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The Impact of ESG (*Environmental, Social And Governance*) Implementation on Financial Performance in Mining Companies

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Abstract: The mining industry plays an essential role in the national economy, but it also has severe environmental impacts. Therefore, *Corporate Sustainability Disclosure* (CSD) is needed to ensure transparent, accountable reporting on sustainability risk mitigation and the improvement of companies' *Environmental, Social, and Governance* (ESG) practices. This study aims to analyze the effect of ESG disclosure transparency on the financial performance of mining companies listed on the Indonesia Stock Exchange (IDX) during the period 2018-2023. This study uses secondary data from annual, financial, and sustainability reports from the IDX and from companies' financial reports. The research sample comprises 40 companies selected through purposive sampling. This study uses panel data regression analysis with the Fixed-Effects and Random-Effects models selected via the Hausman test. The results of this study indicate that the level of sustainability disclosure and ESG scores of mining companies have increased consistently since 2020. The analysis results indicate that ESG disclosure has a positive and significant effect on ROA and ROE, suggesting that ESG transparency can enhance operational efficiency, strengthen risk management, and increase investor confidence.

Keywords: ESG Disclosure, Mining Industry, Profitability, Panel Data Regression, Sustainability Reporting.

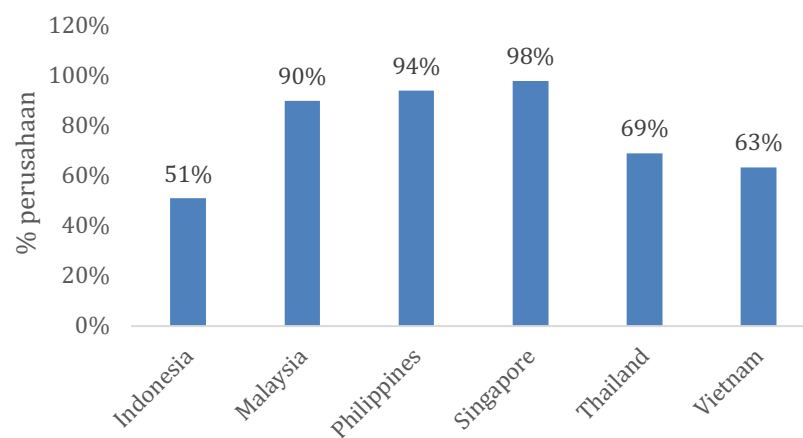
INTRODUCTION

The mining industry is a major contributor to economic growth and improved welfare when managed effectively. With responsible management, the mining sector can support sustainable development and reduce poverty while preserving ecosystems (International Council on Mining and Minerals, 2012). In Indonesia, the performance of the mining industry is reflected in the realisation of non-tax state revenue (PNBP) in the mineral and coal subsector, which has consistently exceeded the government's target since 2021, reaching 193% and 171% in 2022. Despite declines in 2023 and 2024 due to commodity price fluctuations, revenue realisation has remained above target each year. While it offers economic benefits, the mining sector also causes significant social and environmental impacts, including deforestation, water and soil pollution, and biodiversity loss (Justin Caron and James R. Markusen, 2024). The Environmental Performance Index (EPI) is a comprehensive data-based indicator that evaluates

a country's sustainability level across various environmental issue categories, serving as a national measurement tool and global benchmark for assessing and improving environmental performance in the context of sustainable development (Block et al., 2025). Many companies are increasingly recognizing that achieving their future will be challenging without attention to environmental, social, and governance (ESG) factors (Alsayegh et al., 2020). ESG has become a key element in assessing a company's sustainability strategy and a tool for investors to evaluate its non-financial performance (Capizzi et al., 2021). This assessment is conducted using indicators that measure corporate performance from environmental, social, and governance perspectives (Hao et al., 2022).

Although the mining industry contributes significantly to state revenue, it also has a profound environmental impact, necessitating *Corporate Sustainability Disclosure* (CSD) to ensure transparent and accountable reporting on sustainability risk mitigation and the improvement of corporate ESG practices (Perdana et al., 2024). Various studies show that implementing and disclosing ESG can positively contribute to company performance. Research by Yun and Lee (2022) shows that ESG practices increase return on assets (ROA) and return on equity (ROE), while Zhao et al. (2018) find that higher ESG scores correlate with greater profitability. The results of a study by Giese et al. (2019) also show that ESG-based investments increase firm valuation while reducing risk, consistent with Cho's (2022) findings that sustainability performance positively affects stock returns. A study explicitly evaluating the impact of ESG disclosure on company performance was conducted by Dorothy and Endri (2024), although its scope remains limited to financial performance.

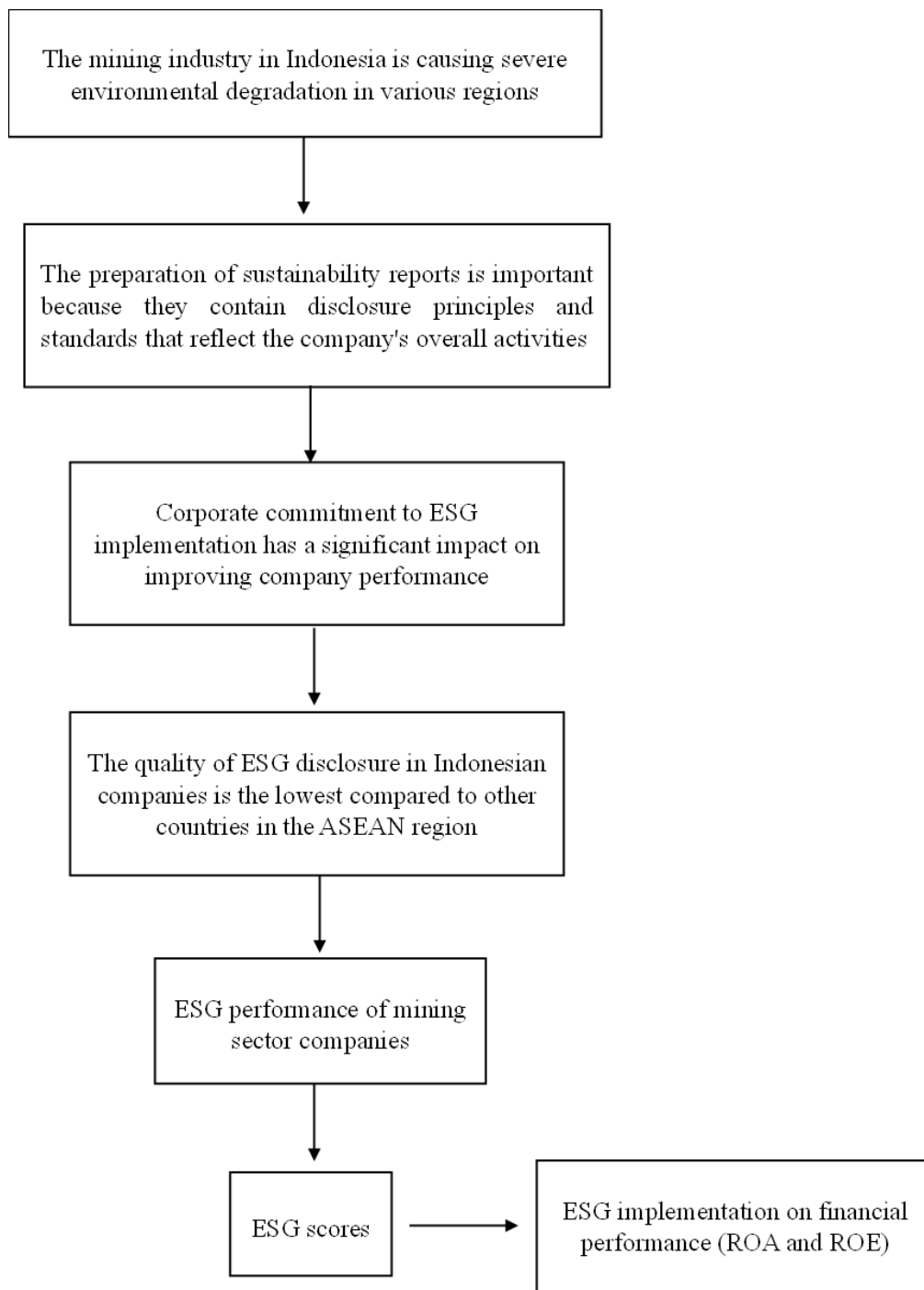
However, the quality of ESG disclosure among companies in Indonesia is the lowest among ASEAN countries. Based on research by Loh and Singh (2020), Indonesia has the lowest level of ESG disclosure completeness, with only 51% of companies achieving complete disclosure quality.



Source: Loh & Singh (2020)

Figure 1. Percentage of ESG disclosure completeness in the ASEAN region

Based on research by Loh & Singh (2020), the Indonesia Stock Exchange (IDX) uses ESG risk ratings from Morningstar Sustainalytics to assess companies' environmental, social, and governance risks and to inform investment decision-making. This assessment is conducted using the concept of risk decomposition, in which companies face two dimensions of ESG issues: exposure and management. *Exposure* is the material ESG risk faced by companies and affects ESG risk assessment. In contrast, management is the commitment and concrete actions of companies to address ESG issues through various company policies and work programs. Based on the ESG risk assessment, companies can be grouped into five risk categories, namely: *negligible* (<10), *low* (10-20), *medium* (20-30), *high* (30-40), and *severe* (>40).



Source: Yun & Lee (2022), Zhao et al. (2018), Giese et al. (2019)

Figure 2. Conceptual Framework

METHOD

This study discusses the effect of ESG disclosure transparency on the financial performance of mining companies listed on the Indonesia Stock Exchange (IDX). The data used in this study are secondary data sourced from financial reports, annual reports, sustainability reports, and publications on the IDX website and the companies' official websites. The population of this study is all mining companies listed on the IDX, and the research sample was selected using purposive sampling with the following criteria:

1. The company has been consistently listed on the Indonesia Stock Exchange from 2018 to 2023. The reason for choosing these years is that in Indonesia, the Financial Services Authority (OJK) issued Regulation No. 51/2017 in 2017, requiring all public companies

to publish their sustainability performance starting in 2021, which was then postponed to 2022 due to the COVID-19 pandemic. Thus, the period from 2018 to 2023 marks the development of ESG reporting among companies in Indonesia.

2. Companies publish financial reports, annual reports, and sustainability reports.

Based on the specified criteria, 40 companies were selected as samples for this study.

ESG transparency assessment is conducted by analyzing the content of companies' annual sustainability reports. Research on the use of GRI standards to assess ESG scores has also been conducted by Abdi et al. (2022) and Gjergji et al. (2021). The indicators in the GRI Standards then serve as guidelines for compiling companies' ESG disclosure scores. The GRI *standard* has changed, specifically from the 2016 GRI *standard* to the 2021 GRI *standard*. Thus, there are differences in the number of items disclosed across dimensions.

The score for each ESG pillar (environment, social, governance) is the number of indicators disclosed per pillar, divided by the total number of indicators that should be disclosed. The total ESG score is the weighted sum of the pillar scores. This is due to the change from the GRI 2016 standard to the GRI 2021 standard. Mathematically, this can be written as follows:

For each pillar P (*environment, social, governance*), the set of GRI items that should be disclosed (index) by company i, in period t, for pillar P. Then $I_{i,t,P}$ = the number of items that should be disclosed (index), the indicator variable (*dummy*) for the disclosure of each item can be written as:

$$x_{i,t,P,k} = \begin{cases} 1, & \text{if item } k \in J_{i,t,P} \text{ is disclosed} \\ 0, & \text{if item } k \in J_{i,t,P} \text{ is not disclosed} \end{cases}$$

Disclosure (D) Pilar P:

$$D_{i,t,p} = \sum_{k \in J_{i,t,P}} x_{i,t,P,k}$$

The score per pillar can be written as follows:

$$Score_{i,t,p} = \frac{D_{i,t,p}}{I_{i,t,p}}, P \in \{E, S, G\} \text{ (defined } I_{i,t,p} > 0)$$

The total ESG disclosure score is not the sum of the scores for each of the E, S, and G pillars, but rather the weighted average based on the proportion of the number of items in each pillar. Mathematically, the ESG score can be written as follows:

$$Score_{i,t}^{ESG} = \sum_{P \in \{E,S,G\}} \left(\frac{I_{i,t,P}}{I_{i,t}^{ESG}} \right) Score_{i,t,P}$$

Where:

- $Score_{i,t}^{ESG}$: ESG disclosure score of firm i in period t.
- $I_{i,t,P}$: Number of disclosure items that should be reported (index items) by firm i in period t for pillar P.
- $I_{i,t}^{ESG}$: Total number of ESG disclosure items that should be reported (index item) by firm i in period t.
- $Score_{i,t,P}$: Disclosure score of firm i in period t for pillar P.
- $P \in \{E, S, G\}$: Pillar representing Environmental, Social, and Governance dimensions.

Table 1. Operational Definition of Research Variables

Panel Data Regression

No	Variabel	Formula	Referensi
Dependent:			
1	ROA	$ROA = \frac{Net\ Income}{Total\ Assets}$	Gitman dan Zutter (2015), Nareswari <i>et al</i> (2023)
2	ROE	$ROE = \frac{Net\ Income}{Total\ Equity}$	Gitman dan Zutter (2015), Rahim <i>et al</i> (2024)
Independent			
3	ESG	$Score_{i,t}^{ESG} = \sum_{P \in \{E,S,G\}} \left(\frac{I_{i,t,P}}{I_{i,t}^{ESG}} \right) Score_{i,t,P}$	Abdi <i>et al</i> (2022), Gjergji <i>et al.</i> (2020)
Control			
4	SIZE	$SIZE = Ln\ Total\ asset$	Dorothy dan Endri (2024), (Perdana <i>et al.</i> , 2024)
5	Leverage	$Leverage = \frac{total\ liabilities}{total\ equity}$	Damodaran (2012), Cho (2022)
6	Likuiditas	$Likuiditas = \frac{current\ asset}{current\ liability}$	Alsayegh <i>et al</i> (2020), De Lucia <i>et al</i> (2020)
7	CAPEX	$CAPEX = \frac{fix\ asset}{total\ asset}$	Niblock (2024), Ferrero <i>et al</i> (2016).

According to Gujarati and Porter (2009), panel data analysis is an econometric method for cross-sectional data on individuals, firms, or countries over multiple time periods (time series). According to Verbeek in Firdaus (2011), the advantage of using panel data over time-series or cross-sectional data alone is that combining time-series and cross-sectional data increases the number of observation units. The marginal effect of the independent variable can be examined across two dimensions: individuals and time. Panel data is also more informative and can accommodate both time-series and cross-sectional data. First, combining time-series and cross-sectional data will increase the number of observation units. The marginal effects of the independent variables can be seen in two dimensions: individuals and time. Panel data is also more informative and can accommodate unobservable individual (company) heterogeneity. The selection of the best panel data regression model is carried out through two approaches, namely the fixed effect model and the random effect model (Gujarati & Porter, 2009):

1. Fixed effect model (FEM)

FEM models fixed differences in unobserved characteristics (*i.e.*, *unobserved individual heterogeneity*) across entities by assigning each entity a distinct intercept. At the same time, the slope coefficient is assumed to be the same across entities. In other words, *unobserved individual heterogeneity* is part of the intercept. This causes the intercept for each company to differ. Operationally, the general approach is Least Squares Dummy Variables (LSDV).

2. Random effects model/REM

The Random Effects Model (REM) in panel data treats differences between entities (unobserved individual heterogeneity) as a random component of the error term. The key assumption is that the unobserved individual-heterogeneity component is uncorrelated with the regressor (independent variable) in the model.

Furthermore, the selected model must be shown to satisfy the Gauss-Markov condition, which requires a series of panel-data-specific assumption tests, namely, tests for heteroscedasticity and multicollinearity. The residual normality test is not necessary because the number of observation units (firm-year) is >30, so based on the central limit theorem, the data is assumed to be normally distributed.

ROA financial performance model

$$1. ROA_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t-1} + \alpha_2 SIZE_{i,t} + \alpha_3 LEV_{i,t} + \alpha_4 LIQ_{i,t} + \alpha_5 CAPEX_{i,t} + \alpha_6 GROWTH_{i,t} + \alpha_7 COV_{i,t} + \varepsilon_{i,t}$$

$$2. ROA_{i,t} = \alpha_0 + \alpha_1 E_{i,t-1} + \alpha_2 S_{i,t-1} + \alpha_3 G_{i,t-1} + \alpha_4 SIZE_{i,t} + \alpha_5 LEV_{i,t} + \alpha_6 LIQ_{i,t} + \alpha_7 CAPEX_{i,t} + \alpha_8 GROWTH_{i,t} + \alpha_9 COV_{i,t} + \varepsilon_{i,t}$$

ROE financial performance model

$$3. ROE_{i,t} = \beta_0 + \beta_1 E_{i,t-1} + \beta_2 E_{i,t-1} + \beta_3 E_{i,t-1} + \beta_4 SIZE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 LIQ_{i,t} + \beta_7 CAPEX_{i,t} + \beta_8 GROWTH_{i,t} + \beta_9 COV_{i,t} + \varepsilon_{i,t}$$

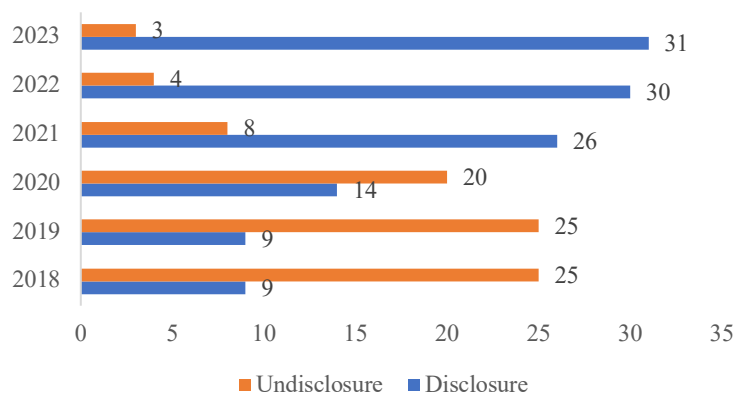
$$4. ROE_{i,t} = \beta_0 + \beta_1 ESG_{i,t-1} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 LIQ_{i,t} + \beta_5 CAPEX_{i,t} + \beta_6 GROWTH_{i,t} + \beta_7 COV_{i,t} + \varepsilon_{i,t}$$

Where:

- ROA_{i,t} : Return On Assets of firm i, period t
- ROE_{i,t} : Return On Equity of firm i, period t
- ESG_{i,t} : ESG disclosure score of firm i in period t
- SIZE_{i,t} : Firm size of firm i in period t
- LEV_{i,t} : Leverage of firm i, period t
- LIQ_{i,t} : Liquidity of firm i in period t
- CAPEX_{i,t} : Capital expenditure intensity of firm i in period t
- GROWTH_{i,t} : Firm growth of firm i in period t
- α₀, β₀, γ₀ : Constants (intercepts)
- α₁ – α₆ : Coefficients model 1
- β₁ – β₆ : Coefficients model 2
- ε_{i,t} : error term

RESULTS AND DISCUSSION

The implementation of sustainable practices in the mining sector is becoming an increasingly important concern in Indonesia, both in terms of regulations and stakeholder demands. The mining industry has significant environmental and social impacts; therefore, implementation and transparency in environmental management, social relations, and corporate governance are crucial to maintaining operational sustainability. To that end, the submission of Sustainability Reporting (SR) has become a strategic instrument for companies to demonstrate their commitment to responsible business practices. Over time, mining companies listed on the Indonesia Stock Exchange have been increasingly encouraged, and even required, to present sustainability information in their public reports.



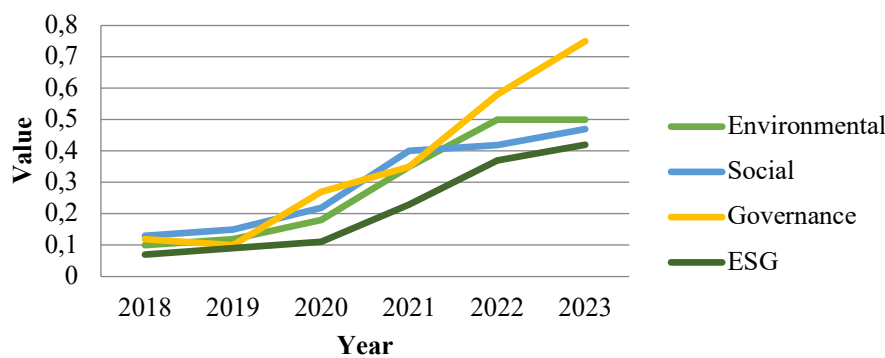
Source: Indonesian Stock Exchange (IDX)

Figure 3. Number of corporate sustainability reports published between 2019 and 2024

Based on Figure 3, the level of sustainability reporting (SR) disclosure by mining companies on the IDX has increased significantly over the last 6 years. In 2018 and 2019, only 26% of mining companies disclosed sustainability reports, while 74% did not. In 2020, the disclosure rate increased to 41%, indicating a serious commitment to ESG implementation. This trend accelerated sharply in 2021, with 76% of companies already disclosing, rising to 88% in 2022 and 91% in 2023. Overall, the proportion of companies that have not disclosed information has declined significantly, from 74% in 2023 to 9% in 2023.

This development aligns with Husnah's (2023) research on the Indonesian mining sector, which shows that companies are increasingly integrating sustainability principles and ESG disclosure into their business strategies to maintain public legitimacy while increasing transparency into the environmental and social impacts of mining operations.

ESG Components Trend (2018–2023)



Source: The data is processed

Figure 4. Development of company ESG pillar scores from 2018 to 2023

Figure 4 shows the average development of the *environmental*, *social*, and *governance* scores of mining companies listed on the Indonesia Stock Exchange from 2018 to 2023. In general, the three ESG pillars have experienced a consistent upward trend each year. This reflects an increase in mining companies' commitment to sustainability, in line with the growing attention of regulators, investors, and the public to the environmental and social impacts of mining activities. Although the increase in ESG scores in the early phase (2018–2019) was still relatively small, the movement became more pronounced in 2020, marking the start of a sharp rise across all components.

The ESG scores for the mining sector show different patterns of improvement across components. The environmental (E) score has increased sharply since 2020, reflecting improved environmental management practices in the wake of the pandemic and increased demands for accountability for ecological risks. The social (S) score has risen gradually, indicating improvements in social responsibility programs, occupational safety, and community relations in mining areas. The governance (G) component has experienced the most significant increase since 2020, reaching its highest score in 2023. This reflects corporate governance structures, including board independence, transparency of information, anti-corruption policies, and effective internal oversight. Good governance is the foundation of business sustainability and an essential factor for investor confidence.

Panel Data Regression Analysis

To choose between the FEM and REM models, the Hausman specification test is conducted, a panel-data specification test that determines between Fixed Effects (FE) and Random Effects (RE) by examining whether the difference between the FE and RE coefficients is systematic. The hypothesis in the Hausman test is:

H0: *random effect model*
 H1: *fixed effect model*

Table 2. Hausman Test Result

No	Dependent variable	P-value	Interpretation
1	<i>Return on assets (ROA)</i>	0.1218	REM
2	<i>Return on equity (ROE)</i>	0.0291	FEM

The Hausman test results in Table 6 indicate that the choice of panel data model differs across the dependent variables analysed. For ROA, the p-value of 0.1218 exceeds the significance level of 0.05, so the appropriate model is the Random Effects Model (REM). Conversely, for the ROE model, the p-value of 0.0291 is smaller than the 0.05 significance level, indicating that the Fixed Effect Model (FEM) is more appropriate. Furthermore, the Tobin's Q model has a p-value of 0.4667, which exceeds the significance level of 0.05; therefore, REM is again the relevant model.

Table 3. Significance of the Model

Criteria	Model	
	ROA	ROE
<i>F statistic</i>	44.365	9.588
<i>Prop F-statistic</i>	0	0
<i>R-square</i>	0.071	0.82

Based on the significance test results in Table 7, all regression models have an F-statistic with a p-value of 0.000, which is smaller than the 5% significance level. This indicates that the independent variables are jointly significant; therefore, the regression model is deemed suitable for further analysis.

Table 4. Panel Data Regression Results

Variable	ROA	ROE
ESG Score	0.098**	0.357**
LIKUIDITAS	0.016***	0.006
GROWTH	0.0002912**	0.001***
CAPEX	-0.068	0.15
SIZE	0.023	-0.026
LEVERAGE	-0.103***	-0.408
COVID	0.026*	0.02
CONSTANT	-0.57	0.986

*** $p < .01$, ** $p < .05$, * $p < .1$

In the ROA model, the *F-statistic* is 44.365, and the R-square is 0.071. This means that the independent variables in the model explain 7.1% of the variation in ROA, while factors outside the research model explain the remaining variation. Furthermore, the model with ROE as the dependent variable yields an F-statistic of 9.588 and an R-square of 0.820. This condition indicates that the independent variables in the model explain 82% of the variation in ROE.

Discussion

ROA measures the ability of assets to generate profits, so a company's success in optimizing its resources (assets) will be reflected in an increase in ROA. The integration of ESG practices has the potential to increase ROA through several mechanisms: (1) operational efficiency and energy management, where better environmental practices encourage waste

reduction and efficient energy use, thereby reducing the company's operating costs; (2) stronger operational risk management, as good social and governance practices minimize operational disruptions, lawsuits, and workplace accidents.

The findings of this study also support the argument of Rabaya & Saleh (2022), who state that ESG implementation, as reflected in ESG disclosure, makes the company superior to others. ESG information disclosure makes companies more accountable and attractive to investors, leading to greater consumer loyalty and enhancing the company's reputation while maintaining stakeholder trust. Masliza et al. (2021) also state that ESG implementation will make companies more competitive than those that do not implement it.

ROE reflects the rate of return to shareholders. The impact of ESG on ROE can arise from increased investor confidence and preferences, whereby investors are increasingly attracted to companies with strong ESG commitments because they are perceived to have lower long-term risks. Second, good governance signals strong management quality to creditors and investors, thereby reducing funding costs and increasing profitability.

In the context of developing countries, these findings align with the results of Patel & Kumar (2024), who conducted research on 10 metal companies in India. The study found that ESG scores have a significant positive effect on the ROA and ROE of metal companies in India. This means that these companies are more profitable and provide greater returns to shareholders. This study is also consistent with the research by De Lucia et al. (2020), which examined a sample of 1,038 public companies in Europe during 2018-2019 and found a positive relationship between ESG variables and financial performance (ROA and ROE).

CONCLUSION

This study found that the level of disclosure of sustainability reports by mining companies increased significantly during 2018–2023. During this period, the proportion of companies reporting ESG rose dramatically to 91% in 2023, and the average ESG score (particularly governance) showed a consistent upward trend each year. In other words, mining companies on the IDX have significantly strengthened their ESG implementation in recent years. ESG has a positive and significant effect on company financial performance (ROA and ROE). This means that the higher a mining company's transparency and ESG commitment, the more effectively its assets generate profits and achieve returns on equity. These findings indicate that ESG implementation increases corporate profitability by improving operational efficiency and risk management.

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