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Impact Of Bank Risk On Bank Performance In Indonesian Commercial Banks: The Moderating Role Of Corporate Governance

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ABSTRACT

This study analyzes the impact of bank risk exposures, including Environmental, Social, and Governance (ESG) Risk, Credit Risk, Liquidity Risk, Market Risk, Operational Risk, and Capital Adequacy Ratio (CAR), on the financial performance of commercial banks in Indonesia, as measured by Return on Assets (ROA). Driven by increasing regulatory pressure and market demands for sustainable financial practices, this research also explores the moderating role of Corporate Governance in strengthening or weakening the impact of these risks on bank performance. The research employs a quantitative approach using panel data regression with EViews 9 software, utilizing secondary data from 10 commercial banks listed on the Indonesia Stock Exchange during the period 2020–2024. Data sources include annual reports, sustainability reports, OJK publications, and Bloomberg ESG Disclosure Scores. The findings reveal that ESG Risk, Liquidity Risk, Market Risk, and CAR have a significant impact on ROA, whereas Credit Risk, Operational Risk, and control variables (Bank Size and Asset Growth) do not have a significant impact. An interesting finding of this study is the positive yet insignificant relationship between Credit Risk and ROA, which contrasts with conventional literature. This result is presumed to be influenced by credit restructuring policies and government stimulus during the COVID-19 pandemic, as well as variations in risk management strategies across banks. Meanwhile, Market Risk, as measured by the Net Interest Margin (NIM), shows a significant negative impact on ROA, contrary to the initial hypothesis, indicating intense market competition and fluctuating interest income within Indonesia's banking sector.

The moderating effect of Corporate Governance on the relationship between risk and performance is not fully significant, except for its interaction with Market Risk, which demonstrates the potential to enhance risk management effectiveness. These findings underscore the importance of strengthening governance and risk management to improve the resilience and profitability of the national banking sector.

INTRODUCTION

The resilience and sustainability of the national economic system are largely dependent on the stability of the banking industry, especially in developing nations like Indonesia where the financial system serves as a vital catalyst for economic growth and recovery. Banks now play a vital role in addressing systemic risks and putting sustainability principles into practice, going beyond their previous function as financial intermediaries (Bouattour et al., 2024).

As global awareness of the importance of sustainability and good governance grows, banks are not only required to manage conventional financial risks such as Credit Risk, Liquidity Risk, Market Risk, Operational Risk, and Capital Risk, but also face new challenges in the form of Environmental, Social, and Governance (ESG) Risk, which are non-financial and multidimensional in nature. ESG Risk is now a key focus both from a regulatory perspective and in terms of market expectations (Defung et al., 2024; Zikriani et al., 2025).

In response to these changes, the Otoritas Jasa Keuangan (OJK) through POJK No. 51/POJK.03/2017 has required commercial banks to integrate sustainable finance principles into their sustainability reports. However, OJK data (2024) shows that by the end of 2023, only around 46% of banks listed on the Indonesia Stock Exchange (IDX) consistently disclosed comprehensive ESG indicators. This indicates a gap between regulatory policy and implementation on the ground. Findings from the IFC (2025) and Jaya et al. (2024) also show that most banks face challenges in systematically adopting ESG principles.

Previous studies have noted that failure to manage ESG risks can lead to serious consequences such as reputational damage, decreased investor confidence, and negative impacts on bank profitability (Bouattour et al., 2024; Cantero-Saiz et al., 2024; Defung et al., 2024). On the other hand, good corporate governance (CG) is believed to strengthen risk management capabilities and improve efficiency and profitability. A combination of strong governance with adequate institutional capacity, such as leverage and asset growth, can also enhance resilience to risk pressures (Almulla et al., 2025; Love, 2011; Zikriani et al., 2025).

However, most previous studies have tended to use a linear approach and have not delved deeply into the moderating role of corporate governance (CG) in strengthening or weakening the influence of various risks on bank financial performance (FP) (Eklemet et al., 2024; Olowofela et al., 2025). Therefore, there is relevant research space to examine how CG acts as a moderating factor in the relationship between risk and bank performance.

Considering this research gap, this study aims to analyze the influence of ESG Risk, Credit Risk, Liquidity Risk, Market Risk, Operational Risk, and Capital Risk on bank financial performance (measured by Return on Assets/ROA), considering Corporate Governance as a moderating variable, and Leverage and Asset Growth as control variables. This study is expected to contribute to the development of risk management and corporate governance literature in the context of banking in developing countries, particularly Indonesia.

LITERATURE REVIEW

This section presents a systematic review of previous studies that examine the relationship between ESG risk, traditional financial risk, corporate governance, and bank performance. This literature review consists of several subsections, covering the theoretical basis and definitions of

each variable, empirical findings related to the influence between variables, and the formulation of hypotheses that form the basis of the conceptual framework of this study.

ESG Risk and Bank Performance

ESG Risk is a form of non-financial risk that is multidimensional and encompasses three main pillars: Environmental, Social, and Governance. In the banking context, ESG Risk can manifest in various forms, such as operational risk due to environmental regulatory violations, reputational risk due to social issues, or compliance risk due to weak corporate governance (Defung et al., 2024; Zikriani et al., 2025). These three dimensions have the potential to affect the overall stability and performance of banks, both in the short and long term. Banks that are unable to manage their exposure to ESG Risk effectively may face significant losses, such as regulatory fines, a decline in public trust, or even operational failure (Bouattour et al., 2024; Cantero-Saiz et al., 2024).

Research by (Defung et al., 2024) identifies that high exposure to ESG risk is negatively associated with the financial stability of banks in Indonesia, particularly those that have not implemented strong governance. A research by (Bouattour et al., 2024) also shows that the interaction between ESG and governance determines whether the impact of ESG risk on ROA is linear or not. Meanwhile, the research by (Cantero-Saiz et al., 2024) emphasizes the importance of measuring and managing ESG risk to support operational sustainability and maintain bank profitability amid market demands that increasingly emphasize sustainability aspects.

H_1: ESG Risk has a negative effect on Bank Performance.

Traditional Risk Exposures (Credit, Liquidity, Market, and Operational)

Traditional financial risks remain a key component in evaluating a bank's financial performance, even though ESG issues are now receiving wider attention. The four main risks in focus are: credit risk, liquidity risk, market risk, and operational risk, each of which has a significant impact on banking profitability and stability.

Credit risk is the possible loss that results from a debtor's failure to fulfill their responsibilities. The percentage of non-performing loans to total loans, or the Non-Performing Loan (NPL) ratio, is used in this study to quantify credit risk. This ratio shows how well the bank manages its credit and how good its assets are. (Harb et al., 2023a; Psaila et al., 2019a) state that high NPLs indicate an increase in loss provisions and a decrease in net interest income, which ultimately reduces Return on Assets (ROA).

Liquidity risk is assessed using the Loan to Deposit Ratio (LDR), which reflects a bank's capacity to fulfill short-term liabilities using its available liquid assets. An imbalance between credit disbursement and third-party fund raising can lead to dependence on external funding, which increases the potential for cash flow volatility and operational failure risk if not managed carefully (Harb et al., 2023b).

Market risk is indicated by the Net Interest Margin (NIM), which evaluates a bank's capability to earn net interest income from its earning assets. A higher NIM signifies greater efficiency in optimizing profit margins through intermediation functions. (Cantero-Saiz et al., 2024; Harb et al., 2023b) found that banks with high NIM tend to generate higher ROA thanks to operational efficiency and competitive interest rate policies.

Operational Risk is the risk arising from failures in internal systems, human error, or processes. In this context, the BOPO ratio (Operating Expenses to Operating Income) is used as an indicator. A high ratio indicates operational inefficiency, such as excessive labor costs or low information system productivity. Related studies also confirm that inefficient operations directly have a negative impact on ROA, as costs increase without a corresponding increase in revenue (Guterres et al., 2025; Harb et al., 2023b).

H_2: Credit Risk has a negative impact on Bank Performance.

H_3: Liquidity Risk has a negative effect on Bank Performance.

H_4: Market Risk has a positive effect on Bank Performance.
H_5: Operational Risk has a negative effect on Bank Performance.

Capital Adequacy Ratio and Bank Performance

The Capital Adequacy Ratio (CAR) serves as a crucial measure of a bank's capital strength in withstanding different types of risks, such as credit, market, and operational risks. CAR reflects the bank's capital's ability to absorb potential losses from operational activities, thereby maintaining the stability and sustainability of the bank's overall financial performance. Under the Basel III framework, the CAR is the minimum requirement that banks must meet to ensure solvency and prevent systemic risk.

Banks with high CAR are generally more stable because they have sufficient capital buffers to anticipate sudden financial pressures, such as a surge in non-performing loans or market losses. Adequate capital buffers not only enhance investor, regulator, and depositor confidence but also strengthen operational sustainability and competitiveness in the financial industry (Almulla et al., 2025).

Several studies indicate a significant positive correlation between CAR and bank financial performance, particularly Return on Assets (ROA). Banks that maintain a CAR above the minimum threshold tend to be better able to manage risk portfolios and enhance profitability (Harb et al., 2023b). A healthy CAR also allows for broader credit expansion without compromising financial stability, thereby supporting sustainable income growth. Thus, capital adequacy serves as both a risk mitigation tool and a catalyst for controlled business expansion.
H_6: Capital Adequacy Ratio has a positive effect on Bank Performance.

Corporate Governance and Bank Performance

Corporate Governance (CG) is a set of principles, mechanisms, and structures designed to guide and control organizations, particularly in terms of achieving objectives, operational transparency, and protecting stakeholder interests. In the banking sector, good governance practices are crucial given the fiduciary nature of banks' business, which involves managing third-party funds with high risks and strict regulations. Therefore, the effectiveness of corporate governance is one of the main pillars in maintaining the sustainability, integrity, and financial performance of banks (Olowofela et al., 2025; Rajagopalan & Zhang, 2008).

The main elements of bank governance include the independence and composition of the board of commissioners, the existence of audit and risk management committees, transparency of financial reports, and compliance with the principles of good corporate governance as regulated by regulators, such as OJK in Indonesia. Strong governance can minimize agency problems, which are conflicts between management and shareholders, and encourage more accountable decision-making based on long-term interests (Love, 2011).

Studies conducted by (Guterres et al., 2025; Olowofela et al., 2025) show that corporate governance has a significant positive correlation with bank financial performance, particularly in improving Return on Assets (ROA). Effective governance enhances internal discipline in asset management, risk control, and operational efficiency. This directly contributes to improved profitability and the bank's resilience in facing external pressures, such as market volatility or economic crises. In addition, CG is also an important factor in strengthening investor and regulator confidence in the bank's long-term performance. Banks with clear and open governance structures tend to be more responsive to regulatory changes and better prepared to face the challenges of global competition.
H_7: Corporate Governance has a positive effect on Bank Performance.

Control Variables (Bank Size and Growth)

Bank size has long been recognized as an important factor influencing differences in financial performance among banking institutions. Based on the theory of economies of scale,

large banks, measured using the natural logarithm of total assets, have advantages in terms of access to funding, portfolio diversification, and economies of scale. Additionally, large banks tend to have more structured risk management and governance systems, enabling them to manage operational complexity and systemic risk more effectively (Almulla et al., 2025).

Research by (Harb et al., 2023b) found that large-scale banks generally exhibit higher Return on Assets (ROA) due to stronger operational capacity and resources, as well as higher levels of trust from investors and customers, which support long-term funding stability.

Asset Growth reflects the expansion of banking activities over time, whether through increased lending, branch expansion, or the acquisition of new assets. Healthy growth indicates a bank's ability to capitalize on market opportunities through effective expansion strategies. A study by Jaya et al. (2024) shows that moderate and sustainable asset growth will increase bank profitability. However, overly aggressive growth without managerial support and risk control can reduce efficiency and increase liquidity pressure (Guterres et al., 2025).

Other research also notes that in the context of ESG and risk management, large and rapidly growing banks face higher expectations from regulators and the public to demonstrate sustainability performance aligned with profitability (Bouattour et al., 2024; Defung et al., 2024).

H_8: Bank Size has a positive effect on Bank Performance.

H_9: Growth has a positive effect on Bank Performance.

Moderating Role of Corporate Governance

CG has evolved into a fundamental concept in the framework of risk management and FP of financial institutions, including banks. CG refers to the systems, principles, and processes that govern how a company is directed and controlled. In this context, CG not only has a direct impact on profitability but also plays a role in strengthening or weakening the influence of various risks on bank performance. Therefore, in this study, Corporate Governance is not only treated as an independent variable but also as a moderating variable that has the potential to strengthen or weaken the relationship between risks and Bank Performance (Eklemet et al., 2024; Olowofela et al., 2025)

In measuring Corporate Governance, this study adopts a score-based corporate governance index, which is formed from a series of indicators such as: the presence of independent/non-executive directors as board chairpersons, clarity of the duties and responsibilities of the board of directors, the existence of an independent internal audit function, the rotation of external auditors as stipulated in the articles of association, the formation of an audit committee, internal audit reporting, and annual evaluation of the internal audit plan (Guterres et al., 2025; Rajagopalan & Zhang, 2008).

Previous literature emphasizes that good corporate governance can reduce agency costs, reduce information asymmetry, lower capital costs, and increase investor confidence (Love, 2011; Olowofela et al., 2025). Rajagopalan and Zhang (2008) note that in complex organizations such as banks, the role of governance as a supervisory mechanism is crucial to ensure that managerial decision-making remains within the interests of shareholders and other stakeholders.

Furthermore, empirical research shows that strong CG has a moderating effect on the relationship between various types of risk and financial performance. For example, in the context of ESG Risk, effective governance can ensure that sustainability policies are consistently and integrally applied in bank operations, thereby reducing negative impacts on ROA (Bouattour et al., 2024; Defung et al., 2024). In credit and liquidity risk, CG functions as a controller in loan origination decisions and funding strategies, while in market and operational risk, governance can enhance internal oversight and compliance systems (Eklemet et al., 2024; Olowofela et al., 2025). Even for the Capital Adequacy Ratio (CAR), governance plays a role in determining an efficient capital structure and maintaining compliance with strict banking regulations (Almulla et al., 2025).

H_{10}: Corporate Governance moderates the negative influence of ESG Risk on Bank Performance.
H_{11}: Corporate Governance moderates the negative influence of Credit Risk on Bank Performance.
H_{12}: Corporate Governance moderates the negative influence of Liquidity Risk on Bank Performance.
H_{13}: Corporate Governance moderates the positive influence of Market Risk on Bank Performance.
H_{14}: Corporate Governance moderates the negative influence of Operational Risk on Bank Performance.
H_{15}: Corporate Governance moderates the positive influence of CAR on Bank Performance.

Empirical Review

The connection among bank performance, CG, and financial risk has been thoroughly studied in the past. However, most of these studies remain fragmented and have not fully integrated all key elements such as ESG Risk, traditional financial risk, corporate governance practices, and internal control factors into a comprehensive empirical model (Bouattour et al., 2024; Eklemet et al., 2024; Olowofela et al., 2025). This gap becomes increasingly relevant in the context of developing countries like Indonesia, where the banking sector faces complex structural challenges, varying regulatory quality, and uneven implementation of corporate governance. Furthermore, control variables such as bank size and asset growth are often overlooked in previous studies, despite their significant roles in determining the profitability and financial resilience of a banking institution (Almulla et al., 2025).

One notable study was conducted by (Eklemet et al., 2024) reveals that effective Risk management practices are essential in enhancing the link between risk exposures especially credit risk and liquidity risk and the overall performance of a bank. Using the Generalized Method of Moments (GMM) approach, this research demonstrates that an adequate risk control system can mitigate the negative impact of financial risk. However, this study does not consider ESG Risk as a primary risk factor and has not integrated corporate governance or internal control variables such as bank size and asset growth into its model framework.

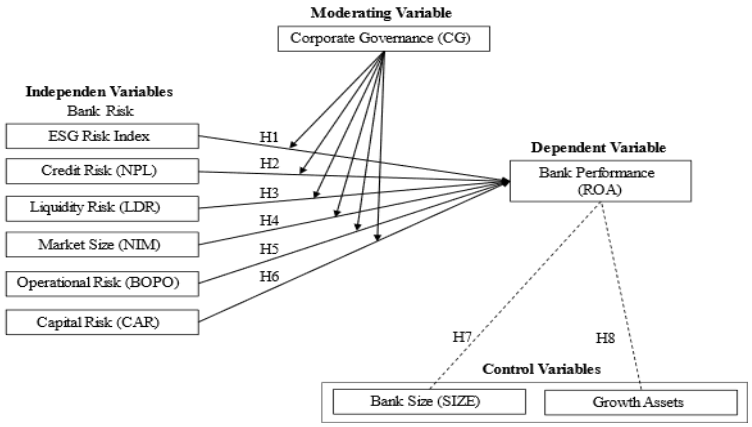
Research by (Defung et al., 2024) specifically examines the impact of ESG Risk on the financial stability of banks in Indonesia. The results show that high exposure to ESG Risk has a negative impact on performance and financial stability, especially in banking institutions that are weak in terms of governance. This study highlight the importance of ESG as a non-financial risk component with significant implications for banks' operational and financial performance. These results align with study by (Bouattour et al., 2024) in the MENA region, which found that the relationship between ESG performance and ROA is non-linear. The study highlights that CG is essential for enhancing or even changing the way that ESG affects profitability.

Furthermore, (Harb et al., 2023b) show that credit risk and liquidity risk remain the main determinants in explaining variations in bank profitability. This study also confirms the importance of the size effect, whereby larger banks have a better ability to manage risk and implement more effective governance, which in turn has a positive impact on ROA. In the context of governance, (Guterres et al., 2025; Olowofela et al., 2025) emphasize that strong corporate governance practices can improve internal efficiency and strengthen banks' competitiveness in the face of external pressures. Additionally, (Jallad et al., 2025) demonstrate that the negative impact of Non-Performing Loans (NPLs) on ROA can be minimized if banks have good ownership structures and governance, indicating that institutional variables play a moderating role in the relationship between risk and profitability.

However, most of these studies are still limited to linear approaches and have not explicitly tested the role of corporate governance as a moderating variable in the context of the relationship between various types of risk and bank FP (Olowofela et al., 2025). There are also few empirical models that integrate all important elements such as ESG Risk, traditional financial

risk, governance, and internal control variables in a comprehensive manner. Therefore, this study aims to address the gap by developing an integrative model, which will be tested in this research as illustrated in the following conceptual framework.

Figure 1



METHODS

This study adopts a quantitative approach with a causal design to examine the impact of various risk types on the financial performance of commercial banks in Indonesia. The independent variables consist of ESG Risk, Credit Risk, Liquidity Risk, Market Risk, Operational Risk (measured by BOPO), and Capital Adequacy Ratio (CAR). Financial performance is assessed using Return on Assets (ROA) as the dependent variable. Furthermore, the study explores the moderating effect of Corporate Governance on the relationship between each type of risk and ROA, while incorporating Bank Size and Asset Growth as control variables to improve model precision.The research utilizes secondary data sourced from the annual reports of commercial banks operating in Indonesia during the 2020–2024 period. For the asset growth variable, data from 2019 was used to calculate annual changes in assets.

Panel data regression analysis was employed in this study. Based on the outcomes of model selection test including the Chow Test, Hausman Test, and Lagrange Multiplier Test, the Common Effect Model (CEM) was determined to be the most appropriate. Data analysis was carried out using Eviews 9 software, supported by classical assumption tests such as normality, multicollinearity, and heteroscedasticity to ensure the robustness of the regression model.

The regression equation was formulated to assess both the direct effects of the independent variables on ROA and the interaction (moderation) effects between each type of risk and Corporate Governance on ROA. All statistical tests were conducted at a 5% significance level, using both descriptive and inferential statistics to ensure a comprehensive understanding of the findings.

Dependent Variable (i.e., Bank Performance ROA)

Bank Performance (ROA): Bank performance is proxied using ROA. ROA reflects the efficiency of banks in managing their assets to generate profits. This ratio shows how much net profit can be obtained from each unit of assets used. The formula for calculating Bank Performance (ROA) is stated in equation (1):

$$Bank\ Performance\ ROA = \frac{Net\ Income}{Total\ Assets} \quad (1)$$

Independent Variable (i.e., ESGR, CR, LR, BOPO, MR, dan CAR)

There are six independent variables used. These variables are ESG Risk (ESG), Credit Risk (CR), Liquidity Risk (LR), Operational Risk (BOPO), Market Risk (MR), and Capital Risk (CAR), which are used to assess their impact on bank performance.

ESG Risk (ESG): ESG risk measures a bank's exposure to risks arising from environmental, social, and governance factors. The higher the ESG Risk score, the greater the potential losses faced by banks due to sustainability issues (Defung et al., 2024).

Credit Risk (CR): Credit risk arises when customers are unable to meet their loan repayment obligations, both principal and interest. This ratio shows the proportion of uncollectible loans compared to total loans disbursed (Jallad et al., 2025; Psaila et al., 2019b). The formula for calculating Credit Risk is stated in equation (2):

$$Credit\ Risk\ (CR) = \frac{Non-performing\ Loans}{Total\ Loans} \times 100\% \quad (2)$$

Liquidity Risk (LR): LR reflects a bank's capacity to fulfill its short-term liabilities. This ratio is calculated by comparing total loans granted to third-party funds successfully collected. An excessively high LDR ratio indicates liquidity pressure (Harb et al., 2023b). The formula for calculating Liquidity Risk is stated in equation (3):

$$Liquidity\ Risk\ (LR) = \frac{Total\ Loans}{Third-party\ Funds} \times 100\% \quad (3)$$

Market Risk (MR): Market Risk is represented by Net Interest Margin (NIM), which reflects the bank's ability to profit from financial intermediation activities. This ratio reflects the bank's effectiveness in producing interest income from its earning assets (Bouattour et al., 2024; Cantero-Saiz et al., 2024). The formula for calculating Market Size is stated in equation (4):

$$Market\ Risk\ (MR) = \frac{Net\ Interest\ Income}{Earning\ Assets} \times 100\% \quad (4)$$

Operational Risk (OR): OR stems from internal failures in processes, human resources, or systems. A high BOPO indicates significant operational inefficiency. This ratio serves to evaluate the degree of operational efficiency within a bank (Guterres et al., 2025; Harb et al., 2023b). The formula for calculating Operational Risk is expressed in equation (5):

$$Operational\ Risk\ (OR) = \frac{Operating\ Expenses}{Operating\ Income} \quad (5)$$

Capital Risk (CAR): CAR represents a bank's ability to absorb potential losses stemming from various financial risks, such as credit, market, and operational risks. Regulators commonly use this ratio to evaluate the strength and stability of a bank's capital structure (Almulla et al., 2025; Harb et al., 2023b). The formula for calculating the Capital Adequacy Ratio is expressed in equation (6):

$$CAR = \frac{Capital}{Risk\ Weighted\ Assets} \times 100\% \quad (6)$$

Moderating Variable (i.e., Corporate Governance)

Corporate Governance: Corporate Governance in this study functions as a moderating variable that aims to assess the extent to which the quality of corporate governance can strengthen or weaken the relationship between various types of risk and bank FP, particularly in the context of ROA. In general, CG represents a set of principles, organizational structures, and oversight mechanisms designed to ensure that management acts transparently, accountably, and responsibly to stakeholders.

To measure this variable, a governance index was constructed consisting of seven structural indicators, developed based on international best practices and previous empirical literature. These indicators include, among others:

1. Leadership of the board of directors by non-executive individuals.
2. Clarity of the division of roles and responsibilities between management and directors in writing.
3. The existence of an independent internal audit function.
4. Rules for the rotation of external auditors in the articles of association.
5. The establishment and active performance of an audit committee.
6. Regular preparation of internal audit reports by the audit committee.
7. Annual evaluation of the internal audit work plan.

Each indicator is given a score of 1 if it is met and 0 if it is not, so that the total score ranges from 0 to 7. The higher the score obtained, the better the quality of governance implemented by the bank. This measurement method is inspired by the approach developed by (Love, 2011) and supported by the findings of (Guterres et al., 2025; Olowofela et al., 2025), which emphasize the importance of governance systems in improving decision-making efficiency, reducing agency conflicts, and building the credibility of financial institutions. In addition, Rajagopalan & Zhang (2008) argue that effective governance practices can reduce information asymmetry and capital costs, which ultimately support the improvement of bank financial performance in the long term.

Control Variables (i.e., Bank Size, and Growth)

This study uses two control variables, namely Bank Size (Size) and Asset Growth, to stabilize the model and control the influence of external variables on the main relationship between the research variables.

Bank Size: Bank size measure describes the operational scale, managerial capacity, and potential of banks to manage risk and take advantage of economies of scale. Larger banks generally have more complex control systems and access to broader resources, which can affect financial performance (Harb et al., 2023). The formula for calculating Bank Size is expressed in equation (7):

$$Bank\ Size = \ln(Total\ Assets) \quad (7)$$

Growth (Asset Growth): Asset growth measures the rate of expansion of a bank from year to year and is an important indicator in assessing a bank's ability to increase its operational scale and competitiveness. Healthy asset growth can reflect an effective expansion strategy, which ultimately can increase profitability. Studies by (Guterres et al., 2025) show that stable asset growth has a positive impact on ROA. The formula for calculating Asset Growth is stated in equation (8):

$$Growth = \frac{Total\ Assets_t - Total\ Assets_{t-1}}{Total\ Assets_{t-1}} \times 100\% \quad (8)$$

Sample Data Resource

This study uses a balanced panel dataset from 10 commercial banks listed on the IDX during the period 2020 to 2024, resulting in a total of 50 observations . The sample selection was conducted using purposive sampling, with the criteria being that the banks had complete annual reports and sustainability reports during the observation period. For the asset growth variable, 2019 data was used as the baseline for calculations.

Quantitative data was obtained from various primary and secondary sources, including the annual reports and sustainability reports of each bank, the official website of IDX, as well as documents and regulations from OJK. ESG Risk data was obtained from Bloomberg ESG Disclosure Scores and adjusted according to the Global Reporting Initiative (GRI) guidelines to reflect ESG dimensions.

All data was compiled and analyzed using EViews 9 statistical software, with a panel data regression approach. Testing was conducted using fixed effects, random effects, and common

effects models, in accordance with the results of the Chow Test, Hausman Test, and Lagrange Multiplier Test.

Analytical Method

This research employs a quantitative method using panel data regression analysis to estimate the impact of ESG Risk, traditional financial risks and the moderating role of Corporate Governance (CG) on the performance of commercial banks in Indonesia, which is proxied by Return on Assets (ROA). The panel data approach was chosen because it can combine time-series dimensions (annual data from 2020 to 2024) and cross-section dimensions (10 commercial banks) in a single analysis model, thereby accommodating variations between time and entities simultaneously. Additionally, this method is considered effective in addressing potential heterogeneity, endogeneity, and omitted variable bias issues that often occur in financial data. The general panel data regression model is stated in equation (9):

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \quad (9)$$

Where Y is the dependent variable (ROA), X is the vector of independent variables, β is the parameter coefficient, i refers to the bank entity, t refers to the time period, and ε_{it} is the error term. To consider the influence of past performance on current performance, the Autoregressive Order 1 or AR(1) approach is used, as expressed in equation (10):

$$ROA_{it} = \alpha + \beta_1 ROA_{(t-1)} + \beta_2 X_{it} + \varepsilon_{it} \quad (10)$$

The autoregressive order one (AR(1)) model was used in this study to improve the robustness of the regression results by addressing several potential classic problems in linear regression models, such as endogeneity, simultaneity, and unobserved heterogeneity, which often arise in panel data. The choice between the Fixed Effect Model (FEM) and Random Effect Model (REM) was made through the Hausman test to determine the model specification that best fits the data characteristics. Before the estimation process was carried out, this study first conducted a series of classical assumption tests, including: normality test, multicollinearity test using the Variance Inflation Factor (VIF), heteroscedasticity test using the White test method, and autocorrelation test using the Durbin-Watson statistic. The entire analysis process was conducted using EViews software, and the significance level for hypothesis testing was set at 5% (α = 0.05).

The final equation of the research model, which includes all independent variables, control variables, and moderating interactions, is written as equation (11):

$$ROA_{it} = \alpha + \beta_1 ESG_{it} + \beta_2 CR_{it} + \beta_3 LR_{it} + \beta_4 MR_{it} + \beta_5 BOPO_{it} + \beta_6 CAR_{it} + \beta_7 CG_{it} + \beta_8 Size_{it} + \beta_9 Growth_{it} + \beta_{10}(ESG \times CG) + \beta_{11}(CR \times CG) + \beta_{12}(LR \times CG) + \beta_{13}(MR \times CG) + \beta_{14}(BOPO \times CG) + \beta_{15}(CAR \times CG) + \varepsilon_{it} \quad (11)$$

This equation represents the functional relationship between all variables analyzed, and forms the basis for testing hypotheses using panel data regression.

RESULTS AND DISCUSSION

Descriptive Analysis

Descriptive statistics are used to provide an overview of the characteristics of the data distribution for all research variables. The statistics presented include the number of observations (N), minimum value, maximum value, mean, and standard deviation for each variable: dependent, independent, moderating, and control. This analysis is important for understanding data patterns and detecting possible outliers or distribution deviations.

Table 1 below presents the descriptive statistics results from 10 commercial banks that were sampled during the 2020–2024 period, yielding a total of 50 panel data observations.

Tabel 1. Descriptive Statistics of Research Variables

Variables	N	Minimum	Maximum	Mean	Std. Deviasi
ROA	50	0.29	3.94	1.9668	0.94341
MR	50	2.86	8.41	5.2456	1.29144
ESG	50	17.8	33.44	26.6816	3.72471
CR	50	0.97	4.37	2.5496	0.82495
LR	50	62	147	89.4222	17.69792
BOPO	50	41.67	93.3	74.9356	12.34437
CG	50	1	1	1	0
CAR	50	16.8	58.27	27.2158	10.0612
Size	50	12.1663282	21.6100138	16.92337	3.55335105
Growth	50	-0.9989235	0.17038398	0.032907	0.21926913

Descriptive statistics show that the ROA variable has an average of 1.9668 with a standard deviation of 0.94341, reflecting variations in profitability among the banks that were the subject of the study.

$$\boldsymbol{ROA_{it}} = 1.068201 - 0.143431\ ESGit + 0.281621\ CRit - 0.040281\ LRit - 0.257159\ MRit - 0.024388\ BOPOit + 0.102876\ CARit + 0.356672\ CGit + 0.038985\ SIZEit + 0.217717\ GROWTHit - 0.054137\ (ESG \times CG) - 0.278178\ (CR \times CG) + 0.007765\ (LR \times CG) + 0.197986\ (MR \times CG) + 0.001523\ (BOPO \times CG) - 0.098540\ (CAR \times CG) + \varepsilon it \quad (12)$$

Equation (12) above describes that ESG coefficient of -0.143431 indicates that the higher the ESG risk faced by banks, the more significantly ROA tends to decline at a confidence level of 1%. This result is consistent with a previous study by (Eklemet et al., 2024), which shows that poorly managed environmental and social risks can erode bank profitability through increased compliance costs and reputational risk.

Conversely, Credit Risk (CR) has a positive coefficient of 0.281621, but it is not statistically significant. This finding differs from the initial hypothesis and the majority of literature, which states that an increase in NPL generally has a negative impact on bank ROA. However, several international studies have also found that under certain conditions, the NPL ratio can have a positive effect on ROA. Study by (Psaila et al., 2019b) in the Euro-Mediterranean region showed a positive relationship between NPL and ROA at a certain level, indicating that banks with good risk management are still able to maintain profitability even as the level of non-performing loans increases. This finding reinforces the argument that the relationship between credit risk and profitability can be non-linear and highly influenced by management strategies and the macroeconomic context. The results of this study may also be influenced by credit restructuring

policies and government stimulus measures during the COVID-19 pandemic, differences in credit risk management strategies among banks, or loss provisioning mechanisms implemented to maintain profitability. This phenomenon indicates that the impact of credit risk on bank profitability in Indonesia during the observation period has not been fully reflected in ROA.

Liquidity Risk (LR) shows a negative and significant effect on ROA with a coefficient of -0.040281, which supports the notion that poor liquidity management will reduce operational efficiency and hinder profit growth.

The Market Risk (MR) variable, proxied by NIM, shows a negative and significant effect on ROA (β = -0.257159). This finding differs from the initial hypothesis, which predicted a positive effect, as theoretically high NIM usually reflects intermediation efficiency and increased profitability. However, the empirical results of this study align with the findings of (Bouattour et al., 2024; Harb et al., 2023b), which suggest that fluctuations in net interest income or differences in bank management strategies can lead to a negative relationship between NIM and ROA, particularly in dynamic market conditions or amid specific liquidity pressures. These differences may be attributed to the specific characteristics of the Indonesian banking sector, the observation period during the pandemic, or the presence of other external factors that indirectly influence profitability.

Operational risk (BOPO) has a negative coefficient, but it is not significant at the 5% level, indicating that operational cost efficiency does not have a strong enough influence on ROA in this model. CAR has a positive and significant effect on ROA (β = 0.102876; $p < 0.01$), which reinforces the argument that CAR is essential role in maintaining bank profitability against risk exposure. The control variables SIZE and GROWTH do not show statistical significance, although the direction of both coefficients is positive.

Meanwhile, the ESG×CG interaction shows a negative coefficient of -0.054137, which, although not significant, indicates that CG has not been able to effectively moderate the impact of ESG risk on FP (Olowofela et al., 2025). This also applies to the CR×CG and CAR×CG interactions, both of which have negative coefficients, indicating that even in institutions with better governance, the impact of credit risk and CAR on profitability has not shown significant improvement.

Conversely, the MR×CG interaction shows a positive coefficient (β = 0.197986), indicating that good governance has the potential to strengthen banks' ability to manage market risk. These results suggest opportunities for enhancing synergy between risk management strategies and more adaptive governance mechanisms amid market uncertainty.

Thus, the high heterogeneity of several key variables reinforces the methodological rationale for using a panel regression approach in this study. This approach allows researchers to capture time and entity dynamics simultaneously, while improving the precision of estimating relationships between variables in Indonesian banking.

Panel Data Model

This study applies panel data analysis to evaluate the impact of ESG risk, traditional financial risks, and both moderating and control variables on the financial performance of banks in Indonesia. Prior to selecting the most suitable panel data regression model, a series of specification tests were conducted, including the Chow test, Hausman test, and Lagrange Multiplier (LM) test.

The Chow test was employed to determine whether the Common Effect Model (CEM) or the Fixed Effect Model (FEM) was more appropriate. The decision was based on comparing the Chi-Square probability value to a 5% significance level (α = 0.05). If the probability value was less than 0.05, H_0 was rejected, indicating the FEM was preferable. The results showed a Cross-Section Chi-Square probability of 0.0276, which is below 0.05, leading to the rejection of H_0 and the conclusion that the FEM was more appropriate than CEM. However, because FEM may not be

more efficient than the Random Effect Model (REM), the next step was to conduct the Hausman test.

The Hausman test helps to choose between the FEM and REM. If the test's probability value exceeds 0.05, H_0 is accepted, indicating REM is more suitable. Conversely, a probability value below 0.05 leads to the selection of the FEM. In this study, the Hausman test resulted in a Cross-Section Random probability value of 0.1194 > 0.05. Therefore, H_0 is accepted, and REM is considered more appropriate than FEM. To further confirm model selection reliability, the LM test was performed.

The LM test compares the CEM with REM. If the Breusch-Pagan LM test probability value is below 0.05, H_0 is rejected in favor of the REM. If it is greater than 0.05, the CEM is deemed more appropriate. In this research, the LM test showed a Breusch-Pagan Cross-Section probability value of 0.9404, significantly above 0.05, indicating that H_0 is accepted. Thus, the CEM is identified as the most suitable model for this study.

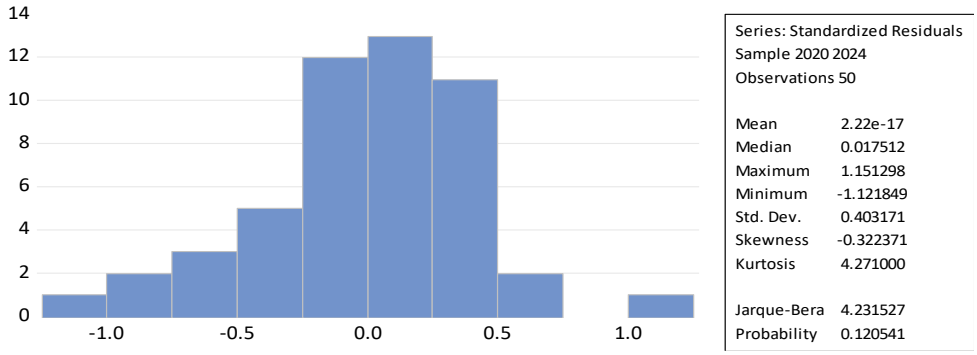
This finding shows that the characteristics of the panel data in this study are more stable in terms of variance over time than between entities, so that the Common Effect model adequately represents the relationship between variables without requiring fixed or random effects. However, to improve the accuracy of the estimation and reduce simultaneous bias and unobserved heterogeneity, in the next stage this model is adapted using the Autoregressive Order 1 (AR(1)) approach.

Classical Assumption Test Results

Classical assumption tests were conducted to ensure that the regression model used in this study met basic statistical requirements, so that the estimation results were reliable and unbiased. Several tests were conducted, including normality, multicollinearity, and heteroscedasticity tests. All tests were conducted at a significance level of 5%.

The purpose of the normality test is to determine if the regression model's residual data is regularly distributed. The Jarque-Bera (JB) method was used to administer the test in this investigation. The residual data is said to be regularly distributed if the probability value is greater than 0.05. According to the test results, the probability value of 0.120541 and the Jarque-Bera value of 4.231527 are both more than 0.05. This suggests that the model's residuals follow a normal distribution. Thus, it may be said that the normalcy assumption is met by the regression model that was employed.

Figure 2 Normality Test



Multicollinearity testing was carried out to identify whether there was a strong correlation among the independent variables in the model. A correlation coefficient greater than 0.80 would indicate the presence of multicollinearity. Conversely, if all coefficients are below 0.80, the model is considered free from multicollinearity. Based on the correlation results among the variables

ESG, CR, LR, MR, BOPO, CG, CAR, GROWTH, and SIZE, all coefficient values fall below the 0.80 threshold. Therefore, it can be concluded that this regression model does not exhibit multicollinearity. This condition confirms that each independent variable contributes uniquely to explaining variations in ROA, without redundant or overlapping effects.

Tabel 2. Correlation Between Independent Variables n

	ESG	CR	LR	MR	BOPO	CG	CAR	GROWTH	SIZE
ESG	1	0.117	0.221	-0.34	0.387	-0.03	0.176	-0.014	-0.161
CR	0.117	1	-0.204	-0.213	0.547	-0.131	-0.409	-0.11	0.026
LR	0.221	-0.204	1	0.184	0.356	-0.193	0.673	0.011	-0.015
MR	-0.34	-0.213	0.184	1	-0.174	0.051	0.389	0.111	-0.241
BOPO	0.387	0.547	0.356	-0.174	1	-0.134	-0.069	-0.134	0.057
CG	-0.03	-0.131	-0.193	0.051	-0.134	1	-0.02	0.09	-0.123
CAR	0.176	-0.409	0.673	0.389	-0.069	-0.02	1	0.119	-0.274
GROWTH	-0.014	-0.11	0.011	0.111	-0.134	0.09	0.119	1	0.283
SIZE	-0.161	0.026	-0.015	-0.241	0.057	-0.123	-0.274	0.283	1

The heteroscedasticity test aims to determine whether there is non-constant variance (heteroscedasticity) in the regression model, which can cause estimates to be inefficient. The test is conducted using the Glejser method, by looking at the probability values of each variable. If the probability value is > 0.05, then there is no heteroscedasticity problem. The test results show that all independent variables, namely ESG Risk, CR, LR, MR, BOPO, CAR, CG, BSIZE, and Growth, have probability values greater than 0.05. Consequently, it may be said that this regression model shows no evidence of heteroscedasticity.

Tabel 3. Heteroscedasticity Test Results

Variables	Probability
ESG	> 0.05
CR	> 0.05
LR	> 0.05
MR	> 0.05
BOPO	> 0.05
CG	> 0.05
CAR	> 0.05
SIZE	> 0.05
GROWTH	> 0.05

Thus, all classical assumptions required in the panel regression model have been met, so the model estimation results can be considered valid and suitable for further analysis. This result is also in line with the research of (Eklemet et al., 2024), which states that the feasibility of panel regression data must first be proven through a series of classical assumption tests to avoid estimation deviations.

Panel Data Regression Analysis

The model estimation used has gone through model selection tests (Chow, Hausman, and LM), as well as classical assumption tests that show that the data is suitable for use in panel models. The regression results show the varying influence of each variable on ROA, both directly and in interaction with CG moderation.

Tabel 4. Panel Data Regression Results

Variables	Coeffiicient	Std. Error	t-Statistic	Prob.
C	1.068201	2.627677	4.065189	0.0003
ESG	-0.143431	0.030359	-4.724495	0
CR	0.281621	0.174587	1.613065	0.116
LR	-0.040281	0.011216	-3.591447	0.001
MR	-0.257159	0.126247	-2.036944	0.0495
BOPO	-0.024388	0.012933	-1.885705	0.0679
CAR	0.102876	0.026834	3.833796	0.0005
CG	0.356672	0.609299	0.585381	0.5622
SIZE	0.038985	0.028283	1.378402	0.1771
GROWTH	0.217717	0.397185	0.548151	0.5872
ESG×CG	-0.054137	0.031739	-1.705725	0.0972
CR×CG	-0.278178	0.24068	-1.155801	0.2558
LR×CG	0.007765	0.013908	0.558283	0.5803
MR×CG	0.197986	0.109474	1.808529	0.0794
BOPO×CG	0.001523	0.013416	0.113507	0.9103
CAR×CG	-0.09854	0.048823	-2.018327	0.0515

The regression results indicate that the ESG Risk variable (Environmental, Social, and Governance Risk) has a significant negative effect on ROA (p-value = 0.000). This suggests that the higher the exposure to ESG Risk in a bank, the more likely its performance is to decline. This finding supports the research of (Bouattour et al., 2024; Defung et al., 2024; Eklemet et al., 2024), who found that exposure to sustainability risk (ESG) directly suppresses bank profitability, especially if not balanced by good governance management.

The Credit Risk (CR) variable, although it has a positive coefficient, is not significant (p = 0.116), indicating that in the context of this study, credit risk does not sufficiently explain individual variations in financial performance. Conversely, Liquidity Risk (LR) has a significant negative effect (p = 0.001), indicating that an excessively high LDR ratio tends to suppress profitability due to increased liquidity pressure. Market Risk (MR) also shows a significant negative effect on ROA (p = 0.0495), indicating that fluctuations in net interest income pose risks that need to be carefully managed.

Meanwhile, the BOPO variable as an indicator of operational risk has a negative direction but is not statistically significant (p = 0.0679). CAR has a significant positive effect (p = 0.0005), reinforcing previous findings that strong capitalization can enhance a bank's resilience and performance. Corporate Governance (CG) as the main moderating variable in this study does not show a significant direct effect on ROA (p = 0.5622), but its interaction with risk variables provides interesting insights.

The ESG×CG interaction (p = 0.0972) shows a negative direction but is not yet significant, meaning that governance practices have not fully been able to moderate the negative impact of ESG Risk on performance. The CAR×CG interaction shows marginal significance (p = 0.0515) and a negative direction, which may indicate the ineffectiveness of governance in managing the influence of capital risk on certain banks. Meanwhile, the MR×CG interaction is close to significant (p = 0.0794), with a positive direction, signaling that governance has the potential to strengthen the positive influence of market risk management on performance.

A T test was conducted to determine the individual effects of each independent variable and interaction on the dependent variable Return on Assets (ROA). The decision criterion is that if the probability value (p-value) < 0.05, then the variable has a significant effect on ROA. The following table presents the complete results of the t-test:

Tabel 4. T test – Panel Regression Results

No	Variables	Coefficient	Std. Error	t-Statistic	Probability
1	C	1.068201	2.627677	4.065189	0.0003
2	ESG	-0.143431	0.030359	-4.724495	0
3	CR	0.281621	0.174587	1.613065	0.116
4	LR	-0.040281	0.011216	-3.591447	0.001
5	MR	-0.257159	0.126247	-2.036944	0.0495
6	BOPO	-0.024388	0.012933	-1.885705	0.0679
7	CAR	0.102876	0.026834	3.833796	0.0005
8	CG	0.356672	0.609299	0.585381	0.5622
9	SIZE	0.038985	0.028283	1.378402	0.1771
10	GROWTH	0.217717	0.397185	0.548151	0.5872
11	ESG×CG	-0.054137	0.031739	-1.705725	0.0972
12	CR×CG	-0.278178	0.24068	-1.155801	0.2558
13	LR×CG	0.007765	0.013908	0.558283	0.5803
14	MR×CG	0.197986	0.109474	1.808529	0.0794
15	BOPO×CG	0.001523	0.013416	0.113507	0.9103
16	CAR×CG	-0.09854	0.048823	-2.018327	0.0515

The simultaneous test (F-test) yielded an F-statistic of 9.236898 with a probability value of 0.000000, indicating that all independent variables collectively have a significant impact on ROA. Additionally, the adjusted R-squared value of 0.716030 suggests that 71.6% of the variation in bank performance is accounted for by the variables included in the model, while the remaining 28.4% is attributed to factors beyond those analyzed in this study.

Overall, the results of this study contribute to the literature by showing that although some financial risks such as ESG, LR, MR, and CAR have a significant effect on ROA, the moderating role of CG is still limited and inconsistent in neutralizing the impact of risk on bank performance. These results align with the studies of (Eklemet et al., 2024; Olowofela et al., 2025), which confirm that the effectiveness of governance moderation is highly dependent on the strength of implementation and the institutional context of each bank. Thus, strengthening governance mechanisms remains an important issue in risk management strategies and improving the performance of the banking sector in Indonesia.

CONCLUSION

This study found that esg risk, liquidity risk, market risk, and capital adequacy ratio (car) significantly affect the financial performance of banks (roa) in commercial banks listed on the idx for the period 2020–2024, while credit risk, operational risk, and control variables do not show a significant effect. An important finding of this study is the positive but insignificant effect of credit risk (cr) on roa, which differs from the initial hypothesis and the majority of the literature that generally shows a negative impact. This is thought to be related to credit restructuring policies and government stimulus during the covid-19 pandemic, as well as varying bank risk management strategies. For market risk (mr), the research results instead show a significant negative impact on roa, contrary to the initial assumption that high nim would enhance profitability, indicating competitive pressure or fluctuations in interest income affecting bank performance during the observation period.

Meanwhile, the moderating role of corporate governance (cg) has not been fully significant in neutralizing the impact of risk on performance, although the interaction with market risk shows the potential for strengthening market risk mitigation through more effective governance. This model explains 71.6% of the variation in bank roa, indicating adequate model strength.

Therefore, this study recommends improving corporate governance quality, strengthening risk management, and the need for further research incorporating external variables or qualitative approaches to capture the evolving dynamics of the banking industry.

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