

THE EFFECT OF GREEN BANKING AND CREDIT RATIOS ON RETURN ON EQUITY IN INDONESIAN BANKING SECTOR (2022-2024)

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ABSTRACT

This research examines how Green Banking practices, Non-Performing Loan (NPL), and Loan to Deposit Ratio (LDR) affect Return on Equity (ROE) among banking firms registered on the Indonesia Stock Exchange throughout the 2022–2024 observation window. A quantitative associative design is applied, drawing on secondary data sourced from financial statements and sustainability disclosure reports. The sample comprises 35 banks with a total of 105 observations gathered through purposive sampling. The analytical framework employs Partial Least Squares Structural Equation Modeling (PLS-SEM) executed via SmartPLS software. Empirical findings reveal that Green Banking exerts a positive and statistically significant influence on ROE, whereas NPL produces a significant negative effect. LDR demonstrates a positive and significant relationship with ROE. The model accounts for 63.8% of the variance in ROE, signifying robust explanatory capacity. These outcomes affirm that banking profitability is shaped by sustainability-oriented practices, credit risk exposure, and liquidity management efficiency.

Keywords: Green Banking, NPL, LDR, ROE, Bank Financial Performance

1. INTRODUCTION

The banking industry serves as a cornerstone of economic stability by performing financial intermediation functions that redirect public savings into productive economic activities. This function makes banks assential institutions in maintaining financial system stability and supporting economic growth (Otoritas Jasa Keuangan, 2023). During the 2022-2024 perid, indonesia banking experienced post-pandemic recovery accompanied by increasing competition and digital transformation (Bank Indonesia, 2023). These conditions require banks to maintain profitability while managing financial risks effectively. Return on Equity (ROE) is

widely adopted to assess banking performance because it captures how effectively a bank converts shareholders' equity into profit, thereby reflecting the impact of internal determinants such as credit quality, liquidity governance, and sustainability-related practices.

2. LITERATURE REVIEW

The literature review contains a systematic review on previous research that are relevant to the topic. This section contains the strengths and weaknesses of previous research which can be used as an argument that this research is carried out to improve or develop previous research. This section also contains the theoretical basis in the form of a summary of theories from the literature that support the research, as well as an explanation of the basic concepts and principles needed for problem solving. The theoretical basis is in the form of qualitative descriptions, mathematical models, or tools that are directly related to the problems studied. The sources referred to in this section must be included in the sentences/statements referred to and in the references. This section may include theoretical framework and/or hypothesis development.

Stakeholder Theory

Stakeholder Theory posits that corporations bear accountability not merely to their shareholders but also to a broader constellation of parties including customers, investors, regulators, employees, and society. Long-term business sustainability depends on the ability of organizations to balance stakeholder expectations and maintain legitimacy. In the banking sector, sustainability initiatives and ESG disclosure are considered strategic instruments to improve transparency, strengthen stakeholder trust, and enhance corporate reputation. Consequently, better sustainability performance may contribute to improved financial outcomes.

Trade-Off Risiko dan Return Theory

Risk–Return Trade-Off Theory states that expected returns are associated with the level of risk undertaken. Higher risk may generate greater returns but may also reduce performance if not managed effectively (Sari & Fauzan, 2024). In banking, credit risk and liquidity risk are important determinants of profitability. Credit risk is quantified through the Non-Performing Loan ratio (NPL), while liquidity exposure is captured via the Loan to Deposit Ratio (LDR). Effective control of these risks supports stronger financial performance (Putra et al., 2024; Rabbani et al., 2024).

Green Banking dan ESG

Green Banking refers to the incorporation of environmental sustainability principles into banking business models and credit allocation decisions (Agustina & Fasa, 2025; Setyorini & Hakam, 2025). Previous studies indicate that sustainability-oriented banking practices may improve operational efficiency, strengthen reputation, and increase investor confidence, thereby supporting financial performance (Haryono et al., 2025; Panjaitan et al., 2025).

Formula ESG :

$$ESG = \frac{\text{Total ESG Indicators}}{DISCLOSED} \times 100\%$$

Credit Ratios and Return on Equity

Credit ratios represent financial metrics employed to assess a bank's proficiency in managing lending portfolios and sustaining financial equilibrium. In this study, credit ratios are represented by Non-Performing Loan (NPL) and Loan to Deposit Ratio (LDR).

Non-Performing Loan (NPL) captures the share of impaired loans relative to total loan disbursements by banking institutions. A rising NPL signals declining asset quality and heightened credit risk exposure, which may consequently suppress bank profitability and financial performance (Rabbani et al., 2024; Putra et al., 2024).

$$NPL = (\text{Non-Performing Loans} / \text{Total Loans}) \times 100\%$$

Higher NPL levels generally reduce Return on Equity because banks are required to allocate additional provisions for loan losses.

Loan to Deposit Ratio (LDR) measures the effectiveness of banks in transforming third-party funds into productive loans while maintaining liquidity balance. Appropriate LDR levels indicate efficient intermediation and support profitability growth (Putra et al., 2024; Sari & Fauzan, 2024).

$$LDR = \frac{\text{Total Loans}}{\text{Third Party Funds}} \times 100\%$$

Excessively high LDR may increase liquidity risk, whereas excessively low LDR may indicate inefficient fund utilization.

Return on Equity (ROE)

Return on Equity (ROE) quantifies a bank's capacity to produce net profit relative to shareholders' equity, and serves as a widely adopted benchmark for assessing financial performance (Hidayat & Lestari, 2023).

$$ROE = \frac{\text{Net Income}}{\text{Total Equity}} \times 100\%$$

ROE is influenced by internal financial conditions, including credit quality, liquidity management, and sustainability practices. Effective management of these factors may improve profitability and shareholder value (Saputra & Nugroho, 2024; Putra et al., 2024).

Conceptual Framework and Hypotheses Development

This investigation examines explores the interplay between Green Banking implementation and credit ratios on banking financial performance. Green Banking is expected to improve Return on Equity (ROE) through sustainability implementation and stronger stakeholder

confidence. Meanwhile, credit ratios represented by Non-Performing Loan (NPL) and Loan to Deposit Ratio (LDR) reflect credit risk and liquidity efficiency that may influence profitability. Based on Stakeholder Theory and Risk–Return Trade-Off Theory, this study proposes that Green Banking, NPL, and LDR affect ROE.

Drawing upon the theoretical and empirical foundations elaborated above, the conceptual research framework is constructed as follows:

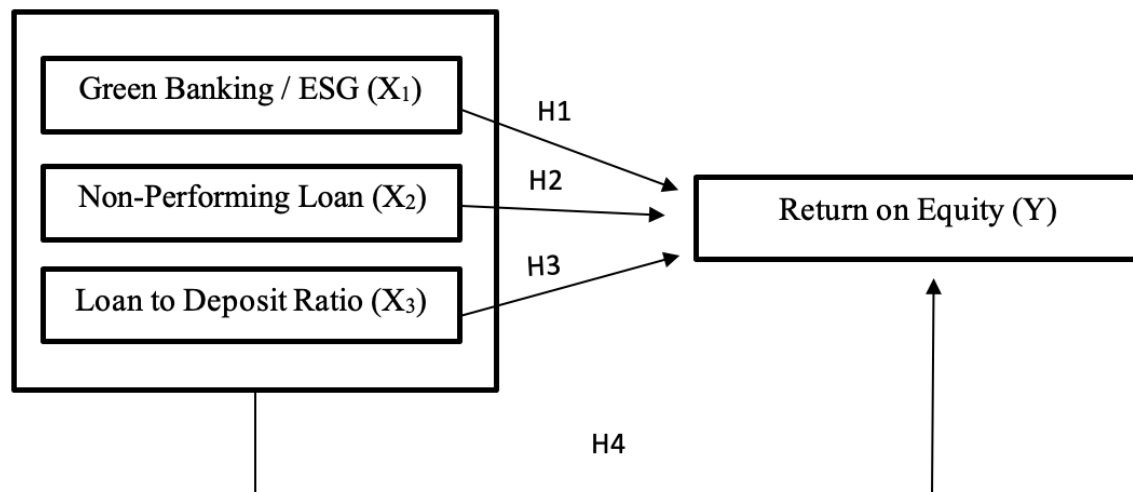


Figure 1.1 Framework of Thought

Hypothesis Development

Based on Stakeholder Theory and Risk–Return Trade-Off Theory, this study proposes that sustainability practices and credit ratios influence banking financial performance. Green Banking is expected to improve profitability through stronger stakeholder trust and operational efficiency, while credit risk and liquidity management may determine a bank's capacity to generate adequate returns. The following hypotheses are accordingly proposed:

H1: Green Banking exerts a positive effect on Return on Equity (ROE).

H2: Non-Performing Loan (NPL) exerts a negative effect on Return on Equity (ROE).

H3: Loan to Deposit Ratio (LDR) has a positive effect on Return on Equity (ROE).

H4: Green Banking, Non-Performing Loan (NPL), and Loan to Deposit Ratio (LDR) simultaneously influence Return on Equity (ROE).

3. METHODS

Research Design

This research adopts a quantitative approach anchored in an associative–causal design to investigate both the nature of relationships and the directional influence of the selected independent variables on financial performance outcomes. The independent variables

encompass Green Banking (ESG), Non-Performing Loan (NPL), and Loan to Deposit Ratio (LDR), while Return on Equity (ROE) functions as the dependent variable.

The study relies on secondary data obtained from annual financial reports and sustainability disclosure documents of banking companies listed on the Indonesia Stock Exchange (IDX) covering the 2022–2024 fiscal period. Data analysis was carried out using the Partial Least Squares Structural Equation Modeling (PLS-SEM) framework with SmartPLS software to empirically evaluate the proposed hypotheses.

Population and Sample

Population

The population of this study consists of all banking companies listed on the Indonesia Stock Exchange (IDX) during the 2022–2024 period, totaling 47 banks. The population includes commercial banks that consistently published annual financial reports and sustainability reports to ensure data availability and research consistency.

Sample

Sample selection was carried out through a purposive sampling procedure, applying predefined eligibility criteria to identify observations satisfying the research objectives:

Table 1. Sample Selection Process

Kriteria	Jumlah
Banking companies listed on IDX	47
Banks publishing annual financial reports	47
Banks without sustainability reports (ESG)	(12)
Banks without sustainability reports (ESG)	35
Observation period	2022-2024
Total observations	35 x 3 =105

Source: Processed by the author (2026)

Following the application of, 35 banking companies fulfilled the sampling criteria. With a three-year observation period, the final dataset consisted of 105 observations used for empirical analysis.

Data Source and Data Collection Technique

This study draws on secondary data retrieved from annual reports, financial statements, sustainability reports, and official IDX publications. Secondary data were selected because they provide objective, documented, and audited information suitable for quantitative analysis (Sugiyono, 2022; Ghozali, 2021). The data include Green Banking (ESG), Non-Performing Loan (NPL), Loan to Deposit Ratio (LDR), and Return on Equity (ROE) covering the 2022–

2024 period. The data were collected from official IDX publications, corporate websites, annual reports, and sustainability reports.

Data collection was conducted through documentation and literature review methods by compiling company reports and reviewing prior studies to support variable measurement and research development (Sugiyono, 2022).

Data Analysis Technique

Statistical analysis was undertaken using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS software. This technique was selected to examine how Green Banking (ESG), Non-Performing Loan (NPL), and Loan to Deposit Ratio (LDR) collectively influence Return on Equity (ROE), while simultaneously testing the proposed hypotheses (Hair et al., 2022).

The analytical procedure unfolded across three sequential stages: measurement model evaluation (outer model), structural model evaluation (inner model), and hypothesis testing. The outer model examined construct validity and reliability, while the inner model assessed inter-variable relationships using R-square, effect size (F-square), and path coefficient estimates. Hypothesis testing was executed through bootstrapping procedures using T-statistics and P-values. A hypothesis was considered supported when the P-value fell below the 0.05 significance threshold.

4. RESULTS AND DISCUSSION

Descriptive Statistics

Table 2. Descriptive Statistics

Variabel	Mean	Min	Max	Std. Dev
Green Banking	0,678	0,53	0,87	0,082
NPL	2,754	0,01	11	1,835
LDR	87,699	14,58	370,59	43,055
ROE	5,799	-79,29	41,69	14,245

Source: Processed by the author (2026)

Drawing from the descriptive statistics, Green Banking registered a mean score of 0.678 with a standard deviation of 0.082, which points to relatively subdued data variability and a more uniform dispersion pattern among sampled banks. Non-Performing Loan (NPL) posted a mean figure of 2.754 alongside a standard deviation of 1.835, reflecting differences in credit risk levels across the sample.

Loan to Deposit Ratio (LDR) recorded a mean value of 87.699 with a standard deviation of 43.055, indicating considerable variation in lending and liquidity management practices. Meanwhile, Return on Equity (ROE) recorded the highest standard deviation at 14.245, suggesting substantial differences in profitability performance among banking companies.

Overall, the descriptive statistics indicate varying levels of data dispersion across variables, reflecting differences in financial characteristics and operational conditions among banks during the observation period.

Diagram Path

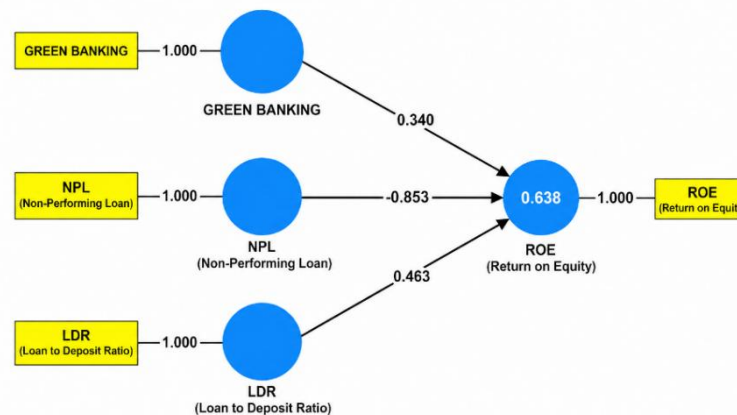


Figure 1.2 Path Diagram.

Based on the path model results, Green Banking, Non-Performing Loan (NPL), and Loan to Deposit Ratio (LDR) demonstrate direct relationships with Return on Equity (ROE). Green Banking shows a positive path coefficient of 0.340, indicating that improved sustainability practices tend to be associated with higher profitability. In contrast, NPL records a negative coefficient of -0.853 , suggesting that increasing credit risk may reduce financial performance. Meanwhile, LDR registers a positive coefficient of 0.463, implying that more effective fund distribution may contribute to higher profitability. The coefficient of determination (R^2) stands at 0.638, meaning that 63.8% of ROE variability is attributable to Green Banking, NPL, and LDR collectively, while the remaining 36.2% is driven by variables outside the present model.

Outer model test

Tabel.4 Outer Loadings.

	ESG	NPL	LDR	ROE
GREEN BANKING	1,000			
NPL			1,000	
LDR		1,000		
ROE				1,000

Source: Processed by the author (2026)

The outer model evaluation confirm that all variables recorded outer loading values of 1.000. This result occurred because each construct in this study was measured using a single indicator derived from financial ratio data.

In single-indicator measurement models, outer loading values are automatically fixed at 1.000, indicating that each indicator fully represents its corresponding construct within the model. Therefore, additional indicator reliability assessment was not required, and the constructs were considered suitable for further structural model analysis.

Uji R.Square

Table 5 results of the coefficient of determination test (R.Square)

	R-Square	R-Square Adjusted
ROE	0,638	0,627

Source: Processed by the author (2026)

Equity (ROE) is 0.638, while its adjusted R-square value is 0.627. These results indicate that Green Banking, Non-Performing Loan (NPL), and Loan to Deposit Ratio (LDR) collectively explain 63.8% of the variation in ROE. The residual 36.2% may be attributed to explanatory factors beyond the scope of this research model.

The narrow gap between the R-square and adjusted R-square values suggests that the model remains stable after adjustment for the number of predictors included in the analysis and demonstrates acceptable explanatory power.

Multicollinearity Test (VIF)

Table 6 Multicollinearity Test Results (VIF).

	VIF
Green Banking (X1) → ROE (Y)	1,007
NPL (X2) → ROE (Y)	1,471
LDR (X3) → ROE (Y)	1,468

Source: Processed by the author (2026).

Drawing from the Variance Inflation Factor (VIF) results, all independent variables recorded VIF values below the threshold value of 5, indicating no multicollinearity issue within the research model. For Return on Equity (ROE), Green Banking (X1) produced a VIF value of 1.007, while Non-Performing Loan (NPL) and Loan to Deposit Ratio (LDR) recorded values of 1.471 and 1.468, respectively.

These findings indicate that the independent variables do not share excessive correlation with one another, allowing each variable to contribute independently to explaining variations in ROE. The structural model therefore meets the collinearity assumption and is suitable for proceeding to hypothesis testing.

F-Square Test

Tabel.7 Effect Size (F-Square).

	f-square
Green Banking (X1)→ ROE (Y)	0,318
NPL (X2) → ROE (Y)	1,365
LDR (X3) → ROE (Y)	0,403

Source: Processed by the author (2026).

Based on the effect size (F-square) results, Green Banking (X1) produced an F-square value of 0.318, indicating a moderate contribution to explaining variations in Return on Equity (ROE). Non-Performing Loan (NPL) recorded an F-square value of 1.365, which indicates a large effect size and suggests that credit risk contributes substantially to changes in ROE.

Meanwhile, Loan to Deposit Ratio (LDR) generated an F-square value of 0.403, indicating a large effect according to the PLS-SEM classification. Overall, the results indicate that the independent variables contribute at different levels to explaining financial performance. Among them, NPL demonstrates the strongest contribution in explaining variations in ROE compared with the other variables.

Hypothesis Testing

Tabel.8 Hasil Uji Hipotesis (Path Coefficient dan P-Values).

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Green Banking (X1)→ ROE (Y)	0,340	0,357	0,098	3,470	0,001
NPL (X2) → ROE (Y)	-0,853	-0,817	0,159	5,362	0,000
LDR (X3) → ROE (Y)	0,463	0,432	0,172	2,690	0,007

Source: Processed by the author (2026).

Based on the hypothesis testing results, Green Banking (X1) shows a positive path coefficient of 0.340 with a T-statistic value of 3.470 and a P-value of 0.001. Since the T-statistic surpasses 1.96 and the P-value is below 0.05, Green Banking demonstrates a positive and statistically significant effect on Return on Equity (ROE). Therefore, H1 is accepted.

For Non-Performing Loan (NPL), the estimated path coefficient is −0.853 accompanied by a T-statistic of 5.362 and a P-value below 0.001. These results confirm that NPL has a negative and statistically significant effect on ROE, , implying that elevated credit risk tends to reduce bank profitability. Thus, H2 is accepted.

Meanwhile, Loan to Deposit Ratio (LDR) records a positive coefficient of 0.463 with a T-statistic of 2.690 and a P-value of 0.007. Since the significance criteria are fulfilled, LDR has a positive and statistically significant effect on ROE. Therefore, H3 is accepted.

Overall, the empirical evidence confirms that Green Banking, NPL, and LDR collectively exert a significant influence on banking financial performance as proxied by Return on Equity, although the direction and magnitude of effects differ across the three predictor variables.

DISCUSSION

Effect of Green Banking on Return on Equity

The findings indicate that Green Banking carries a positive and statistically significant effect on Return on Equity (ROE), suggesting that stronger commitment to sustainability-oriented banking practices translates into improved financial performance. The positive relationship may occur because Green Banking encourages operational efficiency through digital banking services, reduced paper usage, and more effective resource utilization. In addition, sustainability practices may strengthen corporate reputation and enhance stakeholder confidence, which can contribute to profitability improvement.

These results align with prior empirical evidence indicating that ESG implementation supports financial performance and long-term corporate value (Haryono et al., 2025; Panjaitan et al., 2025). The results also support Stakeholder Theory, which emphasizes that organizations that respond effectively to stakeholder expectations tend to strengthen legitimacy and create sustainable value.

Effect of Non-Performing Loan on Return on Equity

The findings demonstrate that Non-Performing Loan (NPL) has a negative and statistically significant effect on ROE. This finding indicates that increasing levels of problematic loans may weaken banking profitability. Higher NPL levels reflect deteriorating credit quality and increase the probability of loan repayment failure. Consequently, banks may allocate larger loan loss provisions, reducing earnings and lowering returns generated from shareholders' equity.

These outcomes align with earlier research documenting a positive association between lending efficiency and profitability (Kasmir, 2022). The findings also support Risk–Return Trade-Off Theory, which argues that increasing exposure to risk may reduce expected returns if not managed appropriately.

Effect of Loan to Deposit Ratio on Return on Equity

The findings show that Loan to Deposit Ratio (LDR) exerts a positive and statistically significant effect on ROE. This result suggests that effective utilization of collected funds through lending activities contributes to higher profitability. An optimal LDR reflects efficient financial intermediation and enables banks to generate interest income more effectively. However, maintaining balance remains important because excessive lending may expose banks to liquidity pressure.

These findings are consistent with previous studies reporting a positive relationship between lending efficiency and profitability (Kasmir, 2022; Brigham & Houston, 2021). The results further support Risk–Return Trade-Off Theory by showing that efficient resource allocation may improve financial outcomes.

5. CONCLUSION AND LIMITATION

Conclusion

This study concludes that Green Banking, Non-Performing Loan (NPL), and Loan to Deposit Ratio (LDR) significantly influence Return on Equity (ROE) among banking companies registered on the Indonesia Stock Exchange throughout the 2022–2024

First, Green Banking positively contributes to ROE, indicating that sustainability implementation may improve operational efficiency and strengthen stakeholder confidence.

Second, NPL negatively affects ROE, suggesting that increasing credit risk reduces profitability through higher provision expenses and lower lending performance.

Third, LDR positively affects ROE, indicating that efficient fund allocation through lending activities supports stronger financial performance.

Implications

The findings suggest that banking profitability depends not only on credit expansion but also on effective risk management and operational efficiency. Banks are encouraged to strengthen sustainability initiatives, maintain credit quality, and optimize liquidity management to support long-term financial performance.

Furthermore, the results indicate that balancing profitability objectives with prudent risk control remains essential for maintaining stable and sustainable banking performance.

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