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The Influence of Green Banking, Credit Risk, and Operational Efficiency on The Financial Performance of Conventional Banks in 2020-2023

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ABSTRACT
This research endeavor is directed toward assessing the impact of Green Banking, Credit Risk, and Operational Efficiency on the Financial Performance of conventional banks in Indonesia in 2020-2023. Green banking was evaluated through the Green Banking Disclosure Index (GBDI), credit risk was represented by the Non-Performing Loan (NPL) ratio, the BOPO ratio indicated operational efficiency, and financial performance was assessed using Return on Assets (ROA). This research adopts a quantitative methodology utilizing pre-existing datasets derived from the annual financial statements of banks listed in collaboration with the Financial Services Regulatory Authority (OJK). The analysis employed panel data regression models executed via EViews software. Empirical findings reveal that green banking exerts a marginally significant influence on financial performance, whereas credit risk does not demonstrate a statistically meaningful relationship. Conversely, operational efficiency exhibits a significant inverse association with financial performance. The independent variables account for 73% of the heterogeneity observed in financial performance, as represented by the recalibrated coefficient of determination. These outcomes underscore the critical role of enhancing cost-efficiency strategies and advancing environmental banking initiatives to foster long-term financial sustainability within the banking sector.

Keywords: Green Banking, Credit Risk, Operational Efficiency, Financial Performance, ROA.
JEL Code: G21, G32, Q56, M41.

I. Introduction

As part of the financial sector, banks also have demands to change their business practices to be more environmentally friendly. One of the things that banks can do to minimize environmental pollution is to implement the concept, which is embedded within the core of their business strategies of green banking. Implementing the green banking paradigm represents a strategic initiative through which the banking sector can mitigate the ecological degradation associated with its operational activities. Accordingly, banking institutions must exercise due diligence in the appraisal and selection of financing proposals. By doing so, financial entities are positioned to actively contribute to ecological preservation and mitigate adverse environmental consequences by implementing green banking principles (Abdelsalam & Nobanee, 2020).

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Bank Indonesia introduced Indonesia's initial regulatory framework addressing green banking principles through Regulation No. 14/15/PBI/2012, which pertains to the Evaluation of Asset Quality in Commercial Banking Institutions. Under the provisions of this regulation, domestic banking institutions are mandated to incorporate environmental considerations as a fundamental criterion in the credit evaluation and approval process (Karyani & Obrien, 2020). Between 2011 and 2013, Bank Indonesia collaborated with the Ministry of Environment through a Memorandum of Understanding (MoU) to advance green banking initiatives. Among the key initiatives undertaken was the provision of specialized training on environmental assessment methodologies, intended to refine the evaluation process of loan feasibility for prospective borrowers (Handayani et al., 2021). To reinforce adopting environmentally responsible practices within Indonesia's banking sector, Indonesia's financial regulatory authority (OJK) enacted regulations that govern the operationalization of Sustainable Finance within Financial Institutions, Listed Issuers, and Publicly Traded Entities in Indonesia. This regulation encompasses a comprehensive framework outlining obligations and directives in the context of sustainable financial practices, comprising the establishment of priority programs, formulation of strategic initiatives, integration of sustainability into business operations, development of Sustainable Finance Action Plans, preparation of Sustainability Reports, and allocation of funds for social and environmental responsibility. This regulatory framework is designed to be adhered to by all Licensed financial institutions, capital market participants, and exchange-listed entities, with the overarching objective of fostering sustainable development and stimulating national economic growth, holistically integrating economic, social, and environmental considerations. By Article 10 of POJK No. 51/2017, banking institutions must compile a Sustainability Report as a formal declaration of accountability concerning their economic, environmental, and social performance within operational activities. The concept of "green banking" began to gain traction in the early 2000s, coinciding with the financial sector's growing inclination toward sustainability-oriented policies. Green banking refers to integrating sustainability principles into financial operations, products, and services to advance long-term environmental and social well-being. (Sahabuddin et al., 2022).

Green banking covers a diverse spectrum of initiatives, encompassing providing financial support for renewable energy ventures, advancing energy-efficient technologies within operational and infrastructural domains, fostering the adoption of environmentally responsible corporate practices, and embedding environmental risk evaluation as a critical component of credit assessment procedures. (Nieto, 2017). Green banking is a form of active banking that supports sustainable funding mechanisms to minimize ecological degradation and the atmospheric carbon output of financial activities (Ngo et al., 2021). Banks that adopt green banking principles typically establish frameworks for evaluating social and environmental risks, allocate credit toward environmentally responsible sectors, and disclose their sustainability efforts through public reporting mechanisms. Over time, implementing such practices is perceived to enhance institutional reputation, strengthen client retention, and promote operational cost-effectiveness factors that collectively contribute to improved financial performance within the banking sector. (Senja Setyoko & Wijayanti, 2022). However, the extent to which green banking implementation impacts bank profitability is still debatable and needs to be studied empirically.

According to (Kasmir, 2010), Non-Performing Loans (NPL), representing a form of credit risk, denote the potential for financial institutions to incur losses stemming from a borrower's failure to fulfill repayment obligations. The NPL ratio reflects a bank's effectiveness in recovering disbursed loans within the agreed repayment period. Beyond environmental considerations, credit risk constitutes a fundamental element of banking risk governance, exerting significant influence over financial soundness and profitability metrics. Elevated credit risk, as evidenced by a rising NPL ratio, signifies deteriorating debtor performance and necessitates greater loan-loss provisioning, ultimately diminishing net earnings and Return on Assets (ROA). Nevertheless, empirical findings suggest that the extent to which credit risk impacts financial outcomes may vary, contingent upon the robustness and efficacy of a bank's credit risk management practices (Baktiar, 2019). Therefore, it is important to test whether NPL fluctuations statistically do have an impact on ROA, providing empirical evidence that NPL contributes positively to the variability of ROA, while Sahabuddin et al. (2022) provided evidence that higher NPL ratios contribute negatively to the bank's profitability, as proxied by ROA.

Another variable analyzed in this study is operational efficiency, proxied through the BOPO ratio (Operating Expenses to Operating Income). The ratio functions as an indicator to assess the effectiveness of banks in regulating financial outflows to maximize organizational earnings. The higher the BOPO, the greater the operational cost burden borne by the bank, which tends to reduce profitability. Based on Efficiency, cost efficiency is the key to maintaining long-term profitability in the financial sector. Therefore, operational efficiency is not just a financial target, but a profound business continuity strategy. According to research by Fadriyaturrohmah & Manda (2022), operational efficiency significantly influences financial performance outcomes. In parallel, empirical findings presented by (Sahabuddin et al., 2022) provide empirical validation that heightened operational inefficiency detrimentally impacts financial performance. This research investigates how green banking practices, credit risk exposure, and operational efficiency contribute to shaping the financial performance of conventional banking institutions in Indonesia over the 2020–2023 period. Using empirical data and relevant theories, this research is expected to offer insight into the influence of green banking, Credit Risk, and Operational Efficiency on Financial Performance. In addition, this research is anticipated to offer substantive input toward advancing more robust and efficacious frameworks and sustainable banking strategies. However, there are still limited empirical studies that simultaneously examine the relationship between green banking practices, credit risk, and operational efficiency on the financial performance of conventional banks in Indonesia, particularly during economic uncertainty from 2020 to 2023. This study aims to fill this gap by presenting the latest empirical evidence in the context of sustainable finance regulations in Indonesia.

II. Literature Review and Hypothesis Development

2.1. Legitimacy Theory

Legitimacy theory is based on a social contract between companies and society. Companies must be viewed as entities that must earn their right to exist in order to survive. Legitimacy influences the behavior and perception of companies within society. Companies that have earned social recognition are seen as more trustworthy and credible, thus encouraging their desire to operate. Companies must obtain and maintain legitimacy to access necessary resources, such as financial resources, staff, and customers, and to prevent risks. Companies must comply with state-imposed regulations if those regulations are not legitimate. Legitimacy theory reveals the importance of directing analytical focus toward the rights of society and the rights of investors for companies. In this case, legitimacy theory is very important for a company because it must maintain its social function by meeting social needs and providing a better image to the community. By using this theory, companies can balance their business activities with social behavior in society so that their business activities can be accepted by society(Senja Setyoko & Wijayanti, 2022). The manifestation of corporate legitimacy is dynamic and may evolve in response to shifts in societal norms and environmental expectations. In navigating these transformations, firms demonstrate their commitment by aligning business practices with the principles of sustainable economic development, thereby securing continued recognition and approval from key stakeholders. Conversely, failure to adhere to established regulatory frameworks may result in the erosion or withdrawal of public legitimacy. Hence, strict compliance with prevailing legal and ethical standards is imperative for ensuring uninterrupted operational continuity and institutional credibility (Puspitaningrum & Indriani, 2021).

2.2. Green Banking

In a study conducted by Bose, S., Khan, H. Z., & Monem (2018), the Green Banking Disclosure Index (GBDI) was conceptualized as a comprehensive framework comprising 21 disclosure indicators to evaluate

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banks' transparency in reporting their sustainability-related strategies and activities. These indicators are systematically structured to gauge the breadth and depth of environmental and sustainability information disclosed by banking institutions. The index serves as a standardized metric to quantify the extent of green banking implementation, and is calculated using the following formula.

$$GBDI = \frac{score\ earned}{21\ disclosure\ items}\ x\ 100\%$$

Each criterion within the index is assigned a binary score—a value of 1 is attributed if the bank reports the corresponding information in its annual or sustainability disclosures, and a value of 0 is given if such information is absent. The cumulative total of these scores constitutes the bank's overall GBDI value, which indicates the comprehensiveness and transparency of its green banking disclosure practices.

H1: The effect of Green Banking on financial performance in conventional banking.

2.3. Credit Risk

When banks extend credit to the public, they will face credit risk. Credit risk arises as there are customers who are unable or fail to return several loans from the company, as well as interest, according to the provisions. One type of credit risk is non-performing loans, which can be substandard credit, doubtful credit, or bad credit. (Jahrotunnupus & Manda, 2021). One of the ratios utilized to quantify the level of credit exposure is the Non-Performing Loan (NPL) ratio. According to (Kasmir, 2010)As banking activities become increasingly multifaceted, they give rise to amplified credit risk, most notably reflected in the upward trend of Non-Performing Loan (NPL) ratios.

$$N\ P\ L = \frac{non - performing\ loans}{total\ credit}\ x\ 100\%$$

An elevated proportion of Non-Performing Loans (NPLs) necessitates higher provisioning for impaired assets and additional operational expenses, which collectively may adversely influence the banking institution's overall financial performance. So the high credit risk of banks impacts the decline in credit quality, which increases the number of non-performing loans. Thus, the higher the credit risk, the lower the bank's profitability. The lower the NPL, the smaller the credit risk that the bank must incur. NPL is measured by comparing the amount of overdue loans with the total loans granted.

H2: The effect of Credit Risk on financial performance in conventional banking.

2.4. Operational Efficiency

Banking efficiency is an indicator of the overall performance of banking activities. Bank efficiency in this study is measured using the BOPO ratio. The BOPO ratio, commonly referred to as the operational efficiency indicator, evaluates the extent to which bank management can effectively regulate operational expenditures relative to operational revenues. As a proxy for operational risk, the BOPO metric reflects managerial proficiency in maintaining cost discipline within the scope of revenue generation, thereby offering insight into the institution's overall operational efficiency. (Kusmayadi, 2019). The following is the formula for finding BOPO :

$$B\ O\ P\ O = \frac{operating\ costs}{operating\ income}\ x\ 100\%$$

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Operating costs are economic burdens the corporate entity sustains to finance its daily bank activities, such as paying salaries, debts, marketing, interest, and other costs. While operating income is the income received by banks from lending in the form of interest rates (Harun, 2009).

H3: The effect of Operational Efficiency on financial performance in conventional banking.

III. Research Method

3.1. Research Type and Approach

This study uses a quantitative approach to examine the influence of green banking, credit risk, and operational efficiency on the financial performance of conventional banks in Indonesia. Unlike previous research, which often examines these variables separately, this study combines them in a single panel regression framework covering 2020–2023. Therefore, this research provides a limited empirical contribution to the literature, particularly in the context of developing countries and the post-pandemic era.

3.2. Population

The population is a generalization area consisting of objects or subjects with specific qualities and characteristics set by researchers to study and then draw conclusions. (Sugiyono, 2018). The quantitative paradigm is grounded in positivist philosophy, aiming to investigate specific populations or samples through probabilistic sampling techniques and standardized instruments, with empirical data subsequently analyzed using statistical procedures.

3.3. Sample

Samples are part of the research chosen to mirror the demographic and structural composition of the entire research universe. The sample selection was made to make the research more efficient and practical, without examining the entire population.(Sugiyono, 2017). The sample for this investigation comprised 42 conventional banking institutions publicly registered as a listed entity on the IDX during the 2020–2023 period. The study employed a purposive sampling technique, wherein sample selection is guided by the researcher's predefined criteria and specific conditions to verify the appropriateness and alignment of the selected samples with the overarching research goals. (Sutrisno, 2017). The basis used in sampling is a population that meets specific requirements. The requirements are as follows:

1. Conventional banking institutions officially listed on the Indonesia Stock Exchange (IDX) throughout the 2020–2023 observation period.
2. Banks that consistently publish their annual financial statements in a timely and structured manner.
3. Conventional banks that disclose data or narratives about green banking practices within their public reports.
4. Banks that provide a complete set of variables required for empirical analysis within the scope of this study.

3.4. Data Source

The data used is secondary data collected through the official websites of the Indonesia Stock Exchange (IDX) (www.idx.co.id), the Financial Services Authority (OJK) (www.ojk.go.id), and the respective banks' websites. The collected data includes annual financial reports, sustainability reports, and green banking indicators. Data was collected at the IDX Investment Gallery, Faculty of Economics, UIN Maulana Malik Ibrahim

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Malang. The main challenge faced was the varying levels of sustainability information disclosure between banks, which required cross-validation from various sources.

3.5. Data analysis

This study adopts a quantitative data analysis approach. Various statistical techniques and computational procedures are employed in processing and interpreting the empirical dataset. The primary analytical instrument utilized in this investigation is the EViews 12 software, which facilitates advanced econometric modeling and hypothesis testing.

3.6. Descriptive Statistic Analysis

According to (Sugiyono, 2015) Descriptive statistical analysis represents a methodological approach to summarize and interpret data characteristics by providing a detailed depiction of observed variables. This technique facilitates the examination of frequency distributions and central tendency measures—such as the mean and median—as well as dispersion metrics including standard deviation, minimum, and maximum values, thereby offering a comprehensive overview of the data structure within the context of this study.

3.7. Selection of Regression Models

In determining the most appropriate panel data regression estimation technique within the EViews 12 statistical framework, researchers typically consider three principal models: the Common Effect Model (CEM), the Fixed Effect Model (FEM), and the Random Effect Model (REM). To identify the optimal model for subsequent analysis, diagnostic procedures such as the Chow Test and the Hausman Test are employed to evaluate the comparative suitability of each estimation approach.

a. Chow Test
   The Chow test is conducted to choose which regression model is better to use between the Common Effect Model (CEM) and the Fixed Effect Model (FEM).
   H0: Using the Common Effect Model (CEM)
   Ha: Using the Fixed Effect Model (FEM)
   Decision-making is done by looking at the probability value in the cross-section F section. Suppose the probability value> 0.05, and then the regression model chosen is the standard effect model (CEM). However, if the Probability value <0.05, then the regression model to be selected is the Fixed Effect Model (FEM).
b. Hausman Test
   The Hausman test is used to choose which regression model is better to use between the Fixed Effect Model (FEM) and the Random Effect Model (REM).
   H0: Using the Random Effect Model (REM)
   Ha: Using the Fixed Effect Model (FEM)
   Decision-making is done by looking at the probability value in the cross-sectional random section. If the Probability value> 0.05, then the regression model chosen is the Random Effect Model (REM). However, if Probability <0.05, then the regression model chosen is the Fixed Effect Model (FEM).

3.8. Classical Assumption Test

Before executing statistical inference procedures, classical assumption diagnostics are essential as a foundational prerequisite for regression analysis. The primary objective of this diagnostic process is to evaluate whether the regression model violates any underlying classical assumptions. This assessment is

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conducted through a series of diagnostic techniques, including but not limited to multicollinearity detection and heteroskedasticity testing, to ensure the reliability and validity of the estimated parameters (Ghozali, 2018).

a. Normality Test: The normality
Normality testing through EViews verifies whether the dataset conforms to a normal distribution. This is typically evaluated using procedures such as the Jarque-Bera or Shapiro-Wilk tests. These tests yield statistical metrics—including p-values or critical thresholds—which facilitate inference regarding the distributional characteristics of the data. EViews-based normality assessments generally follow established statistical conventions, whereby a p-value below the predetermined significance level indicates a deviation from normality, thus warranting further diagnostic scrutiny (usually $\alpha = 0.05$). Then the data is considered normally distributed. If the p-value is smaller than α, the null hypothesis (normally distributed) is rejected. (Ghozali, 2018)

b. Multicollinearity Test Multicollinearity
This diagnostic procedure examines the presence of intercorrelations among independent variables within the regression framework. A regression model is deemed statistically sound when the predictor variables exhibit no multicollinearity, meaning they are orthogonal—i.e., their pairwise correlation coefficients equal zero. The detection of multicollinearity can be evaluated through indicators such as the Tolerance value and the Variance Inflation Factor (VIF). A tolerance value falling below 0.01 or a VIF exceeding 10 signals the presence of multicollinearity, indicating that the explanatory variables may be linearly dependent, which in turn can compromise the stability and interpretability of the regression estimates (Ghozali, 2018)

c. Heteroscedasticity Test
The heteroscedasticity test determines whether the residual variances within a regression model remain constant across observations. The presence of heteroscedasticity is indicated when the residuals exhibit non-uniform variance, which violates one of the key assumptions of classical linear regression. A robust regression model is characterized by homoscedasticity, where residual variance is stable and does not fluctuate with changes in the independent variable (Ghozali, 2018). One widely used method for detecting heteroscedasticity is the Park Test, which involves regressing the squared residuals' logarithm against the independent variables. According to Ghozali (2018), the decision criteria for the Park Test are as follows: (1) if the significance probability value exceeds 0.05, heteroscedasticity is not present; (2) if the value is less than 0.05, it suggests the presence of heteroscedasticity.

d. Autocorrelation Testing
Autocorrelation testing within the EViews platform is employed to identify systematic correlation patterns among residuals in a regression model. This issue can potentially compromise the reliability of parameter estimation and the validity of inferential conclusions. This diagnostic process typically entails importing the dataset into EViews, executing the regression procedure, and analyzing the residual series. The Durbin-Watson statistic or the Breusch-Godfrey serial correlation test—integrated into the EViews suite—is commonly used to detect autocorrelation. These tests rely on a predetermined significance level (commonly $\alpha = 0.05$) to determine whether residual autocorrelation is statistically present within the model.

3.9. Panel Data Estimation Model Selection

Hypothesis testing employed multiple linear regression for the first model and moderated regression analysis (MRA) for the second, using EViews 12. The process included tests for R^2, overall model significance (F-test), and individual coefficient significance (t-test).

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a. Panel Data Regression Analysis
Multiple linear regression analysis is employed to evaluate the extent to which green banking (X_1), credit risk (X_2), and operational efficiency (X_3) exert an influence on financial performance (Y). This relationship is formally represented through the following regression equation model:

$$Y = \alpha + \beta 1X1 + \beta 2X2 + \beta 3X3 + \varepsilon$$

b. The Coefficient of Determination (R^2)
This test serves to quantify the proportion of variance in the dependent variable that can be accounted for by fluctuations in the independent variables. A higher coefficient of determination (R^2) indicates superior explanatory power of the model, reflecting its effectiveness in capturing the underlying structure of the observed data.

c. The Simultaneous Significance Test (F-test)
This statistical procedure evaluates the collective impact of all independent variables on the dependent variable within the regression framework. A significant probability value below 0.05 indicates that the overall model exhibits statistical significance, affirming that the explanatory variables jointly influence the outcome variable.

d. The Partial Significance Test (t-test)
This test is intended to assess the individual contribution of each explanatory variable to the variation in the dependent variable. A p-value below the conventional threshold of 0.05 denotes that the variable in question exerts a statistically significant effect within the model framework.

IV. Results and Discussion

4.1. Statistical Result

4.1.1. Descriptive Analysis

Table 1. Results of Descriptive Analysis

No	Variable	N	Min	Max	Mean	Std. Deviation
1	ROA	168	-0.14	0.48	0.06	0.02
2	GBDI	168	0.09	100	0.60	0.26
3	NPL	168	0.00	0.22	0.04	0.14
4	BOPO	168	0.43	2.95	1.91	0.71

Data was processed using Eviews 12 student version lite software on 168 samples collected previously. The descriptive statistical table above describes the ROA, GBDI, NPL, and BOPO values of 42 conventional banks for 4 periods (2020-2023). The results of the descriptive statistical test show that the financial performance variable (ROA) has an average of 0.06 with a maximum value of 0.48 and a minimum of -0.14; the highest value was achieved by PT Bank Amar Indonesia Tbk (2023), and the lowest by PT Bank Raya Indonesia Tbk (2021).

The Green Banking Disclosure Index exhibits a mean score of 0.60, with the maximum and minimum recorded values being 100 and 0.09, respectively. PT Bank Ina Perdana Tbk, PT Bank Pembangunan Daerah Jawa Barat Tbk, and PT Bank Tabungan Negara Tbk attained the highest index levels. In contrast, the lowest disclosure score was observed in PT Bank of India Indonesia Tbk.. Credit risk (NPL) averages 0.04 with a maximum value of 0.22 and a minimum of 0.00; the highest value was recorded at PT Bank BPD Banten Tbk, and the lowest at PT Bank Capital Indonesia Tbk. Meanwhile, operational efficiency (BOPO) averages 1.91 with a maximum value of 2.95 and a minimum of 0.43; the highest value is owned by PT Bank Raya Indonesia Tbk, and the lowest by PT Bank Central Asia Tbk. As an academic writer, I understand the critical role of the results

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and discussion section in a research paper. This section is where researchers present the key findings of their study and interpret the meaning and significance of those findings. (Şanlı et al., 2014) (Ghasemi et al., 2019)

4.1.2. Normality Test

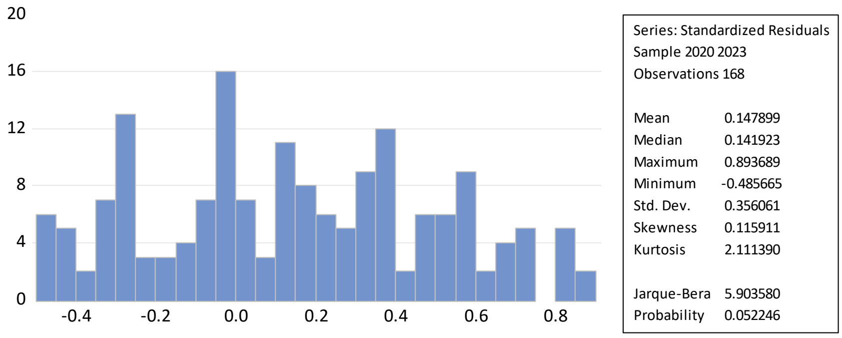

Figure 1. Normality Test Results

The Jarque-Bera statistic yielded a value of 5.903580, accompanied by a probability level of 0.052246, which exceeds the conventional significance threshold of 0.050. This outcome indicates that the data distribution does not significantly deviate from normality, fulfilling the standard distribution assumption and validating its suitability for further regression analysis.

4.1.3. Multicollinearity

The multicollinearity test aims to analyze whether or not there is a linear relationship between independent variables. The multicollinearity test in Eviews 12 uses the variance inflation factor (VIF) with a cut-off value of <10.

Table 3. Multicollinearity Test Results

No	Variable	VIF
1	Green Banking	1.82
2	NPL	2.15
3	BOPO	1.94

Table 3 shows that the VIF value for the green banking variable is 1.82, NPL is 2.15, and BOPO is 1.94. This shows that all independent variables have VIF values.

4.1.4. Heteroscedasticity Test

The heteroscedasticity test aims to detect differences in residual values between observations to ensure the homogeneity of regression data. In EViews 12, testing is done with the White Test, using the Chi-Square probability value > 0.05 to indicate the absence of heteroscedasticity symptoms. Conversely, if the probability value ≤ 0.05, then there is an indication of heteroscedasticity in the model.

Table 4. Heteroscedasticity Test

No	Variable	Prob.
1	ROA	0.1683
2	GBDI	0.0504
3	NPL	0.4668
4	BOPO	0.7610

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The probability value of each variable is > 0.05, so it can be concluded that there are no symptoms of heteroscedasticity in this regression model.

4.1.5. Autocorrelation Test

Table 5. Autocorrelation Test

Variable	Value
Durbin-Watson Stat	1.420493

From the autocorrelation test results table, the Durbin-Watson statistic value is 1.420493. So it can be concluded that this regression model has no autocorrelation symptoms.

4.1.6. Chow Test

The Chow test is conducted to select which regression model is better to use between the Common Effect Model (CEM) and the Fixed Effect Model (FEM).

Table 6. Chow Test

Effect Test	Prob
Cross-section F	0.0000
Cross-section Chi-Square	0.0000

Model selection is determined by evaluating the probability value associated with the Cross-Section F statistic. If the Prob. Value exceeds 0.05, the Common Effect Model (CEM) is deemed appropriate; conversely, if the value falls below 0.05, the Fixed Effect Model (FEM) is preferred. Based on the results presented in the Chow Test, the Cross-Section F statistic yields a probability of 0.000, which is below the 0.05 threshold, thereby justifying the adoption of the FEM specification. Subsequently, the Hausman test is employed to further differentiate between the Fixed Effect Model and the Random Effect Model (REM), ensuring the most robust estimation technique is selected.

4.1.7. Hausman Test

The Hausman test is conducted to select which regression model is better to use between the Fixed Effect Model (FEM) and the Random Effect Model (REM).

Table 7. Hausman Test

Test Summary	Chi-Sq Statistic	Prob
Cross-section random	21.371774	0.0001

Determining the appropriate model via the Hausman test involves assessing the probability value associated with the Cross-Section Random effect. A p-value less than 0.05 indicates that the Fixed Effect Model (FEM) is more suitable, whereas a value greater than 0.05 favors the Random Effect Model (REM). In the present analysis, the test produced a probability value of 21.371774, which falls below the 0.05 significance level, thereby supporting the adoption of the FEM. Consequently, in light of the Chow and Hausman test outcomes, the Fixed Effect Model is identified as the most methodologically appropriate regression framework for this study.

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4.1.8. Partial Test

Table 8. Partial Test

No	Variable	t-statistic	Prob.
1	ROA	1.383929	0.1683
2	GBDI	1.970695	0.0504
3	NPL	-0.729352	0.4668
4	BOPO	-7.011238	0.0000

The GBDI variable yields a t-statistic of 1.970 with a corresponding p-value of 0.0504, slightly exceeding the 0.05 significance threshold. This suggests that green banking exhibits a marginally significant influence on financial performance (Y). In contrast, the NPL variable records a t-statistic of -0.7293 and a p-value of 0.4668, indicating that credit risk does not exert a statistically significant effect on financial performance. Meanwhile, the BOPO variable produces a t-statistic of -7.011238 with a p-value of 0.0000, providing strong statistical evidence that operational efficiency has a significant and negative impact on financial performance, as measured by Return on Assets (ROA).

4.1.9. Simultaneous Test (Test F)

Table 9. Simultaneous Test (Test F)

Variable	Value
F-statistic	18.06432
Prob (F-statistic)	0.000000

Referring to Table 9, the computed F-statistic is 18.06432 with an associated probability value of 0.000. Given that this p-value falls well below the 0.050 threshold, it can be inferred that the independent variables collectively exert a statistically significant influence on the dependent variable within the model.

4.1.10. Coefficient of Determination (R^2)

Table 10. Coefficient of Determination (R^2)

Variable	Value
R-Squared	0.248372
Adjusted R-Squared	0.730152

Based on Table 10, the Adjusted R-Square value is reported at 0.730152, indicating that approximately 73% of the variation in financial performance can be attributed to the explanatory variables—green banking (X_1), credit risk (X_2), and operational efficiency (X_3). The remaining 27% of the variation is influenced by other factors not incorporated within the scope of this study.

4.1.11. Panel Data Regression Analysis

There are results for the regression equation as follows:

$$Y = 7.494 + 4.720*X1 + 6.501*X2 - 2.466*X3 + 1*Y + \varepsilon$$

4.2. Discussion

4.2.1. The effect of Green Banking on financial performance in conventional banking

Within the framework of this study, the first hypothesis posits that adopting green banking practices exerts a significant influence on financial performance disclosure. This inference is drawn from a t-statistic

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value of 1.970 and a corresponding probability value of 0.0504, which marginally exceeds the conventional 5% significance threshold. While this p-value does not meet the strict criterion for statistical significance at the 95% confidence level, its proximity to the cutoff point suggests a marginally significant effect. Thus, the results offer preliminary evidence that green banking initiatives may contribute to shaping financial performance. However, the observed impact has not yet reached a level of robustness sufficient to confirm statistical significance with high certainty. This shows that the influence of green banking may begin to be felt, but it takes time, more mature policies, or a more consistent implementation approach to show a more real impact on the bank's financial performance. This is based on the supporting theory, namely the legitimacy theory, which states that companies, including banks, are responsible to shareholders and the wider community. By adopting the principles of green banking, banks can maintain their social legitimacy through environmentally friendly activities, while building a positive image. This practice helps companies balance economic goals and social responsibility, so that their business activities are more accepted by the community and improve financial performance sustainably.

4.2.2. The effect of Credit Risk on financial performance in conventional banking

In the context of this research, the hypothesis testing reveals that implementing credit risk management does not exert a statistically significant influence on financial performance disclosure. This conclusion is supported by a t-statistic value of -0.7293 and a probability (p-value) of 0.4668, which considerably exceeds the 5% significance threshold. Such a result indicates insufficient statistical evidence to affirm that variations in credit risk levels—proxied by Non-Performing Loans (NPL)—directly affect banks' financial performance throughout the observation period. This phenomenon may be attributed to the ability of several banks to mitigate the adverse effects of bad loans through sound credit risk management, thereby minimizing the impact on their profitability. Nonetheless, institutions such as PT Bank KB Bukopin Tbk, which recorded an NPL of 10.66% in 2021, and PT Bank Pembangunan Daerah Banten Tbk, with NPL levels of 22.17% and 14.09% in 2020 and 2021, respectively, exemplify cases where credit risk remained high and potentially uncontained. The findings of this study are consistent with those reported by Mohammad et al. (2020), who concluded that Non-Performing Loans (NPL) do not exert a statistically significant impact on Return on Assets (ROA). This outcome suggests that banks may continue to achieve substantial profitability even amid rising levels of non-performing credit. Such resilience may be attributed to implementing robust credit risk management frameworks or to a concurrent increase in interest-based revenues that sufficiently offset potential credit losses.

4.2.3. The effect of Operational Efficiency on financial performance in conventional banking

This study reveals that operational efficiency exerts a statistically significant influence on financial performance disclosure, as evidenced by a t-statistic of -7.011238 and an associated p-value of 0.0000, which falls well below the conventional 0.05 threshold. The magnitude of the t-statistic, even in its negative form, reinforces the robustness of this variable's impact within the regression framework. In line with efficiency theory, an elevated BOPO ratio—indicative of diminished operational efficiency—is inversely correlated with financial performance as measured by ROA. Conversely, enhanced efficiency in bank operations is generally associated with improved profitability outcomes. This finding supports previous research, indicating that effective cost control enhances profitability by reducing the cost-to-income ratio, thus improving overall financial performance. This efficiency reflects management's ability to control costs without sacrificing service quality or productivity. A low BOPO ratio indicates that the bank can maximize revenue by reducing unnecessary expenses. Therefore, high operational efficiency is important in sustainably maintaining and improving the bank's financial performance.

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4.2.4. The influence of Green Banking, Credit Risk, and Operational Efficiency on Financial Performance

The empirical findings reveal that green banking, credit risk, and operational efficiency collectively influence financial performance. The regression model incorporating these three variables yields a coefficient of determination (Adjusted R-Square) of 0.730152, indicating that approximately 73% of the variability in financial performance can be attributed to the combined effect of these predictors. The remaining 27% of the variation is presumed to be influenced by external factors not encompassed within the scope of the current model. The three combinations are considered quite good in explaining variations in financial performance variables. This is because the combination of green banking, credit risk, and operational efficiency adopts various factors that come from internal and external sources. Green banking represents an internally driven initiative within financial institutions, reflecting their commitment to green financing as a strategic approach for fostering sustainable industrial advancement. While this practice is anticipated to enhance profitability by potentially lowering operational expenditures, its early-stage implementation may instead lead to increased costs due to transitional adjustments toward a green economy. Moreover, firm size—measured by the total assets under management—is pivotal in shaping profitability outcomes. Banks with substantial asset bases generally possess greater capacity to optimize earnings and absorb transitional costs, sustaining higher financial performance.

V. Conclusion

This research examines the influence of Green Banking, Credit Risk, and Operational Efficiency on the Financial Performance of conventional banking institutions in Indonesia during the 2020–2023 period. Several key inferences were derived by applying multiple regression analysis utilizing EViews software. First, green banking significantly impacts financial standing, with a significance value of 0.0504. This indicates that environmentally friendly financing practices are starting to positively impact profitability, although it is not yet statistically significant and requires more consistent implementation. Second, credit risk (NPL) does not significantly affect financial performance ($p = 0.4668$). Banks can manage credit risk effectively, so NPL fluctuations do not directly affect profitability. Third, operational efficiency, measured by the BOPO ratio, is intensely damaging and highly significant to financial performance. The t-statistic of -7.011 and a p-value of 0.0000 substantiate the critical role of cost management in enhancing banking sector profitability. Fourth, simultaneously, the three variables have a statistically significant influence on financial performance, evidenced by an F-statistic of 18.064 and a p-value of 0.000000. The coefficient of determination, recorded at 73%, suggests that the regression model accounts for most of the variance in ROA. In contrast, the remaining 27% is attributable to explanatory variables not incorporated within the current analytical framework. Overall, operational efficiency is the most dominant factor affecting bank financial performance, followed by green banking, which shows an initial effect. In contrast, credit risk does not show a significant effect during the study period.

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