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Financial Performance and Firm Value: The Moderating Role of ESG Disclosure in Indonesian Mining Firms

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ABSTRACT

Purpose: This study examines whether Return on Assets (ROA) affects firm value (Tobin's Q) and whether Environmental, Social, and Governance (ESG) disclosure moderates this effect in Indonesian mining firms.
Methodology: An explanatory quantitative design with secondary data was applied to nine mining firms listed on the Indonesia Stock Exchange that issued complete annual and sustainability reports in 2021–2025 (45 firm-year observations). ESG disclosure was scored by content analysis of the 30 indicators of the National Association of Securities Dealers Automated Quotations (NASDAQ) ESG Reporting Guide 2.0. Moderated panel regression was estimated in EViews, and the Chow and Hausman tests selected the fixed effect model.
Results: ROA has a positive but insignificant effect on Tobin's Q (coefficient 0.433, $p = 0.176$). The ROA × ESG interaction is positive (3.722) but not significant at the 5% level ($p = 0.070$). The model is jointly significant (adjusted $R^2 = 0.809$), largely because of firm fixed effects.
Conclusions: The evidence is insufficient to conclude that ROA influences firm value or that ESG disclosure alters that influence at the 5% level.
Limitations: The sample is small, the period is short, no control variables are included, and the binary disclosure index varies little across firms.
Contribution: The study tests ESG disclosure as a moderator, not a direct predictor, with recent evidence from a commodity-exposed extractive industry.

Keywords: *ESG Disclosure, Financial Performance, Firm Value, Mining, Return on Assets, Tobin's Q*

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1. Introduction

In 2025, nickel mining in Raja Ampat Regency, Southwest Papua, became a matter of national concern when the Indonesian government revoked four Mining Business Permits (*Izin Usaha Pertambangan*/IUP) operating in the area. The decision followed an evaluation of environmental and technical aspects and took into account input from communities and local government (Kementerian, 2025). The episode shows that a mining company is no longer judged only by its

ability to generate economic benefits; it is also judged by how it manages environmental and social impacts and how well it is governed.

This shift in expectations has reached capital markets. Evidence from other markets indicates that investors respond to sustainability information: mutual funds ranked as highly sustainable attracted net inflows while low-ranked funds suffered outflows, firms with higher social capital earned better stock returns during the 2008–2009 financial crisis, and ESG performance helped stocks withstand the COVID-19 shock in China (Hartzmark, & Sussman, 2019; Lins, Servaes, & Tamayo, 2017; Broadstock, Chan, Cheng, & Wang, 2021). Firms with stronger corporate social responsibility also show lower systematic risk and higher valuation (Albuquerque, Koskinen, & Zhang, 2019). Investors therefore look beyond current earnings to how a firm sustains its performance and manages future risks (Nafisah, 2025). When a firm is perceived as exposed to high risk or as lacking sustainable business practices, investor confidence may erode and market valuation may suffer.

These dynamics are especially relevant in Indonesia, where mining is a strategic sector. According to Badan Pusat Statistik, the output value of the six main mineral and coal mining activities rose from about IDR 832.34 trillion in 2020 to IDR 1,454.77 trillion in 2021 and IDR 3,165.81 trillion in 2022, before declining to IDR 2,823.76 trillion in 2023 and IDR 2,074.32 trillion in 2024. The scale of this activity enlarges the potential environmental and social impact of mining, so firms are expected not only to create economic profit but also to run responsible and sustainable businesses (Arofah & Khomsiyah, 2023).

Firm value expresses how the market perceives the condition and future prospects of a company. A high value indicates strong investor confidence in the firm's ability to create sustainable economic value, whereas a low value reflects weak market appreciation of its prospects and performance (Xaviera & Rahman, 2023). This study measures firm value with Tobin Q, which compares the market value of a firm with the value of its assets and therefore shows how the market values the firm relative to the resources it controls (Dzahabiyya, Jhoansyah, & Danial, 2020).

Financial performance is one of the factors expected to shape firm value. It reflects how well a firm uses its resources to earn profit, and a widely used indicator is ROA, which measures the profit generated from total assets. A higher ROA means that assets are used more efficiently and sends a positive signal to investors, whereas a declining ROA may indicate weaker earning capacity and may eventually depress market valuation (Bancin, Sitohang, Bangun, Situmorang, & Permana, 2025; Lutfi, & Panuntun, 2024). Table 1 presents the average ROA and Tobin Q of the nine mining companies analyzed in this study for 2021–2025.

Table 1. Average Return on Assets (ROA) and Tobin's Q of the sampled mining companies, 2021–2025

Year	Average ROA	Average Tobin Q
2021	0.2006	0.7341
2022	0.2932	0.7404
2023	0.1734	0.5840
2024	0.1403	0.5656
2025	0.0939	0.5671

Between 2021 and 2024 the two series moved broadly in the same direction. Average ROA rose from 0.2006 in 2021 to 0.2932 in 2022, accompanied by a small increase in average Tobin Q from 0.7341 to 0.7404, and both then declined through 2024. In 2025, however, average ROA continued to fall to 0.0939 while average Tobin Q edged up to 0.5671. This divergence in the final year suggests that factors other than profitability also influence the market valuation of mining firms,

which is consistent with the view that investors weigh more than financial information when assessing long-term development (Lutfi & Panuntun, 2024).

One factor that has attracted growing attention is ESG. As sustainable investing has developed, investors have begun to consider how firms manage environmental risk, fulfil social responsibilities, and apply good governance when they make investment decisions (Rahmansyah & Mutmainah, 2024). The risk profile of mining makes ESG particularly important for the sector. Katadata Insight Katadata (2025) reports that the median ESG score of mining companies increased from 50.22 in 2023 to 50.50 in 2024 and 58.21 in 2025, which suggests that mining firms are paying more attention to sustainability practices. In Indonesia, Financial Services Authority Regulation No. 51/POJK.03/2017 on sustainable finance requires issuers and public companies to prepare sustainability reports, so sustainability information has become part of the information that firms deliver to investors (Peraturan, 2017). ESG disclosure may therefore influence how the market interprets financial performance.

Previous studies of financial performance, ESG, and firm value have produced mixed results. Arofah and Khomsiyah (2023) found that good corporate governance and ESG had no direct effect on firm value, although ROA moderated the relationship. Kartika, Hudaya, and Septianingsih (2024) reported that ESG, ROA, and return on equity (ROE) positively and significantly affected firm value, while Tanjaya and Ratmono (2024) found that ESG had no significant effect on firm performance. Meini and Setijaningsih (2024) concluded that ESG raises firm value in Indonesia, but Xaviera and Rahman (2023) showed that the aggregate effect of ESG performance is not significant and depends on governance and on the firm's life cycle.

This inconsistency motivates the present study, which differs from earlier work in two respects. First, it treats ESG disclosure as a moderating variable that may strengthen or weaken the effect of ROA on firm value, whereas most earlier studies treat ESG as an independent variable. Second, it focuses on mining companies listed on the Indonesia Stock Exchange (IDX) in 2021–2025, an extractive industry that attracts intense scrutiny of its environmental impact and that operates under the sustainability reporting rules mentioned above. The study asks whether ROA affects firm value and whether ESG disclosure moderates the effect of ROA on firm value in these companies. The remainder of the article reviews the literature and develops the hypotheses, describes the methodology, presents and discusses the results, and closes with conclusions, limitations, and suggestions.

2. Literature Review and Hypotheses Development

2.1 Theoretical background

2.1.1 Signaling Theory

Signaling theory explains how the party that holds private information (the sender) transmits signals that reveal its quality to the receiver, who then uses them in decision making. In capital markets, management conveys the prospects of the firm to investors through financial reports, and investors build these signals into their valuation (Wicaksono & Mispiyanti, 2020). From this perspective, strong profitability signals sound fundamentals and positive prospects. ESG disclosure is an additional signal: it can reduce information asymmetry between the firm and investors and increase the credibility of the firm's financial information (Fatemi et al., 2018; Nafisah, 2025). ESG disclosure is therefore positioned in this study as a variable that may change how strongly the market responds to the profitability signal.

2.1.2 Stakeholder Theory

Stakeholder theory holds that a company is accountable not only to its shareholders but also to every party affected by its activities, such as employees, communities, government, and the environment, and that it must balance these interests to keep operating and to create long-term value (Najwa, 2025). Mining firms operate under permits granted by the government and in communities close to extraction sites, so pressure from investors, regulators, and communities pushes them to demonstrate accountability through comprehensive ESG disclosure and not through financial statements alone (Dyck et al., 2019). Susanto et al. (2026) found that ESG positively moderated the

relationship between financial performance and firm value among industrial-sector firms listed on the IDX, which indicates that stakeholders value ESG disclosure as evidence of commitment to sustainable development.

2.2 Firm Value and Financial Performance

Firm value is an external assessment that integrates the market value of a firm's shares with the financial position reported in its statements. Using financial statement data in this way gives the market a measurable basis for judging efficiency and growth potential beyond recorded book values (Krismiaji & Kusumadewi, 2020). Tobin Q is a market-based measure that compares the market value of a firm with the value of its assets, treating asset value as an approximation of replacement cost, and it describes how the market values a firm relative to its assets (Dzahabiyya et al., 2020). Higher firm value reflects greater investor confidence in the firm's ability to maintain operating stability and achieve sustained growth (Lutfi & Panuntun, 2024).

Profitability is one of the main determinants of firm value because it shows the ability of a firm to earn profit from its sales, assets, and capital, and a high level of profitability can raise investor confidence and demand for the firm's shares (Bancin et al., 2025; Wicaksono & Mispiyanti, 2020). ROA is the ratio of net income after tax to total assets and indicates how efficiently management uses the firm's entire asset base to generate profit. It is therefore a direct proxy for financial performance and is the one used in this study.

2.3 ESG Disclosure

According to Nasdaq (2019), ESG is a set of environmental, social, and governance factors that can affect a company's ability to create value over the long term. The disclosure of such information complements the financial statements by showing how the firm manages the effects of its operations on the environment, society, and its own governance (Meini & Setijaningsih, 2024). In Indonesia, firms disclose ESG information in sustainability reports or annual reports under Financial Services Authority Regulation No. 51/POJK.03/2017 (Peraturan Otoritas Jasa Keuangan Nomor 51/POJK.03/2017, 2017). This study measures ESG disclosure with the NASDAQ ESG Reporting Guide 2.0, which organizes disclosure into environmental, social, and governance dimensions with 30 indicators and links them to international reporting frameworks such as the Global Reporting Initiative and the Sustainability Accounting Standards Board (Nasdaq, 2019).

2.4 Previous studies

A sizeable literature relates ESG to performance and value, and its conclusions depend on the context and on the performance measure used. Velte (2017), using German firms, found a clearer link between ESG performance and accounting-based returns than between ESG performance and Tobin Q. Buallay (2019) examined ESG disclosure against operational, financial, and market performance in European banks, and Alareeni and Hamdan (2020) studied the effect of ESG on the performance of US S&P 500 firms. Aboud and Diab (2018) analyzed the value relevance of social, environmental, and governance disclosure in Egypt, an emerging market, while Wong et al. (2021) reported that ESG certification is associated with higher firm value. Aydoğmuş et al. (2022) found that overall ESG scores are positively and significantly related to both firm value and profitability. Duque-Grisales and Aguilera-Caracuel (2021) tested the relationship between ESG scores and financial performance in Latin American multinationals and examined the moderating roles of geographic international diversification and financial slack. Fatemi et al. (2018) found that disclosure moderates the relationship between ESG performance and firm value, and in particular reduces the adverse effect of ESG weaknesses. Garcia and Orsato (2020) tested whether the link between ESG and financial performance differs with the institutional setting of the country, and Pedersen et al. (2021) modeled how investors who care about ESG trade ESG scores against financial returns, so that ESG characteristics enter the way firms are priced. In reviews of the accounting and finance literature, Brooks and Oikonomou (2018) concluded that the evidence on ESG disclosure, ESG performance, and firm value remains mixed, and Gillan et al. (2021) noted that the relation between ESG and firm outcomes depends on how ESG is measured and on the setting studied.

Indonesian studies show the same inconsistency. Arofah and Khomsiyah (2023) reported that neither good corporate governance nor ESG significantly affected firm value, while ROA strengthened the effect of governance on firm value. Kartika et al. (2024) found that ESG had a positive and significant effect on Tobin Q, that ROA and ROE were also significant, that growth was not, and that dividend policy moderated the effect of ESG. Tanjaya and Ratmono (2024) showed that overall ESG performance did not affect ROA, ROE, or Tobin Q in the full sample and before the COVID-19 pandemic; during the pandemic ESG affected ROA and ROE but not Tobin Q, and board size did not moderate these relationships. Meini and Setijaningsih (2024) found that ESG performance raises firm value in Indonesia and Singapore, that the environmental and governance pillars matter most to investors, and that the effect is larger in Indonesia. Xaviera and Rahman (2023) found no significant aggregate effect of ESG on firm value in Indonesia; the governance dimension was positive and significant, the environmental dimension negative, the social dimension insignificant, and the effect of ESG was positive only in the growth stage of the life cycle. Nafisah (2025) studied ESG disclosure and firm value with firm size as a moderator, Rahmansyah and Mutmainah (2024) studied ESG disclosure and financial performance with sharia compliance as a moderator, and Najwa (2025) examined corporate social responsibility and governance in relation to the value of mining firms listed on the IDX in 2021–2023.

Evidence on the profitability–value link is also mixed. Rosidah and Priono (2026) found that ROA has a positive and significant effect on firm value measured by Tobin Q, whereas Dewi et al. (2023) found that ROA has a negative and significant effect. Lutfi and Panuntun (2024) treated firm value as an outcome of profitability ratios, and Bancin et al. (2025) and Wicaksono and Mispiyanti (2020) included profitability among the determinants of firm value. Evidence on the moderating role of ESG is scarcer. Susanto et al. (2026) found a positive moderating role of ESG between financial performance and firm value among industrial-sector firms on the IDX, whereas Arofah and Khomsiyah (2023) placed financial performance, not ESG, in the moderating position.

Taken together, the studies above leave three gaps. The results on whether ESG affects firm value, and whether profitability affects it, are inconsistent. Most studies treat ESG as an independent variable or position financial performance as the moderator. And few studies examine the combined effect of ROA and ESG disclosure on Tobin Q in the mining sector, where environmental scrutiny is highest, for the period 2021–2025. This study addresses these gaps by testing ESG disclosure as a moderator of the effect of ROA on Tobin Q in Indonesian mining companies.

2.5 Conceptual framework and hypotheses

The conceptual framework is shown in Figure 1. Following signaling theory, a high ROA is read by the market as a sign of sound fundamentals and efficient operations, which should raise investor confidence, share demand, and therefore firm value (Tobin Q). However, the effect of profitability may not be uniform across firms, because investors also consider how profit is earned and whether the firm operates sustainably. Following stakeholder theory, firms that disclose more ESG information are seen as more transparent, more responsible, and better able to manage non-financial risks. ESG disclosure is therefore expected to change how strongly the market translates ROA into firm value.

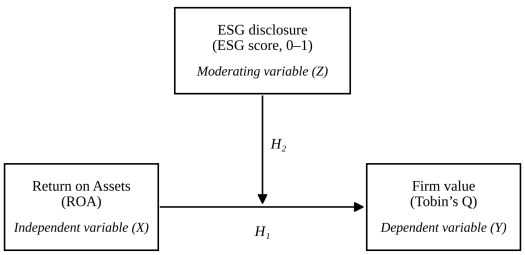


Figure 1. Conceptual framework

ROA shows the capability of a firm to generate profit from its assets. Under signaling theory, information about profitability reaches investors as a signal about the fundamental condition and prospects of the firm and can be reflected in market valuation, here measured by Tobin Q. The empirical evidence, however, points in different directions: Rosidah and Priono (2026) found a positive and significant effect of ROA on Tobin Q, whereas Dewi et al. (2023) found a negative and significant effect. Because prior evidence does not support a single direction, the first hypothesis is stated non-directionally:

H_1: Return on Assets (ROA) affects firm value

Investors no longer value firms only on their ability to earn profit; they also consider whether the firm operates responsibly and sustainably (Hartzmark & Sussman, 2019). A firm with good financial performance and high-quality ESG disclosure tends to be seen as more sustainable, more credible, and better at managing non-financial risk, which can raise market confidence in its financial information and make the relationship between ROA and Tobin Q stronger (Fatemi et al., 2018; Susanto et al., 2026). By contrast, good financial performance that is not accompanied by adequate ESG disclosure may not receive the same market response. The evidence on ESG and performance is itself inconsistent, which indicates that ESG may not act uniformly (Tanjaya & Ratmono, 2024; Velte, 2017). This reasoning leads to the second hypothesis:

H_2: ESG disclosure moderates the effect of ROA on firm value

3. Methodology

3.1 Research design

This study is an explanatory quantitative study of the associative-causal type. It is archival and non-experimental: no treatment was applied and no survey or questionnaire was used. All data are secondary data taken from published company documents and cover a panel of firms observed over several years. The study tests two hypotheses about the effect of ROA on firm value and about the moderating role of ESG disclosure in that effect. It rests on two theories, signaling theory and stakeholder theory, and it assumes that financial statements and sustainability reports provide reliable and comparable information to investors. Research conditions are therefore fixed by the sample criteria, the observation period (2021–2025), and the 5% significance level described below.

3.2 Population and sample

The population comprises all mining companies listed on the IDX during 2021–2025. Using the latest IDX industry classification, the population covers issuers in the Energy and Basic Materials sectors that conduct mining operations, a total of 204 companies identified on the official IDX portal. The sample was drawn by purposive sampling, because ESG disclosure is not yet mandatory for all IDX issuers and not every member of the population supplies the data needed. A company was retained if it (a) belongs to the mining sector and was listed on the IDX during 2021–2025; (b) was listed consecutively throughout 2021–2025 and published complete annual reports and financial statements for the period; (c) carries out mining activities directly and is not merely a mining service provider, contractor, transporter, logistics firm, trader, or heavy-equipment lessor, and was not delisted during the period; and (d) published complete sustainability reports for 2021–2025. Table 2 summarizes the selection process.

Table 2. Sample selection criteria

No	Criterion	Companies meeting the criterion
1	Mining companies listed on the IDX during 2021–2025	204
2	Listed consecutively in 2021–2025 and published complete annual reports and financial statements	150
3	Conduct mining activities directly (excluding mining services, contractors, transportation, logistics, trading, and equipment rental) and not delisted	23

No	Criterion	Companies meeting the criterion
4	Published complete sustainability reports for 2021–2025	9
Number of companies in the sample		9
Number of firm-year observations (9 × 5 years)		45

Nine companies met all criteria: PT Alamtri Resources Indonesia Tbk (ADRO), PT Aneka Tambang Tbk (ANTM), PT Bumi Resources Tbk (BUMI), PT Bayan Resources Tbk (BYAN), PT Golden Energy Mines Tbk (GEMS), PT Harum Energy Tbk (HRUM), PT Vale Indonesia Tbk (INCO), PT Indo Tambangraya Megah Tbk (ITMG), and PT Bukit Asam Tbk (PTBA). Observed over five years, they produce a balanced panel of 45 firm-year observations.

3.3 Data sources and collection

The data are quantitative and come from the annual reports, financial statements, and sustainability reports of the sampled companies for 2021–2025. Net income after tax, total assets, total liabilities, closing share price, and shares outstanding were taken from these reports and from the official IDX website, and ESG disclosure was taken from sustainability reports and annual reports available on the IDX website and the websites of the companies. Data were collected by documentation, that is, by retrieving and recording published documents, because all data were already published by the companies or by official institutions and no field data collection was needed. Because the figures reported by the companies are in different currencies, every component of Tobin Q was converted into rupiah at the Bank Indonesia middle exchange rate on the last day of the relevant fiscal year, which keeps the currency unit consistent across firms and years.

3.4 Variable operationalization

Table 3. Operationalization of variables

Variables	Operational definition	Measurement	Scale
Firm value (*Y*)	Market perception of the firm reflected in the ratio of its market value to its total assets (Tobin Q).	Tobin Q = (market value of equity + total liabilities) / total assets, where market value of equity = closing share price × shares outstanding. All components converted to rupiah at the Bank Indonesia middle rate at fiscal year-end.	Ratio
Financial performance (*X*)	Ability of the firm to earn net profit from all of its assets (ROA).	ROA = net income after tax / total assets.	Ratio
ESG disclosure (*Z*)	Extent to which the firm discloses environmental, social, and governance information.	ESG index = number of indicators disclosed / 30 indicators of the NASDAQ ESG Reporting Guide 2.0 (10 environmental, 10 social, 10 governance), by content analysis.	Ratio

Table 3 defines the variables. Firm value (*Y*) is Tobin Q, ROA (*X*) is the proxy for financial performance, and ESG disclosure (*Z*) is the moderating variable. ESG disclosure was scored by content analysis of the sustainability report and annual report of each company-year. Each of the 30 indicators of the NASDAQ ESG Reporting Guide 2.0 (10 environmental, 10 social, and 10 governance indicators) was assigned a score of 1 if the company disclosed the information and 0 if it did not. The scores were summed and divided by the number of indicators (30) to obtain an ESG disclosure index between 0 and 1, so that a higher value indicates broader disclosure.

3.5 Data analysis

Data analysis was conducted using EViews statistical software. Given that the dataset combines cross-sectional observations from multiple firms with time-series data covering the 2021–2025

period, panel data regression was employed to account for heterogeneity across firms and variations over time. The analytical procedure consisted of descriptive statistical analysis, panel regression model selection, classical assumption testing, moderated regression analysis, and hypothesis testing. Descriptive statistical analysis was performed to summarize the characteristics of the research variables, including Return on Assets (ROA), Environmental, Social, and Governance (ESG) disclosure, and firm value measured by Tobin's Q. The analysis included the mean, median, maximum, minimum, and standard deviation to provide an overview of the distribution and variability of the observations.

Panel regression model selection was conducted by comparing three estimation approaches: the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The CEM estimates a pooled regression without accounting for firm-specific differences, whereas the FEM accommodates unobserved firm-specific characteristics through individual intercepts. Meanwhile, the REM treats firm-specific effects as random components of the error structure. The Chow test was employed to determine whether CEM or FEM was more appropriate, with a probability value below 0.05 indicating a preference for FEM. Subsequently, the Hausman test was used to distinguish between FEM and REM, where a probability value below 0.05 supported the selection of FEM. The Lagrange Multiplier test was considered when an additional comparison between CEM and REM was necessary.

Classical assumption testing was conducted to evaluate the reliability of the regression estimates. Multicollinearity was assessed using the correlation matrix of the independent variables, with correlation coefficients below 0.90 indicating the absence of severe pairwise multicollinearity. Heteroskedasticity was evaluated through visual inspection of the regression residuals to identify systematic patterns or changes in their dispersion. Residuals exhibiting random fluctuations around zero without systematic changes in spread were considered consistent with homoskedasticity. Moderated Regression Analysis (MRA) was employed to examine whether ESG disclosure moderates the relationship between financial performance, measured by ROA, and firm value, measured by Tobin's Q. The analysis incorporated an interaction term between ROA and ESG disclosure to evaluate the moderating effect. The regression model is formulated as follows:

$$Y_{it} = \alpha + \beta_1 X_{it} + \beta_2 Z_{it} + \beta_3 (X_{it} \times Z_{it}) + \varepsilon_{it} \quad (1)$$

In Equation (1), Y_{it} represents firm value measured by Tobin's Q, X_{it} denotes ROA, and Z_{it} represents ESG disclosure for firm i in year *t*. The symbol α indicates the intercept, *β1, β2*, and *β3* represent regression coefficients, and ε_{it} denotes the error term. The interaction term ($X_{it} \times Z_{it}$) captures the moderating effect of ESG disclosure on the relationship between ROA and firm value. Before constructing the interaction term, ROA and ESG disclosure were mean-centered by subtracting their respective sample means. This procedure helps reduce nonessential multicollinearity and facilitates the interpretation of the main effects at the mean value of the moderating variable. The moderating effect was determined by examining the statistical significance of the interaction coefficient β3.

Hypothesis testing was conducted using partial significance tests (*t*-tests), simultaneous significance tests (*F*-tests), and the adjusted coefficient of determination (adjusted R^2). The t-test was used to assess the statistical significance of individual regression coefficients, while the *F*-test evaluated the joint significance of the explanatory variables. Adjusted R^2 was employed to assess the explanatory power of the regression model in accounting for variations in firm value. Statistical significance was determined at the 5% level ($p < 0.05$), providing the basis for evaluating the proposed research hypotheses.

4. Results and Discussion

4.1 Descriptive statistics

Table 4. Descriptive statistics

Variables	N	Mean	Median	Maximum	Minimum	Std. dev.
Firm value, Tobin Q (*Y*)	45	0.6383	0.4868	1.8013	0.2112	0.3800
ROA (*X*)	45	0.1803	0.1230	0.6037	0.0017	0.1552
ESG disclosure (*Z*)	45	0.8496	0.8333	0.9667	0.6667	0.0866

Table 4 presents the descriptive statistics of the 45 firm-year observations, covering nine mining firms over the 2021–2025 period. Tobin's Q has a mean of 0.6383 and a median of 0.4868, with values ranging from 0.2112 to 1.8013 and a standard deviation of 0.3800. The mean exceeds the median, suggesting a positively skewed distribution, with several firm-year observations exhibiting relatively higher values. The average Tobin's Q below 1 indicates that, on average, the market value of these firms together with their liabilities was lower than the book value of their assets.

As shown in Table 4, ROA has a mean of 0.1803, a median of 0.1230, a maximum of 0.6037, and a minimum of 0.0017. These findings indicate that the sampled firms generally generated positive returns on their assets, although profitability varied considerably across observations. Meanwhile, ESG disclosure has a mean of 0.8496, a median of 0.8333, and values ranging from 0.6667 to 0.9667. The relatively high mean and low standard deviation of 0.0866 indicate that the sampled firms disclosed a substantial proportion of the 30 indicators included in the NASDAQ ESG Reporting Guide 2.0, with limited variation across observations. The descriptive statistics of the interaction term are not presented because it was constructed using mean-centered variables and subsequently evaluated through the moderated regression analysis.

4.2 Panel model selection

Table 5. Estimates of the common effect, fixed effect, and random effect models (dependent variable: Tobin's Q)

Variables	CEM Coefficient (Prob.)	FEM Coefficient (Prob.)	REM Coefficient (Prob.)
Constant (*C*)	0.6439 (0.0000)	0.6500 (0.0000)	0.6496 (0.0000)
ROA (*X*)	0.1317 (0.7374)	0.4333 (0.1763)	0.3921 (0.1854)
ESG (*Z*)	1.6904 (0.0131)	−0.5163 (0.2242)	−0.2646 (0.5143)
ROA × ESG (XZ)	1.7964 (0.6504)	3.7220 (0.0697)	3.5829 (0.0762)
R^2	0.1475	0.8569	0.1034 (weighted)
Adjusted R^2	0.0852	0.8092	0.0378
F-statistic (Prob.)	2.3655 (0.0849)	17.9683 (0.0000)	1.5757 (0.2099)

Table 5 shows the estimates of the three panel models, which were compared before the final model was selected. The CEM explains only 14.75% of the variation in Tobin Q ($R2$ = 0.1475) and the REM has a weighted R2 of 0.1034, whereas the FEM reaches an R2 of 0.8569 once firm-specific intercepts are included. This large increase indicates heterogeneity among the mining firms that is not captured when the data are simply pooled. The overall *F*-statistic is significant only in the FEM (probability 0.0000), whereas it is not significant at the 5% level in the CEM (0.0849) or the REM (0.2099).

Table 6. Results of the chow test and the hausman test

Test	Statistic	d.f.	Prob.
Chow test: cross-section F	20.4524	(8, 33)	0.0000

Test	Statistic	d.f.	Prob.
Chow test: cross-section chi-square	80.3142	8	0.0000
Hausman test: cross-section random	10.3388	3	0.0159

Table 6 presents the results of the Chow and Hausman tests conducted to determine the most appropriate panel regression model. The Chow test results show that the cross-section *F*-statistic is 20.4524 with a probability of 0.0000, while the cross-section chi-square statistic is 80.3142 with a probability of 0.0000. Since both probability values are below the 5% significance level, the null hypothesis is rejected, indicating that the Fixed Effect Model (FEM) is preferred over the Common Effect Model (CEM). Furthermore, the Hausman test produces a cross-section random statistic of 10.3388 with a probability of 0.0159, which is also below 0.05. This result supports the selection of FEM over the Random Effect Model (REM). Therefore, both tests consistently indicate that FEM is the most appropriate estimation model for testing the research hypotheses, making the Lagrange Multiplier test unnecessary.

4.3 Classical assumption tests

Table 7 shows the correlations among the independent variables. All coefficients are far below 0.90; the highest absolute value is 0.3664, between ROA and the interaction term. There is therefore no multicollinearity problem in the model, which also shows the benefit of mean-centering the variables before forming the interaction term.

Table 7. Correlation matrix of the independent variables

Variables	ROA (*X*)	ESG (*Z*)	ROA × ESG (*XZ*)
ROA (*X*)	1.0000	−0.2406	−0.3664
ESG (*Z*)	−0.2406	1.0000	0.0708
ROA × ESG (*XZ*)	−0.3664	0.0708	1.0000

The residuals of the FEM were inspected graphically for a funnel shape or a systematic trend. The residuals fluctuate around zero without a systematic pattern. A few observations have relatively large residuals, notably INCO in 2021, but they do not form a pattern that would indicate unequal variance, so the model shows no sign of heteroskedasticity.

4.4 Moderated regression results

Table 8. Moderated panel regression results (fixed effect model, dependent variable: Tobin's Q)

Variables	Coefficient	Std. error	t-statistic	Prob.
Constant (*C*)	0.6500	0.0255	25.4660	0.0000
ROA (*X*)	0.4333	0.3136	1.3818	0.1763
ESG (*Z*)	−0.5163	0.4168	−1.2387	0.2242
ROA × ESG (*XZ*)	3.7220	1.9856	1.8745	0.0697
R^2	0.8569			
Adjusted R^2	0.8092			
F-statistic (Prob.)	17.9683			0.0000

Table 8 presents the results of the moderated panel regression analysis using the Fixed Effect Model (FEM), as selected through the Chow and Hausman tests. The estimated regression equation is $Y = 0.6500 + 0.4333X - 0.5163Z + 3.7220XZ + \varepsilon$. Since ROA and ESG disclosure were mean-centered, the constant of 0.6500 represents the expected Tobin's Q at the mean levels of both variables, averaged across firm-specific intercepts. The ROA coefficient of 0.4333 indicates a positive association with firm value when ESG disclosure is at its mean, whereas the ESG

disclosure coefficient of −0.5163 indicates a negative association when ROA is at its mean. Furthermore, the positive interaction coefficient of 3.7220 suggests that the relationship between ROA and firm value becomes stronger as ESG disclosure increases. However, the interpretation of these coefficients must consider the interaction between the variables. Based on the estimated coefficients, the slope of ROA is approximately −0.248 at the lowest observed ESG disclosure score (0.6667) and 0.869 at the highest score (0.9667). The statistical significance of this moderating effect is evaluated through the interaction coefficient $\beta 3$.

4.5 Hypothesis tests

The partial significance test (*t*-test) indicates that Return on Assets (ROA) has a positive but statistically insignificant effect on firm value, with a probability value of 0.1763, exceeding the 5% significance threshold. Therefore, H_1 is not supported. Similarly, the interaction between ROA and ESG disclosure produces a positive coefficient of 3.7220 with a probability value of 0.0697, indicating that the moderating effect is not statistically significant at the 5% level. Consequently, H_2 is not supported. Although the probability value is below 0.10, the result provides insufficient evidence to establish a significant moderating effect under the predetermined 5% significance criterion.

The simultaneous significance test (*F*-test) produces an F-statistic of 17.9683 with a probability value of 0.0000, indicating that the estimated Fixed Effect Model (FEM) is statistically significant at the 5% level. This result demonstrates the joint significance of the model, including ROA, ESG disclosure, their interaction, and firm-specific fixed effects. However, the significant *F*-statistic does not necessarily imply that each explanatory variable has a statistically significant individual effect on firm value.

Furthermore, the coefficient of determination shows an adjusted R^2 of 0.8092, indicating that the estimated model accounts for approximately 80.92% of the observed variation in firm value, while the remaining 19.08% is not explained by the model. The relatively high explanatory power is likely attributable largely to firm-specific fixed effects, which capture unobserved characteristics that differ across the sampled companies. Therefore, the substantial adjusted R^2 should not be interpreted as evidence that ROA, ESG disclosure, or their interaction individually exerts a statistically significant effect on firm value.

4.6 Discussion

ROA has no statistically significant effect on Tobin Q (coefficient = 0.4333, p = 0.1763) after controlling for firm fixed effects; therefore, H_1 is not supported. The positive coefficient is consistent with the direction expected from signaling theory and the positive effect reported by Rosidah and Priono (2026), although the effect is not statistically significant in the present sample. This finding differs from Dewi and Luh (2023), who identified a significant negative effect, indicating that the relationship between profitability and firm value remains inconclusive in the literature. Temalagi, Darmawati, and Amiruddin (2025) found that profitability, measured using ROE, had a significant positive relationship with Tobin Q among companies included in the IDX ESG Leaders index, further highlighting differences in empirical findings across samples and profitability measures. The present result is also consistent with Velte (2017), who identified a stronger relationship between ESG performance and accounting-based returns than with Tobin Q. Furthermore, it supports the broader argument of Brooks and Oikonomou (2018) that empirical findings depend on the measurement approaches and research contexts employed.

Several explanations can be offered for this finding. From a signaling perspective, Tobin Q in the mining sector is influenced by external factors beyond management control, particularly fluctuations in global commodity prices, such as coal and nickel. When these factors dominate market expectations, signals derived from historical profitability become less decisive, as investors also consider anticipated commodity prices and broader market prospects. Consequently, a positive market response to profitability may exist but may not be sufficiently strong or consistent to achieve statistical significance in the short term. The divergence observed in 2025, as presented in Table 1, where average ROA declined while average Tobin Q remained stable, illustrates this pattern,

although this descriptive trend does not establish causality. From a stakeholder perspective, mining companies must accommodate the interests of various stakeholders, including government authorities responsible for issuing Mining Business Permits (IUPs), local communities surrounding mining operations, and environmental regulatory institutions. When these considerations strongly influence market valuation, profitability generated from company assets may not be the primary determinant of investor perceptions. Furthermore, the relatively small sample of 45 observations from nine companies may contribute to the insignificant result, as the Fixed Effects Model (FEM) requires the estimation of firm-specific intercepts, reducing the precision of the ROA coefficient.

The interaction coefficient between ROA and ESG disclosure is positive (3.7220) but statistically insignificant at the 5% level (p = 0.0697). Therefore, H_2 is not supported, indicating insufficient statistical evidence that ESG disclosure moderates the relationship between ROA and firm value. The positive direction is consistent with Susanto, Mustaruddin, and Ristyawan (2026), who identified a positive moderating role of ESG among industrial-sector companies listed on the Indonesia Stock Exchange (IDX), and with Fatemi, Glaum, and Kaiser (2018), who argued that disclosure enhances the value relevance of ESG information. However, the statistical evidence in the present study remains insufficient to confirm this relationship. Yeye and Egbunike (2023) reported a statistically insignificant interaction between ESG disclosure and ROA in explaining firm value, suggesting that sustainability disclosure does not necessarily strengthen the relationship between profitability and market valuation. This finding also aligns with previous Indonesian studies reporting inconclusive effects of ESG on firm value (Arofah, & Khomsiyah, 2023; Tanjaya, & Ratmono, 2024; Xaviera, & Rahman, 2023). Although the probability value approaches the conventional 5% significance threshold, the observed association cannot be considered statistically significant at that level. Nevertheless, the positive coefficient is broadly consistent with evidence suggesting that investors may value sustainability-related information (Hartzmark, & Sussman, 2019; Lins, Servaes, & Tamayo, 2017; Wong, Batten, Ahmad, Mohamed-Arshad, Nordin, & Adzis, 2021). In addition, Siska, Agia, and Triputra (2026) found that ESG disclosure significantly enhanced firm value in the long term within Indonesia energy sector, suggesting that the valuation implications of sustainability disclosure may vary depending on the observation period and industry context.

Two characteristics of the data may help explain the absence of a statistically significant moderating effect. First, ESG disclosure scores are relatively high and homogeneous across the sampled companies, ranging from 0.6667 to 0.9667, with a standard deviation of 0.0866. This limited variation reduces the information available to identify differences in the moderating role of ESG disclosure across companies. Second, from a stakeholder perspective, the relatively high disclosure levels may indicate that ESG reporting has become a common practice among mining companies operating under increasingly demanding environmental regulations. Consequently, investors may perceive ESG disclosure as a minimum compliance requirement rather than a distinctive competitive advantage, potentially limiting its ability to strengthen profitability signals. Related evidence from Antrika, Wardhani, and Rudianto (2026) indicates that environmental performance did not significantly affect firm value among Indonesian mining companies, further suggesting that sustainability-related performance does not automatically translate into higher market valuation. The limited sample size may also reduce the statistical power of the interaction test. Moreover, the ESG disclosure index measures whether sustainability-related information is reported rather than assessing its quality, credibility, or comparability. As a result, the index may not fully capture the characteristics of ESG information that investors consider relevant when evaluating company performance and long-term prospects.

For mining companies, these findings suggest that improvements in profitability and sustainability disclosure should be accompanied by clearer communication regarding the management of commodity-price risks, as market valuations may reflect these external considerations alongside accounting-based profitability. For investors, ROA alone may not provide sufficient information for evaluating mining companies, while ESG disclosure remains relevant for monitoring even though its moderating effect is not statistically significant in the present study. For regulatory authorities,

particularly the Financial Services Authority, the relatively high and homogeneous ESG disclosure scores suggest that regulatory attention could extend beyond reporting compliance toward improving the quality, consistency, and comparability of sustainability information. This recommendation is consistent with Munyepwa, Mudzengerere, Ranganai, and Gwesu (2026), who emphasized the importance of the depth, quality, and consistency of ESG disclosures in understanding differences in firm valuation across industries.

5. Conclusions

5.1 Conclusion

This study examined the effect of ROA on firm value (Tobin Q) and the moderating role of ESG disclosure in nine mining companies listed on the IDX in 2021–2025 (45 firm-year observations), using a fixed effect model selected through the Chow and Hausman tests. The conclusions are as follows. First, ROA has no significant effect on firm value (coefficient 0.4333, p = 0.1763), so the first hypothesis is not supported at the 5% level, although the positive sign is consistent with signaling theory. Second, ESG disclosure is not shown to moderate the effect of ROA on firm value at the 5% level (interaction coefficient 3.7220, p = 0.0697); the positive sign agrees with the hypothesis, but the statistical evidence is insufficient to conclude that ESG disclosure strengthens or weakens the effect of ROA. Third, ROA, ESG disclosure, and the interaction term jointly have a significant effect on firm value (F-statistic probability 0.0000), and the model explains 80.92% of the variation in firm value (adjusted R2), although most of this explanatory power comes from the firm fixed effects and not from the three variables individually. These findings answer the study objectives and show that, in this sample, the market valuation of Indonesian mining firms is not explained by profitability and ESG disclosure alone.

5.2 Research Limitations

This study has several limitations. The sample is small (nine firms and 45 observations) and the period is short, which limits statistical power, especially for the interaction test in a fixed effect model that absorbs many degrees of freedom, and limits the generalization of the findings. The model has no control variables such as firm size or capital structure. ESG disclosure is measured by a binary index based on the presence of information, which does not capture quality, and it varies little across the sampled firms. Tobin Q is calculated with a simplified formula based on book values of assets and liabilities, and the study period is influenced by commodity-price swings that are not modeled. The classical assumption tests are limited to multicollinearity and a graphical check of heteroskedasticity; autocorrelation was not tested formally.

5.3 Suggestions and Directions for Future Research

Future research should enlarge the sample and extend the observation period so that the moderating effect can be tested with more power, for example by including the wider energy and basic materials sectors or by comparing sectors. It should add control variables such as firm size and capital structure, consider other proxies of financial performance such as ROE, and include commodity-price indicators. ESG disclosure should be measured in ways that capture quality, completeness, and comparability, not only the presence of information, and the estimation should be accompanied by tests suited to panel data, including autocorrelation and heteroskedasticity tests and, where needed, robust standard errors. Mining firms are advised to maintain asset efficiency to support sustainable profitability and to improve the quality and consistency of ESG disclosure so that it reflects actual practice and not only compliance with reporting rules. Investors and regulators may pay more attention to the quality and comparability of sustainability information than to its mere availability.

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