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# The Influence Of Internal And Macroeconomic Factors On Bank Profitability Moderated By Asset Quality

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Solvency, Liquidity, Credit Risk, Inflation, Return on Assets.



**ABSTRACT**

This study aims to analyze the impact of internal bank factors, including solvency (CAR), liquidity (LDR), and credit risk (NPL), as well as macroeconomic factors such as Gross Domestic Product (GDP) and inflation, on bank profitability measured by Return on Assets (ROA). In addition, the study examines the moderating role of Asset Quality (AQ) in influencing the relationship between independent variables and ROA. The data used in this research are derived from the financial statements of conventional banks in Indonesia and macroeconomic indicators covering the 2019–2024 period. The analysis is conducted using panel data regression with a moderation approach, applying the Generalized Least Squares (GLS) method and robustness testing with the Generalized Method of Moments (GMM). The results indicate that internal and macroeconomic variables collectively exert a significant influence on bank profitability. Partially, credit risk (NPL), asset quality (AQ), and bank size (SIZE) show statistically significant effects on ROA. Higher credit risk reduces profitability, while larger banks achieve greater efficiency and returns due to economies of scale. Asset quality demonstrates a dual role enhancing or constraining profitability depending on its management effectiveness. Moreover, AQ significantly moderates the relationship between internal and external factors, emphasizing the importance of prudent credit management and sound asset allocation for sustainable profitability in Indonesia's banking sector.

## INTRODUCTION

A bank is a financial institution whose primary role is to collect funds from the public and distribute them to those in need in the form of credit. In addition, banks provide various services such as currency distribution and supervision, safekeeping of valuables, and support for the smooth functioning of the payment system. Overall, the existence of banks contributes to improving public welfare.

Bank profitability serves as an important indicator in assessing financial performance and operational efficiency in managing bank assets. One of the key indicators for measuring profitability is the Return on Assets (ROA), which represents the ratio of net income to total assets. ROA is widely used in financial literature as the main representation of a bank's managerial success in utilizing available resources. In this context, understanding the factors that can influence ROA is crucial for policymakers in the banking sector.

According to Savchenko and Derbeneva (2020), financial risks faced by a business include liquidity, solvency, and profitability risks. However, businesses that adopt effective business planning and performance management are more likely to achieve their strategic and operational goals.

Several internal factors such as solvency (CAR), liquidity (LDR), and credit risk (NPL) are often the main focus of research examining bank performance and profitability. Understanding the theoretical and empirical relationship between these internal factors, macroeconomic variables, and bank profitability is crucial for constructing a comprehensive analytical framework. Prior studies have investigated how financial ratios and macroeconomic indicators collectively influence the Return on Assets (ROA), emphasizing that both internal financial management and external economic conditions play a significant role in shaping bank performance.

Accordingly, this section provides a review of the relevant theories and empirical evidence underlying each independent, moderating, and control variable used in this study. The discussion not only outlines prior research findings but also serves as the foundation for developing the research hypotheses. Each subsection elaborates on the theoretical rationale and empirical justification for the proposed relationships among solvency, liquidity, credit risk, macroeconomic indicators, asset quality, and profitability, leading to the formulation of testable hypotheses (H1–H12) that reflect the expected direction and strength of these effects.

Solvency (CAR) plays a fundamental role in assessing a bank's capacity to absorb potential losses and maintain financial stability. According to Gentiana Mehmetaj and Vjosa Hajdari (2025), solvency has a statistically significant impact on bank performance and is crucial for enhancing profitability. Similarly, Saiz-Sepúlveda et al. (2024) highlight that a higher Capital Adequacy Ratio (CAR) helps banks remain stable under financial stress and strengthens investor and regulatory confidence. Wahyudi (2020) further confirms that an optimal CAR positively contributes to profitability by reinforcing the capital buffer. These findings collectively suggest that CAR serves as a critical determinant of bank profitability, reflecting the institution's resilience in managing financial risks.

H1: CAR has a positive effect on ROA.

Liquidity (LDR) represents another vital aspect of banking operations, indicating how effectively a bank utilizes third-party funds to generate income. The findings of Gentiana Mehmetaj and Vjosa Hajdari (2025) show that liquidity has mixed and statistically less significant effects on profitability, while Mariem Ben Abdallah and Slah Bahloul (2024) report a strong positive relationship between liquidity, solvency, and profitability. Gazi et al. (2024) further reveal that an optimal Loan to Deposit Ratio (LDR) enhances interest income and improves ROA, provided it is managed efficiently. However, excessive lending relative to deposits may heighten liquidity risk and negatively affect profitability, suggesting the need for balanced liquidity management.

H2: LDR has a positive effect on ROA.

Credit Risk (NPL) has been widely recognized as a major determinant of bank performance, reflecting the proportion of non-performing loans in a bank's credit portfolio. An increase in NPL typically leads to higher loan-loss provisions and reduced profitability. Shkodra et al. (2024) found a significant negative correlation between NPL and ROA among Eastern European banks, while Annas et al. (2024) define NPL as loans overdue for more than 90 days. Furthermore, Tao Jiang and Yanqiu (2024) emphasize that NPLs significantly affect banks' asset management efficiency. Saiz-Sepúlveda et al. (2024) describe NPL as a critical measure of asset

quality that captures credit risk and directly impacts profitability. A high NPL ratio signals deteriorating credit portfolio quality, compelling banks to allocate more resources for loan-loss reserves, which in turn reduces ROA.

H3: NPL has a negative effect on ROA.

From a macroeconomic perspective, Gross Domestic Product (GDP) serves as a key indicator of economic activity influencing the banking sector. Economic expansion tends to stimulate credit demand and enhance banks' lending opportunities, thereby improving profitability. Zuhdi et al. (2024) confirmed a positive relationship between GDP growth and ROA among Islamic banks in Indonesia, implying that economic growth directly supports banking performance.

H4: GDP has a positive effect on ROA.

Conversely, inflation (INFL) is often associated with negative effects on profitability. Studies by Merko and Habili (2023) and Hidayat et al. (2023) show that higher inflation increases operational costs and reduces borrowers' repayment capacity. Similarly, Soesetio et al. (2022) highlight that inflation diminishes the real value of assets and erodes profitability.

H5: Inflation has a negative effect on ROA.

Asset Quality (AQ) functions as a moderating variable that captures a bank's ability to manage credit risk and maintain the efficiency of its productive assets. In the moderating context, AQ can either strengthen or weaken the influence of internal and macroeconomic variables on profitability. Abdallah and Bahloul (2024) demonstrate that banks with higher asset quality can mitigate the adverse impact of poor credit risk indicators and enhance capital utilization efficiency. Therefore, the degree to which financial ratios affect ROA largely depends on a bank's underlying asset quality and credit risk management practices.

H6: Asset quality (AQ) strengthens the positive effect of CAR on ROA.

H7: Asset quality (AQ) strengthens the positive effect of LDR on ROA.

H8: Asset quality (AQ) weakens the negative effect of NPL on ROA.

H9: Asset quality (AQ) strengthens the positive effect of GDP on ROA.

H10: Asset quality (AQ) weakens the negative effect of inflation on ROA.

Bank Size (SIZE), typically measured by the natural logarithm of total assets, is another key determinant of profitability. Mulbah et al. (2024) find that bank size has a positive and significant impact on profitability and efficiency among Tanzanian banks. Supporting this view, Pasiouras et al. (2022) suggest that larger banks tend to achieve economies of scale, leading to higher ROA and ROE.

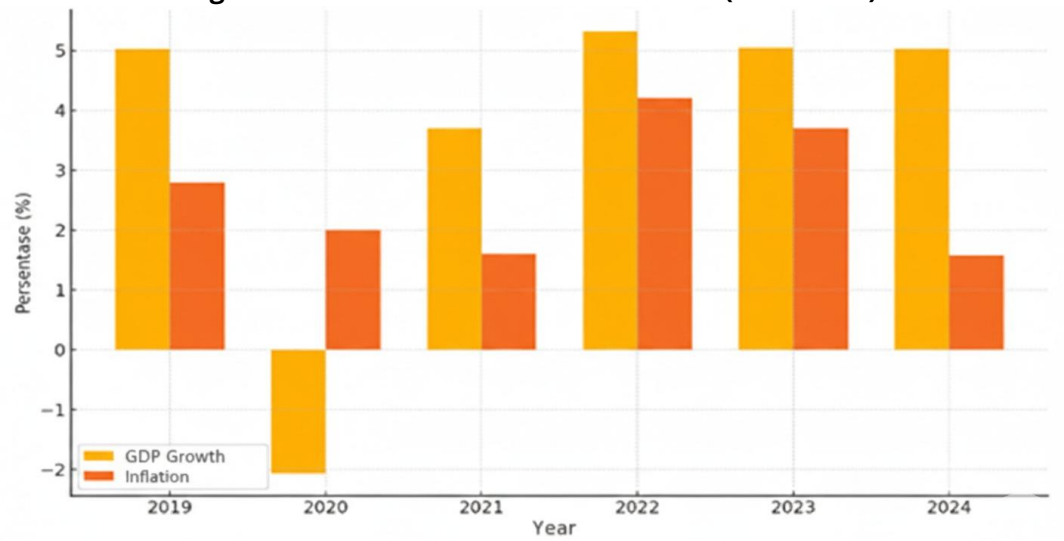
H11: Bank size (SIZE) has a positive effect on ROA.

Finally, economic growth, expressed as the logarithm of GDP, reflects the overall health of an economy and its capacity to influence banking sector profitability. Chowdhury and Salman (2021), Ahmad et al. (2023), and Borio et al. (2018) report that GDP growth is positively associated with profitability measures such as ROA and ROE, particularly in developing countries. Pasiouras et al. (2022) further emphasize that annual GDP growth serves as a critical proxy for economic activity, directly shaping banks' financial performance and profitability outcomes.

H12: Economic growth (log GDP) has a positive effect on ROA.

Overall, the literature suggests that bank profitability is shaped by a complex interaction of internal financial indicators and external macroeconomic conditions. However, inconsistencies across empirical findings highlight the importance of incorporating moderating factors such as asset quality and economic growth to better understand these relationships within the Indonesian banking context.

**Figure 1. GDP Growth and Inflation Rate (2019–2024)**




However, various studies show that the influence of both internal and macroeconomic factors on ROA is not always consistent. This suggests the presence of other variables that may moderate the relationship. In this context, Asset Quality (AQ) is considered an important moderating variable. Abdallah & Bahloul (2024) emphasize that asset quality can strengthen or weaken the effects of CAR, LDR, and NPL on ROA. High-quality assets indicate a bank's success in managing credit risk and maintaining asset efficiency.

This study aims to provide empirical evidence on the factors influencing the profitability of conventional banks in Indonesia, as measured by Return on Assets (ROA). Specifically, it seeks to identify which internal and macroeconomic variables exert the most significant effect on bank profitability and how moderating variables, such as asset quality and economic growth, alter these relationships. The findings are expected to contribute to the development of more effective financial management strategies, assist bank management and policymakers in making informed decisions, and enhance the overall stability and resilience of the Indonesian banking sector during the 2019–2024 period, which encompasses both the COVID-19 pandemic and the subsequent economic recovery phase.

Referring to the research background and problem formulation, this study analyzes the impact of both internal and external factors on bank profitability. The internal factors include the Capital Adequacy Ratio (CAR), Loan to Deposit Ratio (LDR), and Non-Performing Loan (NPL), which represent solvency, liquidity, and credit risk, respectively. The external or macroeconomic factors consist of Gross Domestic Product (GDP) and inflation, reflecting the broader economic environment affecting banking performance. Furthermore, the study examines the moderating role of Asset Quality (AQ) in influencing the relationship between internal and macroeconomic variables and profitability. In addition, it evaluates the effect of bank size (SIZE) as a control variable and investigates whether economic growth (log GDP) moderates the influence of these internal and external factors on ROA.

## LITERATUR RIVIEW

### Bank Profitability and Return on Assets (ROA)

Bank profitability is a central topic in banking and financial economics, as it reflects a bank's ability to generate sustainable income while managing risks and resources efficiently. Among various profitability indicators, Return on Assets (ROA) is widely regarded as the most comprehensive measure, particularly for banking institutions, because it captures management efficiency in utilizing total assets to generate earnings (Athanasoglou et al., 2008; Pasiouras & Kosmidou, 2007). ROA is preferred over equity-based measures since bank operations are

predominantly asset-driven, and regulatory frameworks emphasize asset quality and risk-weighted assets.

Prior studies argue that ROA is influenced by both bank-specific (internal) factors and macroeconomic conditions (Dietrich & Wanzenried, 2014; Saona, 2016). Internal factors reflect managerial decisions and operational efficiency, whereas macroeconomic variables capture external economic dynamics beyond managerial control. The interaction between these two dimensions forms a comprehensive framework for understanding bank profitability.

**Solvency (Capital Adequacy Ratio – CAR)**

Capital adequacy represents a bank's financial strength and its ability to absorb unexpected losses. Theoretical perspectives rooted in financial intermediation theory suggest that well-capitalized banks face lower bankruptcy risk, enjoy reduced funding costs, and are better positioned to exploit profitable lending opportunities (Berger, 1995). Empirically, numerous studies confirm a positive association between CAR and ROA, indicating that adequate capitalization enhances bank stability and profitability (Saiz-Sepúlveda et al., 2024; Mehmetaj & Hajdari, 2025).

However, the relationship is not always linear. Excessively high capital levels may indicate inefficient capital utilization, potentially reducing profitability (Goddard et al., 2011). This divergence in findings underscores the importance of considering moderating factors such as asset quality, which can determine whether capital buffers translate into higher profitability.

**Liquidity (Loan to Deposit Ratio – LDR)**

Liquidity management is essential for balancing profitability and risk in banking operations. According to liquidity preference theory, banks must maintain sufficient liquidity to meet withdrawal demands while allocating funds efficiently to income-generating assets. The Loan to Deposit Ratio (LDR) reflects this trade-off by indicating the extent to which deposits are transformed into loans.

Empirical evidence on the liquidity–profitability nexus remains mixed. Some studies report a positive effect of LDR on ROA, suggesting that effective loan deployment increases interest income (Gazi et al., 2024; Abdallah & Bahloul, 2024). Conversely, excessively high LDR levels may expose banks to liquidity risk and funding pressure, ultimately undermining profitability (Mehmetaj & Hajdari, 2025). These inconsistencies highlight the need to examine liquidity effects in conjunction with asset quality and risk management practices.

**Credit Risk (Non-Performing Loans – NPL)**

Credit risk is widely acknowledged as one of the most critical determinants of bank profitability. From a risk–return trade-off perspective, higher credit risk necessitates greater loan-loss provisions, directly reducing net income and ROA (Louzis et al., 2012). Non-Performing Loans (NPL) serve as a standard proxy for asset quality deterioration and inefficiencies in credit risk management.

Extensive empirical literature documents a robust negative relationship between NPL and profitability across different banking systems (Shkodra et al., 2024; Saiz-Sepúlveda et al., 2024). High NPL ratios not only erode earnings but also constrain banks' lending capacity and capital adequacy. Consequently, effective credit risk control is essential for sustaining profitability, particularly during periods of economic uncertainty.

**Economic Growth (GDP)**

Macroeconomic conditions significantly shape banking performance through their influence on credit demand, borrower solvency, and investment activity. According to endogenous growth theory, economic expansion stimulates financial intermediation by increasing savings, investment, and lending opportunities. Empirical studies consistently find

that GDP growth positively affects bank profitability, as stronger economic activity enhances loan performance and reduces default risk (Zuhdi et al., 2024; Ahmad et al., 2023). In emerging economies such as Indonesia, GDP growth plays an even more critical role due to the close linkage between banking activity and real sector performance. However, the magnitude of this effect may depend on banks' asset quality and risk management capabilities.

**Inflation**

The impact of inflation on bank profitability is theoretically ambiguous. On one hand, anticipated inflation may allow banks to adjust interest rates accordingly, preserving margins. On the other hand, unanticipated inflation increases operational costs, reduces borrowers' real income, and elevates credit risk (Perry, 1992).

Empirical evidence largely supports a negative relationship between inflation and ROA, particularly in developing economies where inflation volatility is high (Merko & Habili, 2023; Hidayat et al., 2023). Persistent inflation can erode asset values and weaken credit quality, emphasizing the importance of macroeconomic stability for banking performance.

**Asset Quality as a Moderating Variable**

Asset quality represents a bank's effectiveness in managing productive assets and controlling credit risk. In recent literature, asset quality is increasingly treated not only as a direct determinant of profitability but also as a moderating variable that shapes the strength and direction of other relationships (Abdallah & Bahloul, 2024).

Banks with high asset quality are better positioned to convert capital adequacy and liquidity into profitable outcomes while mitigating the adverse effects of credit risk and macroeconomic shocks. Conversely, poor asset quality can neutralize the benefits of strong capitalization or favorable economic conditions. Therefore, incorporating asset quality as a moderating variable provides a more nuanced understanding of bank profitability dynamics.

**Control Variable: Bank Size**

Bank size is commonly included as a control variable due to its association with economies of scale, diversification benefits, and market power. Large banks tend to achieve lower average costs and greater revenue diversification, which can enhance profitability (Pasiouras et al., 2022; Mulbah et al., 2024). However, excessive size may also lead to inefficiencies and agency problems, suggesting that the size–profitability relationship may vary across banking systems.

**Synthesis of Literature and Research Gap**

Overall, existing literature demonstrates that bank profitability is influenced by a complex interplay of internal financial indicators and macroeconomic conditions. Nevertheless, empirical findings remain inconsistent across countries and periods, particularly regarding liquidity and inflation effects. Moreover, limited studies explicitly examine the moderating role of asset quality in linking internal and macroeconomic factors to profitability, especially within the Indonesian banking context during periods of economic shock and recovery.

Accordingly, this study addresses these gaps by integrating asset quality as a moderating variable and examining both internal and macroeconomic determinants of profitability in conventional Indonesian banks over the 2019–2024 period. This approach is expected to provide more robust empirical insights and contribute to the advancement of banking profitability literature.

## METHODS

This study employs a quantitative associative research method designed to analyze the relationship between internal factors and macroeconomic variables on banking profitability, with asset quality serving as a moderating variable. The research design aims to describe and test causal relationships through statistical analysis of historical data. The quantitative approach was chosen because it allows for objective and measurable assessment of inter-variable relationships.

Data analysis is conducted using panel data regression, as the dataset covers both cross-sectional (bank entities) and time-series (yearly) dimensions. This method effectively accounts for unobserved individual heterogeneity that may influence the results. In addition, a moderation analysis (interaction test) is applied to determine whether the impact of internal and macroeconomic factors on Return on Assets (ROA) is affected by the bank's asset quality, as discussed by Abdallah & Bahloul (2024).

This study uses secondary data as the primary source for quantitative analysis. The dataset consists of annual financial reports from conventional commercial banks listed on the Indonesia Stock Exchange (IDX), along with national macroeconomic indicators obtained from Statistics Indonesia (BPS), Bank Indonesia (BI), the Financial Services Authority (OJK), and Bloomberg Terminal. The research covers the period 2019–2024.

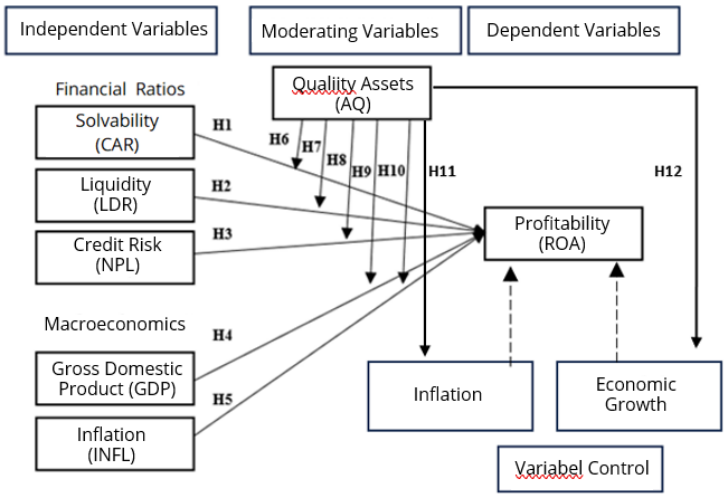
The population of this study consists of all conventional commercial banks listed and actively traded on the Indonesia Stock Exchange (IDX). Using a purposive sampling method, banks were selected based on specific criteria, including active listing on the IDX during 2019–2024, the availability of complete financial statements for the entire period, and the completeness of data for all variables analyzed. Based on these criteria, a total of 26 banks were identified as the research sample.

The operational definitions of variables in this study refer to measurement indicators commonly applied in previous empirical studies, including Abdallah & Bahloul (2024), Gazi et al. (2024), and Shkodra et al. (2024). The operational definition table summarizes all variables used in this research, detailing how each is measured and analyzed.

**Table 1. Operational Definitions Of Variables**

| Variable | Symbol | Indicator / Measurement | Unit | Reference |
|---|---|---|---|---|
| Profitability | ROA | Net Income / Total Assets | % | Mariem Ben Abdallah & Slah Bahloul (2025) |
| Solvency | CAR | Capital / Risk-Weighted Assets (RWA) | % | — |
| Liquidity | LDR | Loans / Third-Party Funds (Deposits) | % | — |
| Credit Risk | NPL | Non-Performing Loans / Total Loans | % | Tao Jiang & Yanqiu (2025) |
| Gross Domestic Product | GDP | Economic Growth Rate | % | Mariem Ben Abdallah & Slah Bahloul (2025) |
| Inflation | INFL | Year-on-Year (YoY) Inflation Rate | % | Zuhdi, Wulandari, & Setyowati |
| Asset Quality | AQ | NPL Ratio or other proxy of earning/productive assets quality | % | Mariem Ben Abdallah & Slah Bahloul (2025) |
| Bank Size | SIZE | ln (Total Assets) | ln | Pasiouras et al. (2022) |
| Economic Growth | log GDP | ln (Real GDP) | ln | Pasiouras et al. (2022) |

**Figure 2: Framework of Thought**




The data analysis in this study was carried out using panel data regression methods through several analytical stages. First, descriptive statistics were used to summarize and describe the characteristics of the research variables, providing an overview of the data distribution. Second, classical assumption tests were conducted, including tests for normality, heteroskedasticity, autocorrelation, and multicollinearity, along with model specification tests such as the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test, to determine the most appropriate panel regression model. Third, the selected panel data regression model either the Fixed Effect Model (FEM) or Random Effect Model (REM) was estimated based on the results of these specification tests. Finally, moderation analysis was performed by incorporating interaction terms between the independent variables and the moderating variable, Asset Quality (AQ), to examine its moderating role in influencing the relationship between internal bank factors, macroeconomic variables, and profitability. The regression models used in this study are as follows:

Direct Model:

$$ROA_{it} = \alpha + \beta_1 CAR_{it} + \beta_2 LDR_{it} + \beta_3 NPL_{it} + \beta_4 GDP_t + \beta_5 INFL_t + \beta_6 AQ_{it} + \beta_7 SIZE_{it} + \beta_8 LogGDP_t + \varepsilon_{it}$$

Moderated (Interaction) Model:

$$ROA_{it} = \alpha + \beta_1 CAR_{it} + \beta_2 LDR_{it} + \beta_3 NPL_{it} + \beta_4 AQ_{it} + \beta_5 (CAR_{it} \times AQ_{it}) + \beta_6 (LDR_{it} \times AQ_{it}) + \beta_7 (NPL_{it} \times AQ_{it}) + \beta_8 SIZE_{it} + \beta_9 LogGDP_t + \beta_{10} INFL_t + \beta_{11} (LogGDP_t \times AQ_{it}) + \beta_{12} (INFL_t \times AQ_{it}) + \varepsilon_{it}$$

## RESULTS

This section presents the results of data processing for all research variables collected from 26 conventional commercial banks in Indonesia over the period 2019–2024. During the data processing stage, a filtering procedure was applied to refine the sampling. Out of the total 26 banks, 8 were excluded from the analysis for specific reasons: 5 banks were identified as having outlier data, and 3 banks recorded negative ROA values, which caused data distribution irregularities during the normality test. Consequently, the final analysis was conducted on 18 banks that met the criteria for valid distribution and data quality. The analysis was carried out to test the hypotheses formulated in the earlier theoretical framework.

The testing process was performed in several stages. It began with descriptive statistical analysis to obtain a general overview of the data characteristics, followed by classical assumption tests to ensure the validity of the regression model. Next, panel model selection tests including the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test were conducted to determine the most appropriate estimation approach for panel data regression, whether it be the Common Effect Model (CEM), Fixed Effect Model (FEM), or Random Effect Model (REM).

After determining the optimal model, panel data regression analysis was conducted using both the baseline model and the interaction (moderation) model to assess the moderating influence of Asset Quality (AQ). The discussion of empirical findings was then developed in reference to previous studies and within the broader context of the Indonesian banking industry, as outlined in the literature review.

Descriptive statistics are utilized to provide an initial overview of the distribution and key characteristics of the variables examined in this study, including the minimum, maximum, mean (average), and standard deviation values. According to Koutroumpis et al. (2020), descriptive analysis is essential for understanding the general characteristics of the dataset and for identifying potential deviations or emerging patterns before conducting regression analysis.

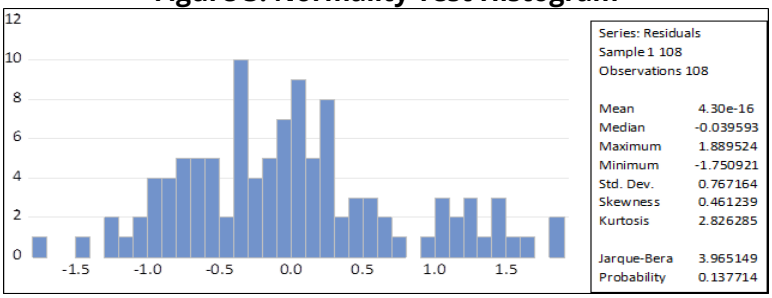
**Table 2. Descriptive Statistics**

| Variable | n | *Median* | *Maximum* | *Mean* | Std. Deviasi |
|---|---|---|---|---|---|
| ROA | 108 | 1.41 | 4.22 | 1.67 | 1.12 |
| CAR | 108 | 23.30 | 40.11 | 23.90 | 5.31 |
| LDR | 108 | 83.48 | 113.50 | 79.14 | 15.24 |
| NPL | 108 | 2.80 | 7.29 | 2.84 | 1.22 |
| GDP | 108 | 5.03 | 5.31 | 3.67 | 2.63 |
| INFL | 108 | 2.40 | 4.21 | 2.65 | 1.03 |
| AQ | 108 | 0.90 | 4.56 | 1.28 | 0.94 |
| SIZE | 108 | 32.68 | 35.43 | 31.13 | 4.58 |
| Log GDP | 108 | 16.465 | 16.60 | 16.49 | 0.07 |

The normality test was conducted to verify whether the residuals from the regression model follow a normal distribution. According to Singh and Banerjee (2021), this test is crucial to ensure the validity of inferential statistical analysis, particularly in panel data–based linear regression models.

Based on the histogram and Jarque–Bera test, the calculated statistic was 3.3965149 with a probability value of 0.137714. Since the probability value exceeds the 5% significance threshold (α = 0.05), it can be concluded that the residuals are normally distributed.

**Figure 3. Normality Test Histogram**




The multicollinearity test was conducted to detect the presence of high correlations among independent variables in the panel regression model. This analysis was performed using the Variance Inflation Factor (VIF) method. To ensure that there is no high correlation among the independent variables, the VIF test was applied. Based on recent econometric guidelines, VIF values below 5 indicate no multicollinearity, while values below 10 are still acceptable in the context of econometric analysis (Hair et al., 2019; Luo et al., 2023).

The results of the multicollinearity test show that all variables have VIF values well below the tolerance threshold of 10. Therefore, it can be concluded that the regression model used in this study is free from multicollinearity issues.

**Table 3. Multicollinearity Test Results**

| Variable | VIF |
|---|---|
| ROA | 1.04 |
| CAR | 1.09 |
| LDR | 2.89 |
| NPL | 138.25 |
| GDP | 1.96 |
| INFL | 2.85 |
| AQ | 1.01 |
| SIZE | 130.48 |
| Log GDP | 1.04 |

The heteroskedasticity test was conducted to determine whether any variance inconsistency exists in the residuals of the panel regression model. In this study, heteroskedasticity was examined using the Breusch–Pagan–Godfrey test. The purpose of this test is to identify whether the residual variance is variable (heteroskedastic) or constant (homoskedastic).The test results show an F-statistic probability value of 0.7034, which is greater than the significance level α = 0.05. Similarly, the Obs*R-squared probability is 0.6844, and the Scaled Explained SS probability is 0.8244—all exceeding the 0.05 threshold.

According to Baltagi (2021), when the probability value of the Breusch–Pagan test is higher than the significance level (e.g., 0.05), there is no evidence of heteroskedasticity, and the regression model is considered to satisfy the classical assumption of constant residual variance. Therefore, the results indicate that there is no heteroskedasticity problem in this regression model. Since the test does not provide sufficient evidence to reject the null hypothesis ($H_0$), it can be concluded that the residual variance is constant (homoskedastic).

**Table 4. Heteroskedasticity Test Results**

| Statistik Uji | Nilai | Probabilitas |
|---|---|---|
| F-statistic | 0.685388 | 0.7034 |
| Obs*R-squared | 5.667661 | 0.6844 |
| Scaled explained SS | 4.348759 | 0.8244 |

The autocorrelation test was conducted to determine whether there is a correlation among the residuals in the panel regression model. One of the most commonly used techniques for this purpose is the Durbin–Watson (DW) test.Based on the estimation results using the Random Effect Model (REM) approach, the Durbin–Watson value was found to be 1.204963. This value lies slightly below the midpoint of 2, suggesting the potential presence of positive autocorrelation. However, DW values between 1.5 and 2.5 are generally considered to indicate that the model is free from significant autocorrelation problems.

**Table 5. Autocorrelation Test Results**

| Statistik Uji | Nilai |
|---|---|
| Durbin-Watson stat | 1.204963 |

This study employed three stages of testing to determine the most appropriate panel regression model, namely the Chow test, the Hausman test, and the Lagrange Multiplier (LM) test.The first stage, the Chow test, was conducted to compare whether the Common Effect Model (CEM) or the Fixed Effect Model (FEM) was more suitable. The Chow test is a common approach used to assess whether the fixed effect model provides advantages over the pooled model by analyzing the significance of individual effects in panel data (Bo et al., 2023). The test produced F-statistic and Chi-square probabilities of 0.0000, indicating statistical significance

since the values are below the 5% significance level (α = 0.05). Therefore, the null hypothesis was rejected, and the Fixed Effect Model (FEM) was considered more appropriate than the Common Effect Model (CEM).The second stage, the Hausman test, aimed to determine which model was preferable between the Fixed Effect Model (FEM) and the Random Effect Model (REM). The test yielded a probability value of 1.0000; however, this result was considered invalid because the variance of the coefficients could not be accurately computed.

Since the Hausman test results were deemed invalid and could not be used to identify the most suitable model, the third stage, the Lagrange Multiplier (LM) test, was conducted. This test compares the Common Effect Model (CEM) with the Random Effect Model (REM) at a significance level of α = 0.05. The LM test produced a probability value of 0.0000, which is lower than the specified significance threshold. Consequently, the null hypothesis was rejected, and it was concluded that the Random Effect Model (REM) was more appropriate than the Common Effect Model (CEM) for this analysis.

**Table 6. Model Selection Tests**

| Test | Purpose | Result | Decision |
|---|---|---|---|
| Chow Test | Compare CEM vs FEM | Prob = 0.0000 | Reject $H_0$ → use Fixed Effect Model (FEM) |
| Hausman Test | Compare FEM vs REM | Prob = 1.0000 (invalid) | Test result cannot be used |
| LM (Lagrange Multiplier) Test | Compare CEM vs REM | Prob = 0.0000 | Reject $H_0$ → use Random Effect Model (REM) |

The F-test was conducted to determine whether the independent variables in the model simultaneously have a significant effect on the dependent variable, namely Return on Assets (ROA). The estimation results show an F-statistic value of 13.86100 with a probability value of 0.0000, which is well below the 5% significance level (α = 0.05). This indicates that the model is statistically significant overall.According to Yang et al. (2021), the F-test serves as a fundamental tool to assess the collective significance of all predictor variables in a regression model. When the probability value is smaller than the predetermined significance level, it suggests that at least one independent variable has a statistically significant influence on the dependent variable. Therefore, it can be concluded that, statistically, all independent variables in the model jointly exert a significant simultaneous effect on ROA.

**Table 7. Simultaneous Test (F-Test)**

| Description | Value |
|---|---|
| F-Statistic | 13.861 |
| Probability (F-Statistic) | 0.0000 |
| R-squared | 0.52832 |
| Adjusted R-squared | 0.490204 |

The results of the t-test from the panel data regression model show that out of eight independent variables, only Non-Performing Loans (NPL), Asset Quality (AQ), and Bank Size (SIZE) have a statistically significant effect on Return on Assets (ROA).The NPL variable has a coefficient of –0.375906 with a p-value of 0.001, indicating a significant negative impact on ROA at the 1% level. This means that higher levels of non-performing loans reduce profitability, consistent with Shkodra et al. (2024) who note that increased credit risk weakens bank performance. Asset Quality (AQ) also shows a negative and significant effect (coefficient = –0.355378; p = 0.0131), suggesting that overly strict internal controls may hinder operational flexibility and reduce profitability. In contrast, Bank Size (SIZE) has a positive and significant effect (coefficient =

0.083731; p = 0.000), indicating that larger banks benefit from economies of scale and better resource utilization (Wang & Zhang, 2020).

Other variables such as CAR, LDR, GDP, Inflation, and Economic Growth do not significantly affect ROA, although they remain theoretically relevant. Overall, the findings highlight that credit risk, asset management quality, and bank scale are the main determinants of profitability in Indonesia's conventional banking sector, with asset quality playing a key moderating role in strengthening these relationships.

**Table 8 Regression Test (t-Test Results)**

| Variable Name | Coefficient | t-Statistic | Probability | Effect Direction | Significance |
|---|---|---|---|---|---|
| CAR (Solvency) | –0.017575 | –1.137628 | 0.2580 | Negative | Not significant |
| LDR (Liquidity) | –0.005244 | –0.957772 | 0.3405 | Negative | Not significant |
| NPL (Credit Risk) | –0.375906 | –3.402070 | 0.0010 | Negative | Significant (p < 0.05) |
| GDP | 0.050885 | 1.259541 | 0.2108 | Positive | Not significant |
| Inflation | –0.017833 | –0.214759 | 0.8329 | Negative | Not significant |
| Asset Quality (AQ) | –0.355378 | –2.526919 | 0.0131 | Negative | Significant (p < 0.05) |
| Bank Size (SIZE) | 0.083731 | 4.933944 | 0.0000 | Positive | Significant (p < 0.05) |
| Economic Growth (log GDP) | –1.198830 | –0.819976 | 0.4142 | Negative | Not significant |

The regression analysis reveals that the independent variables collectively have a significant impact on the profitability of banks, as measured by Return on Assets (ROA). This is evidenced by the F-test value of 13.861 and a probability value of 0.000, which is well below the 5% significance threshold. These results confirm that the regression model is appropriate and statistically valid in explaining how internal and macroeconomic factors influence bank profitability.

## DISCUSSION

In the partial analysis, three variables were found to have a significant individual effect on ROA. First, the Non-Performing Loan (NPL) ratio shows a significant negative relationship with profitability (p = 0.001). This finding suggests that an increase in problem loans tends to reduce profitability, aligning with risk management theory and supporting the empirical evidence reported by Ali et al. (2021). Second, Asset Quality (AQ) demonstrates a significant negative effect (p = 0.0131). Although strong asset quality controls are designed to enhance efficiency, overly stringent management and monitoring practices may restrict short-term profitability, as highlighted by Wang and Zhang (2020). Third, Bank Size (SIZE) exhibits a significant positive effect on profitability (p = 0.000), indicating that larger banks are better positioned to leverage economies of scale and diversify their operations.

Meanwhile, other variables such as the Capital Adequacy Ratio (CAR), Loan to Deposit Ratio (LDR), Gross Domestic Product (GDP), and inflation do not show statistically significant effects when tested individually. However, their collective influence remains relevant and significant in the overall model. This outcome suggests that the combined interaction of these financial and macroeconomic factors exerts a stronger influence on bank profitability than any single factor alone. It also indicates the potential moderating role of asset quality in shaping the relationship between these variables and ROA.

## CONCLUSION

Based on the findings of this study, it can be concluded that internal and macroeconomic variables collectively exert a significant influence on the profitability of conventional banks in

Indonesia. This indicates that the performance of the banking sector is not solely determined by internal financial management but also by broader economic conditions. The results of the partial analysis further reveal that credit risk, asset quality, and bank size have a statistically significant impact on Return on Assets (ROA). Specifically, higher credit risk tends to reduce profitability, while larger bank size contributes positively due to economies of scale and operational efficiency. Asset quality, on the other hand, plays a dual role it can either enhance or constrain profitability depending on how effectively it is managed.

Moreover, asset quality is found to act as an important moderating variable that shapes the strength and direction of the relationships among internal and external factors influencing profitability. Its moderating effect highlights the crucial role of maintaining sound credit management and prudent asset allocation in sustaining financial performance. These findings reinforce previous research in the field and emphasize that consistent improvement in asset quality and credit risk management is essential for enhancing the stability and profitability of Indonesia's banking sector.

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