find that macroeconomic factors significantly influence profitability in liberalized banking environments, while Nguyen (2024) reports that inflation affects profitability depending on broader economic and financial conditions. Similar findings are reported by Le and Ngo (2020), Al-Homaidi et al. (2018), and

Yitayaw (2021), who demonstrate that macroeconomic conditions influence bank profitability through interest margins, liquidity conditions, and operational environments.

From a managerial perspective, the findings imply that banks should strengthen asset-liability management, pricing strategies, and operational efficiency to maintain profitability under changing macroeconomic conditions. Inflation may create opportunities for higher margins, but sustainable profitability still depends on prudent cost control and effective risk management.

Capital Adequacy and Banking Profitability

The findings show that capital adequacy has no significant effect on banking profitability. Therefore, H4 is not supported. This result indicates that higher CAR does not automatically increase ROA among Indonesian listed banks. Although capital adequacy is important for maintaining solvency, absorbing losses, and meeting regulatory requirements, it does not directly generate earnings unless capital is allocated efficiently toward productive assets.

Several explanations may account for this insignificant relationship. First, most listed banks in Indonesia maintain capital levels above regulatory minimum requirements, thereby reducing variation in CAR across banks. When banks are already sufficiently capitalized, differences in capital adequacy may no longer explain profitability variation. Second, higher capital levels may reduce financial leverage, potentially limiting return generation. Third, capital may function more as a stability buffer than as a direct driver of profitability.

This finding contributes to the ongoing debate in banking literature regarding the relationship between capital and profitability. Coccoresse and Girardone (2021) argue that the effect of capital on profitability is highly context-dependent and influenced by market structure and institutional conditions. Abbas et al. (2024) similarly suggest that the capital–profitability relationship depends on broader economic and institutional environments. In contrast, Berger and Bouwman (2013) find that stronger capital contributes positively to bank performance during financial crises because it improves resilience and depositor confidence. Gupta and Mahakud (2020) also emphasize that capitalization influences banking performance differently depending on bank characteristics and market conditions.

The insignificant result in this study therefore does not necessarily contradict prior findings. Instead, it suggests that capital adequacy among Indonesian listed banks functions more as a mechanism for stability and resilience than as a direct source of profitability. Similar arguments are presented by Al-Nimer et al. (2024), who note that the profitability effect of capital depends on how effectively banks utilize their financial resources and manage liquidity conditions.

From a managerial perspective, this finding implies that maintaining adequate capital is necessary but not sufficient for improving profitability. Banks must also ensure that capital is utilized productively through efficient intermediation, prudent lending, and operational efficiency. For regulators, the result suggests that capital regulation should continue to support financial stability while encouraging banks to improve operational productivity and efficiency.

Pandemic Period as a Structural Control Variable

The pandemic period has a negative but statistically insignificant effect on banking profitability. Since the pandemic variable is treated as a structural control variable, this finding suggests that the COVID-19 period did not significantly affect average profitability after controlling for operational efficiency, credit risk, inflation, and capital adequacy.

This finding does not imply that the pandemic had no impact on the banking sector. Instead, it indicates that the pandemic effect may have been absorbed through internal bank-specific factors and regulatory intervention. During the crisis period, banks experienced declining credit demand, increasing borrower vulnerability, and pressure on operational income. However, loan restructuring policies, liquidity support, and regulatory flexibility may have reduced the direct negative impact of the pandemic on profitability.

The insignificant pandemic effect also indicates that profitability differences among banks were more strongly explained by internal managerial capability than by the crisis condition itself. Banks with stronger operational efficiency and more effective credit risk management were better able to maintain profitability despite economic disruption. This finding reinforces the argument that internal managerial capability is more decisive than external shocks in explaining profitability dynamics.

This interpretation is consistent with studies on banking resilience during crisis periods. Goodell (2020) argues that COVID-19 created unprecedented challenges for financial institutions, but the impact varied substantially across banks depending on internal financial conditions and institutional preparedness. Demirgüç-Kunt et al. (2021) also show that banking sector performance during the pandemic depended heavily on regulatory support and bank-specific resilience. Similarly, Al Zafir and Sudarjah (2025) emphasize that profitability differences among Indonesian banks during the pandemic were closely related to variations in credit risk exposure and managerial capability.

Theoretical and Practical Implications

The findings provide several important theoretical implications. First, this study extends the banking profitability literature by demonstrating that operational efficiency is more dominant than credit risk in explaining profitability among Indonesian listed banks. This finding supports efficiency theory and reinforces the argument that cost control is a central mechanism for sustaining profitability in emerging banking markets.

Second, this study refines the risk–return tradeoff perspective in banking. Although credit risk negatively affects profitability, its influence is weaker than operational efficiency. This indicates that banking profitability depends not only on asset quality but also on managerial capability in controlling operating expenses and improving productivity.

Third, this study contributes to the literature on banking resilience by showing that the pandemic period does not significantly affect profitability after controlling for internal financial variables. This suggests that resilience should be understood not only as the ability to survive external shocks but also as the ability to maintain operational efficiency and manage risk effectively during periods of uncertainty.

From a practical perspective, the findings imply that bank management should prioritize operational efficiency strategies to sustain profitability. Digital transformation, process automation, branch network optimization, and cost control are essential managerial priorities. Nevertheless, credit risk management remains critical because deteriorating loan quality continues to reduce profitability and threaten financial stability.

For regulators, the findings suggest that banking resilience requires policies that support both stability and efficiency. Capital adequacy and crisis intervention policies remain important, but long-term profitability also depends on banks' ability to strengthen operational efficiency, improve risk management quality, and adapt to structural transformation within the banking industry.

5. Conclusions

This study concludes that operational efficiency is the most dominant determinant of banking profitability among Indonesian listed banks during the 2010–2024 period. The findings show that a higher BOPO ratio significantly reduces profitability, indicating that cost inefficiency weakens banks' ability to generate returns from their assets. Credit risk also negatively affects profitability, confirming that deteriorating loan quality reduces interest income and increases provisioning costs. Meanwhile, inflation has a positive effect on profitability, suggesting that banks may benefit from manageable inflation conditions through better interest margin adjustments. In contrast, capital adequacy and the pandemic period do not significantly affect

profitability after controlling for internal financial variables. Overall, the study demonstrates that internal managerial capability, particularly operational efficiency and credit risk management, plays a more decisive role in sustaining profitability than external macroeconomic shocks alone.

This study has several limitations. First, the analysis is limited to publicly listed banks, which may not fully represent the entire Indonesian banking sector, especially regional development banks, Islamic banks, and smaller non-listed institutions. Second, the study applies a static panel regression approach, which may not fully capture dynamic relationships and potential endogeneity between profitability and bank-specific variables. Third, the model focuses primarily on operational efficiency, credit risk, inflation, capital adequacy, and the pandemic period, while other potentially important determinants such as liquidity, bank size, ownership structure, corporate governance, market competition, digitalization intensity, and sustainability practices are not included in the analysis. Therefore, the findings should be interpreted within the scope and limitations of the selected variables and sample.

Future research is encouraged to extend the analysis by incorporating a broader range of banking institutions and applying more advanced econometric techniques such as the Generalized Method of Moments (GMM) or dynamic panel models to address endogeneity and dynamic effects more effectively. Future studies may also examine the role of digital transformation, fintech adoption, green banking practices, corporate governance quality, and sustainability-oriented financing in influencing banking profitability and resilience. In addition, comparative studies across ASEAN or other emerging economies would provide deeper insight into whether the dominance of operational efficiency over credit risk is unique to Indonesia or reflects broader structural characteristics of emerging banking markets in the post-pandemic era.

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