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Unveiling Mining Profitability: The Interplay of Financial Metrics and ESG Disclosures (2023–2025)

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Abstract

The objective of this study is to empirically examine the influence of liquidity, solvency, activity, and ESG disclosure on profitability. The sample focuses on mining sector companies listed on the Indonesia Stock Exchange (IDX) during the 2023–2025 period. Utilizing secondary data retrieved from annual financial and sustainability reports published by companies and the IDX, data processing was conducted using EViews 12. Through purposive sampling, 19 companies were selected across three years, resulting in 57 observations. The analytical framework incorporates descriptive statistics, classical assumption tests, and multiple linear regression analysis. The results show that solvency has a negative and significant effect on profitability because the interest and financial costs of debt put pressure on net profit. Liquidity has a negative and insignificant effect because current assets mainly serve as a buffer for short-term obligations. Meanwhile, activity and ESG disclosure have a positive but insignificant effect, because activity reflects daily operational efficiency, while ESG disclosure requires upfront costs with long-term benefits.

Keywords: Profitability, Liquidity, Solvency, Activity, ESG Disclosure

INTRODUCTION

The mining industry is a vital pillar of Indonesia's national economic structure and makes a tangible contribution to foreign exchange earnings, job creation, and capital investment inflows (Ulandari et al., 2025). As a country rich in mineral and energy resource deposits, Indonesia's extractive corporations hold strategic appeal in global supply chains. Nevertheless, the 2023–2025 period was marked by highly volatile international macroeconomic dynamics. Fluctuations in the prices of key commodities such as coal, nickel, and gold, driven by geopolitical adjustments, the global energy transition, and shifts in global benchmark interest rates, require mining companies to

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maintain their financial performance stability in a rational and measured manner (Ali et al., 2025).

In recent years, the financial performance of mining companies, particularly profitability as measured by *Return on Assets* (ROA), has shown considerable ups and downs (Sari & Suryandani, 2023; Sembiring et al., 2024). The success of a mining company is no longer measured solely by the profit it earns, but also by its ability to preserve the environment and support social performance in the areas surrounding its operations. During 2023–2025, the prices of key commodities such as gold, nickel, and coal surged due to strong industrial demand, supply constraints caused by supply chain disruptions and global geopolitical instability, and policies supporting the energy transition. The price of gold even broke the US$3,800 record in September 2025 (CNBC Indonesia, 2025), while nickel prices soared in step with the shift toward electric vehicles.

Amid these global market challenges, profitability serves as the primary yardstick for assessing operational achievement as well as management efficiency in utilizing all of the assets the firm owns. Profitability, represented by *Return on Assets* (ROA), describes how effectively an entity's assets are converted into net profit after tax (Abbas et al., 2020). Nevertheless, the ROA achieved by mining issuers on the Indonesia Stock Exchange (IDX) fluctuates to varying degrees. The ups and downs of ROA are largely determined by internal managerial decisions in managing working capital liquidity, the solvency funding structure, inventory turnover efficiency, and the transparency of sustainability disclosure covering the environmental, social, and governance dimensions (*Environmental, Social, and Governance* / ESG) (Terdpaopong et al., 2024).

The importance of managing these internal factors is reflected in the function of each financial ratio. Liquidity, calculated through the *Current Ratio* (CR), shows how ready cash and current assets are to finance daily mining operations (Tulung et al., 2024). Overly loose liquidity management risks creating idle cash, whereas tight liquidity threatens the smooth fulfillment of short-term liabilities. Next, solvency, represented by the *Debt to Equity Ratio* (DER), measures the amount of debt funding relative to owners' equity (Inyang et al., 2026). The use of debt can serve as financial leverage, yet a swelling of loan obligations triggers an increase in fixed interest expense that risks squeezing net profit. Meanwhile, the efficiency of inventory turnover, measured through *Inventory Turnover* (ITO), determines the smoothness of the commodity supply chain from the mine site to sale (Alnaim & Kouaib, 2023). In the modern era, ESG disclosure (*ESG Disclosure*) has become a crucial non-financial aspect demanded by global investors to mitigate environmental impact risks and secure social legitimacy around mining areas (Setiawati & Hidayat, 2023).

A review of prior literature reveals inconsistent empirical findings (*research gap*) regarding the determinants of profitability. Ulandari et al. (2025) reported that liquidity

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(CR) has a significant positive effect on ROA, whereas Tulung et al. (2024) and Sukmala et al. (2026) concluded that liquidity has no significant effect. For the solvency variable, Amoa-Gyarteng & Dhliwayo (2022) found a significant positive effect, but Inyang et al. (2026) and Subhan (2023) demonstrated that DER has a significant negative effect on ROA. For the activity ratio, Alnaim & Kouaib (2023) showed that ITO has a positive and significant effect on profitability, in contrast to the findings of Simon-Ilogho (2025) and Putri et al. (2026), who found no significant effect. As for ESG disclosure, Ali et al. (2025) found a significant positive impact on ROA, whereas Terdpaopong et al. (2024) and Priadi & Wahyudi (2026) showed that *ESG disclosure* has no significant effect on profitability in the current period.

Based on the gaps in prior research results and the dynamics of the post-pandemic extractive industry and the 2023–2025 energy transition period, this study aims to examine in depth the effects of liquidity (CR), solvency (DER), activity (ITO), and *ESG disclosure* on the profitability (ROA) of mining sector companies on the IDX, both partially and simultaneously.

The scope of this study is limited to mining companies listed on the IDX throughout 2023–2025. Other sectors such as banking, financial services, and property are not covered because they have fundamentally different operational characteristics and financial structures. The independent variables used are liquidity (*Current Ratio*/CR), solvency (*Debt to Equity Ratio*/DER), activity (*Inventory Turnover*/ITO), and *ESG disclosure* (ESGD), while the dependent variable is profitability, proxied by ROA. External factors such as inflation, interest rates, and macroeconomic policy are not discussed in depth because they lie beyond the scope of the study.

Based on the above, the research problems are formulated as follows: (1) does liquidity affect profitability, given that working capital adequacy is crucial for smooth operations; (2) does solvency affect profitability, given that the proportion of debt can have a dual impact on business expansion and the risk of financial burden; (3) does activity affect profitability, given that inventory turnover efficiency determines the speed at which mined commodities are converted into sales; and (4) does *ESG disclosure* affect profitability, given that transparency on environmental, social, and governance aspects has the potential to boost a company's reputation, resource efficiency, and competitiveness in the capital market.

Theoretically, this study is expected to enrich the finance and sustainability accounting literature and to explain the differences in results (*research gap*) among prior studies. Practically, the findings can serve as input for the management of mining entities in managing working capital, capital structure, commodity inventory turnover efficiency, and the implementation of ESG principles, as well as for investors and other stakeholders in assessing the financial health, risk level, and sustainability prospects of mining

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companies. Academically, this study can be used as a reference by future researchers who wish to add new variables or broaden the sector and observation period coverage.

LITERATURE REVIEW

The theoretical foundation of this study rests on Signaling Theory proposed by Spence (1973). According to this theory, an entity's management seeks to convey cues or signals in the form of relevant information to external parties (investors and creditors) in order to reduce information asymmetry. Financial statements and annual sustainability reports act as the main signaling channels. A high *Return on Assets* (ROA) implies a good signal (*good news*) regarding the efficiency of operating asset management. Proportional liquidity management, a measured solvency debt structure, efficient inventory activity, and transparent ESG disclosure strengthen the credibility of management's signal that the company has healthy and sustainable growth prospects in the future (Ali et al., 2025).

Within this theoretical framework, *Return on Assets* (ROA) is positioned as the primary financial signal (*financial signal*) that communicates the level of efficiency, quality of governance, and management's actual capability to earn net profit from all the assets it manages (Simon-Ilogho, 2025). A high and stable ROA serves as a positive signal (*good news*) indicating that the company is productive and has bright growth prospects (Tulung et al., 2024). For mining companies in particular, which face commodity price fluctuations and high operational risk, a strong ROA gives the market concrete evidence that the extractive assets and working capital they hold can be effectively converted into economic value (Simon-Ilogho, 2025; Terdpaopong et al., 2024).

The market's response to profitability signals is reflected in increased stakeholder confidence. A positive ROA signal raises investment appeal, lowers the risk perceived by investors, and eases access to funding at a more efficient cost of capital (Ali et al., 2025; Alnaim & Kouaib, 2023). Conversely, a low or sharply fluctuating ROA emits a negative signal (*bad news*) about operational inefficiency or high cost burdens, which can lower the company's credibility in the eyes of the public and the capital market (Ali et al., 2025). Accordingly, profitability (ROA) is the main yardstick of the performance signal captured by the market to assess the success and sustainability of a business entity.

Profitability (ROA). Profitability describes a company's capacity to earn profit from all of the resources and total assets invested. In this study, ROA is calculated by comparing net profit after tax with total assets (Abbas et al., 2020). This study positions profitability as the dependent variable (Y) because ROA is able to capture how efficiently a company manages all of its wealth, whether from internal capital or external funding, to generate profit; an increase in ROA reflects assets being used productively and optimally.

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Liquidity (CR). Liquidity measures the ability of an entity's current assets to settle short-term liabilities that are due immediately. A *Current Ratio* at an adequate level assures that daily mining operations will not be hampered by cash liquidity problems (Tulung et al., 2024). The mining sector, which is vulnerable to commodity price swings, greatly needs certainty of working capital. The challenge lies in balance: excessive liquidity causes idle current assets to accumulate and erodes profit potential, whereas a value that is too low heightens the risk of default that disrupts mining operations.

Solvency (DER). Solvency evaluates the degree to which a company's capital depends on external debt. The *Debt to Equity Ratio* (DER) is calculated by dividing total liabilities by total equity. Excessive use of debt triggers a rise in loan interest expense that erodes net profit margins (Inyang et al., 2026). Unlike liquidity, which focuses on daily payments, solvency assesses the long-term resilience of the business and the extent to which total assets can guarantee debts in the event of liquidation. Creditors use this ratio to map credit risk, while for management and investors, capital structure is crucial for maintaining the efficiency of *financial leverage*.

Activity (ITO). Activity is measured using *Inventory Turnover* (ITO), which shows the efficiency of converting commodity inventory into sales. Rapid turnover minimizes tied-up working capital and reduces warehouse storage costs (Alnaim & Kouaib, 2023). For the mining sector, which is rife with logistics and commodity storage dynamics, the efficient management of operating assets is key to preventing an unproductive buildup of working capital. Slow turnover indicates an accumulation of mined-product inventory that may increase storage costs and the risk of value depreciation.

ESG Disclosure Index (ESGD). ESG disclosure measures the extent to which an entity makes its environmental, social, and governance performance information transparent, based on the standard criteria of the Global Reporting Initiative (GRI). This reporting enhances public reputation and sustainability legitimacy (Setiawati & Hidayat, 2023). In the mining sector, sustainability issues are critical because natural resource extraction directly affects ecosystems, occupational safety, and the social dynamics of surrounding communities. Transparency on sustainability aspects helps reduce potential environmental remediation costs, avoid regulatory sanctions, and minimize the risk of conflict with local communities.

Relationships Between Variables

Liquidity and Profitability. The level of liquidity serves as a financial signal from management to reflect the company's operational stability and financial health. Based on Signaling Theory, adequate liquidity emits a positive signal that the operational chain can run without cash flow obstacles, thereby assuring the market, creditors, and investors that the company has solid financial resilience amid market fluctuation risks. Healthy

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liquidity provides a positive signal about the security of working capital for mining operations, thereby supporting the achievement of profit efficiency.

Solvency and Profitability. Through Signaling Theory, additional debt can be a positive signal of management's confidence in the stability of future cash flows, although uncontrolled debt risks sending a negative signal because of interest expense that erodes profit. This impact is non-linear and highly dependent on the efficiency of capital utilization and the macroeconomic conditions of the industry. Amoa-Gyarteng & Dhliwayo (2022) found a significant positive effect because debt was used for productive expansion, whereas Inyang et al. (2026) found a significant negative effect due to refinancing risk and swelling interest expense. Therefore, determining an ideal and measured limit of *financial leverage* is key for management to balance growth signals against the risk of financial pressure. High use of external debt emits a financial risk signal and triggers an increase in fixed-cost interest obligations that reduce net profit.

Activity and Profitability. Rapid inventory turnover (*Inventory Turnover*/ITO) can increase profitability through storage cost efficiency and faster working capital cycles, although too little inventory risks causing shortages when demand surges. The impact of ITO is influenced by industry characteristics: Alnaim & Kouaib (2023) demonstrated a significant positive effect in Saudi Arabia's manufacturing sector thanks to cost efficiency, whereas Simon-Ilogho (2025) found an insignificant effect because inventory accounts for a relatively small share compared with fixed assets. Therefore, ITO control must be tailored to the specifics of the business sector, such as capital-intensive mining, to prevent funds from being tied up in non-productive assets. Efficient, rapid inventory turnover reflects a smooth operating cycle and accelerates the conversion of commodity sales into cash.

ESG Disclosure and Profitability. ESG disclosure serves as a positive signal (*positive signal*) to minimize information asymmetry between management and external investors, because sustainability transparency conveys the company's governance credibility and risk commitment. Ali et al. (2025), studying 100 non-financial companies in Saudi Arabia, demonstrated that ESG disclosure has a significant positive effect on ROA, whereas Terdpaopong et al. (2024) found a significant positive effect on market value (*Tobin's Q*) but an insignificant effect on ROA because the impact on operating profit takes time and is eroded by initial investment costs. The effectiveness of ESG as a signaling instrument is strongly influenced by market maturity and regulation. Transparent ESG disclosure provides a signal of superior governance, reduces the risk of environmental and social claims, and broadens competitiveness in green financing.

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HYPOTHESIS DEVELOPMENT

From the perspective of Signaling Theory, the level of liquidity serves as a financial signal (*financial signal*) sent by management to external parties regarding the company's financial health, risk level, and operational continuity (Alnaim & Kouaib, 2023). The adequacy of a mining company's liquidity reflects financial flexibility and cash flow resilience amid global commodity price fluctuations, thereby increasing creditor and investor confidence, lowering the risk premium, and easing access to financing at an efficient cost of capital (Tulung et al., 2024). Empirically, Ulandari et al. (2025) demonstrated in the mining sector that adequate liquidity provides a significant positive signal for increased profitability. Based on this, the following hypothesis is formulated: **H1: Liquidity (CR) has a positive and significant effect on profitability (ROA).**

The level of solvency serves as a primary financial signal that communicates capital structure, financial risk profile, and future obligation burden to creditors and investors (Alnaim & Kouaib, 2023). Rising solvency tends to emit a negative signal (*bad news*) about the risk of financial distress (*financial distress*), and the market and lenders respond with heightened risk perception, premium demands, and more expensive interest rates (Tulung et al., 2024). Empirically, Inyang et al. (2026) showed that high solvency has a negative impact on profitability, although Amoa-Gyarteng & Dhliwayo (2022) found the opposite result for measured and controlled use of debt. Under conditions of high financial risk, an increase in the debt ratio tends to be predominantly interpreted by the market as a negative signal. Based on this, the following hypothesis is formulated: **H2: Solvency (DER) has a negative and significant effect on profitability (ROA).**

A company's activity reflects management's efficiency in controlling, turning over, and utilizing inventory to generate revenue, and its turnover rate acts as an operational signal of the quality of internal control and the efficiency of working capital management (Alnaim & Kouaib, 2023; Simon-Ilogho, 2025). In the capital-intensive mining sector, high turnover reflects management's success in minimizing storage costs, preventing commodity spoilage, and avoiding unproductive funds (Simon-Ilogho, 2025). Empirically, Alnaim & Kouaib (2023) demonstrated that efficient activity turnover significantly increases profitability through reduced operating costs and optimized asset productivity. Based on this, the following hypothesis is formulated: **H3: Activity (ITO) has a positive and significant effect on profitability (ROA).**

ESG transparency serves as a non-financial signal (*non-financial signal*) sent by management to reduce information asymmetry regarding environmental, social, and governance risks in the eyes of investors, creditors, and the public (Ali et al., 2025; Terdpaopong et al., 2024). In the high-risk mining industry, transparent ESG disclosure

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gives a positive signal that the company actively mitigates risk, complies with regulations, and maintains community relations, which the capital market responds to through easier access to green financing, a lower cost of capital, and an improved reputation (Ali et al., 2025). Empirically, Ali et al. (2025) demonstrated that ESG disclosure significantly increases profitability through strengthened legitimacy and funding efficiency, in line with Terdpaopong et al. (2024), who showed a positive direction of relationship with financial performance. Based on this, the following hypothesis is formulated: **H4: *ESG Disclosure* (ESGD) has a positive and significant effect on profitability (ROA).**

The conceptual framework of this study is presented below:

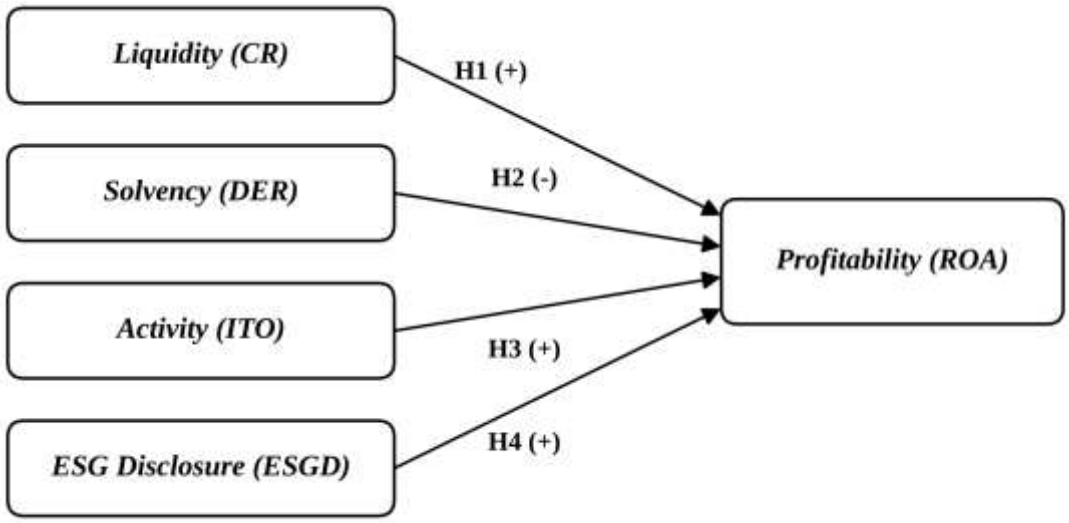


Figure 1: Conceptual Framework

RESEARCH METHOD

This study employs a quantitative approach with a causal associative explanatory design to test the cause-and-effect relationships among variables. The data used are quantitative secondary data in the form of panel data (*unbalanced panel*) compiled from the audited financial statements and annual sustainability reports (*Sustainability Report*) of mining sector issuers listed on the IDX during 2023–2025.

The population of this study comprises all mining companies listed on the IDX. The sample was determined using *purposive sampling* based on the following criteria: (1) mining companies consistently listed on the IDX during 2023–2025; (2) companies that publish complete audited annual financial statements denominated in Rupiah or US Dollars; (3) companies with complete data on inventory ratios, cost of goods sold (COGS), and ESG disclosure; and (4) companies free from extreme outlier data (*outliers*).

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These criteria yielded 19 sample companies with a total of 57 observations over the three-year observation period.

The research design is grounded in the positivist paradigm, in which phenomena are tested objectively through structured statistical measurement. Data were collected through a documentation study of the annual financial statements and sustainability reports (*sustainability report*) of issuers, downloaded from the Indonesia Stock Exchange website (www.idx.co.id) and each company's website. The data obtained were organized using *Microsoft Excel* and then processed using *EViews 12* software.

The dependent variable is profitability, proxied by ROA, namely net profit after tax divided by total assets, which describes the efficiency of using working capital and large-scale operating assets amid fluctuations in world commodity prices and increasingly stringent environmental regulations. The independent variables consist of liquidity, represented by the *Current Ratio* (total current assets divided by total short-term liabilities); solvency, represented by the *Debt to Equity Ratio* (total liabilities divided by total equity); activity, represented by *Inventory Turnover* (cost of goods sold divided by average inventory); and *ESG disclosure*, measured through the *ESG Disclosure Index* (the number of ESG items disclosed divided by the total disclosure indicators under the *Global Reporting Initiative* (GRI) standard).

The operationalization and measurement of the variables used in this study are summarized as follows:

Table 1: Operationalization and Measurement of Variables

No	Variable	Conceptual Definition	Measurement Formula	Scale
1.	Profitability (Y)	Efficiency of asset utilization for net profit	ROA = (Net Profit After Tax / Total Assets) x 100%	Ratio
2.	Liquidity (X1)	Capacity of current assets to cover short-term debt	CR = Total Current Assets / Total Short-Term Liabilities	Ratio
3.	Solvency (X2)	Proportion of debt financing relative to equity	DER = Total Liabilities / Total Equity	Ratio
4.	Activity (X3)	Speed of commodity inventory turnover	ITO = Cost of Goods Sold / Average Inventory	Ratio

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No	Variable	Conceptual Definition	Measurement Formula	Scale
5.	ESG Disclosure (X4)	Transparency of ESG aspect disclosure (GRI)	ESGD = ESG Items Disclosed / Total GRI Indicators	Ratio

Data analysis was carried out with the aid of the *EViews 12* econometric software. The analysis steps consisted of: (1) descriptive statistics; (2) classical assumption tests (*Jarque-Bera* normality test, VIF multicollinearity test, Breusch-Godfrey LM autocorrelation test, and Glejser heteroskedasticity test); (3) panel data regression model selection (Chow test, Hausman test, and *Lagrange Multiplier* test); and (4) multiple panel data regression estimation accompanied by hypothesis testing (F test, *Adjusted* R^2 test, and partial t test).

Descriptive statistics are used to describe the characteristics of the data distribution through minimum, maximum, mean, and standard deviation values. Panel data regression estimation is carried out through three approaches, namely the *Common Effect Model* (CEM), which pools *cross-section* and *time-series* data using the *Ordinary Least Squares* method (Amaliah et al., 2020); the *Fixed Effect Model* (FEM), which captures intercept differences across companies through dummy variables using the *Least Squares Dummy Variable* method (Fayola & Nurbaiti, 2020); and the *Random Effect Model* (REM), which accounts for error correlation across individuals and over time using the *Generalized Least Squares* technique (Fayola & Nurbaiti, 2020).

The best model is selected through the Chow test (CEM versus FEM), the Hausman test (REM versus FEM), and the *Lagrange Multiplier* test (CEM versus REM) at the 0.05 significance level (Widarjono, 2018, as cited in Fayola & Nurbaiti, 2020). In the Chow test, a *cross-section Chi-square p-value* below 0.05 points to FEM, whereas a value above 0.05 points to CEM. In the Hausman test, a *cross-section random p-value* below 0.05 points to FEM, whereas a value above 0.05 points to REM. In the *Lagrange Multiplier* test, a *p-value* below 0.05 points to REM, whereas a value above 0.05 points to CEM.

The effects of the four independent variables on profitability are tested through multiple linear regression analysis with the following equation model:

$$ROA_{it} = \alpha + \beta_1 CR_{it} + \beta_2 DER_{it} + \beta_3 ITO_{it} + \beta_4 ESGD_{it} + \varepsilon_{it}$$

where α is the constant, β is the regression coefficient, ε is the residual, *i* denotes the *i*-th mining company, and *t* denotes the *t*-th year. The coefficient of determination (*Adjusted* R^2) shows the extent to which the model can explain the variation in the dependent variable, with a value range from 0 to 1. The F test is used to assess the

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simultaneous effect of the independent variables, while the t test is used to assess the partial effect, both at the 0.05 significance level; the null hypothesis is rejected if the significance value is less than 0.05.

Before the hypotheses are tested, the model first undergoes classical assumption testing. In the normality test, residuals are considered normally distributed if the significance value is 0.05 or greater (Ghozali, 2018). The multicollinearity test uses the *Variance Inflation Factor* (VIF); a VIF value below 10 and *tolerance* above 0.10 indicate the absence of a strong linear relationship among the independent variables (Zahroh, 2019). The heteroskedasticity and autocorrelation tests use the *Chi-Square* probability value; the model is declared free of both problems if the value exceeds 0.05 (Ghozali & Ratmono, 2017).

STATISTICAL TEST RESULTS AND FINDINGS

Overview of the Research Sample. During 2023–2025, there were 73 mining sector companies listed on the IDX. After selection according to the *purposive sampling* criteria, 68 companies remained with data on average inventory and cost of goods sold (COGS). Restricting the sample to the coal and mineral mining subsectors and the mining contractor and drilling services subsector left 30 companies (90 observations). Automatic outlier detection at a significance level of α = 0.05 eliminated 33 observations from 11 companies (IHS Markit, 2020), so the final sample comprised 19 companies with 57 observations (19 companies × 3 years). Table 2 presents the details of the sample selection process.

Table 2: Summary of Sample Selection

No	Sample Criteria	2023–2025
1	Mining sector companies listed on the Indonesia Stock Exchange (IDX) in 2023–2025, with annual financial statements, and IPO before 2023	73
2	Companies with data on average inventory and cost of goods sold (COGS)	68
3	Companies in the Coal and Mineral Mining subsectors and the Mining Contractor & Drilling Services subsector	30
4	Companies filtered out (outliers)	-11
5	**Total sample after outliers that meets the criteria during 2023–2025**	**19**

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Descriptive Statistics. Descriptive statistical testing on the 57 observations for 2023–2025 provides an overview of the distribution characteristics of the research variables, as shown in Table 3.

Table 3: Descriptive Statistics of Research Variables

Variable	N	Mean	Minimum	Maximum	Std. Deviation
ROA (Y)	57	0.0486	-0.0840	0.1920	0.0560
CR (X1)	57	2.4372	0.0000	13.3290	2.6490
DER (X2)	57	2.3705	0.1430	30.2550	4.3708
ITO (X3)	57	24.7237	0.9530	138.0610	30.1206
ESGD (X4)	57	0.7996	0.5250	1.0000	0.1304

Profitability (ROA) has a mean of 0.0486, with the highest value of 0.1920 recorded by Resources Alam Indonesia Tbk. (KKGI) in 2024 and the lowest value of -0.0840 recorded by Dwi Guna Laksana Tbk. (DWGL) in 2023. Liquidity (CR) has a mean of 2.4372, with the highest value of 13.3290 recorded by Atlas Resources Tbk. (ARII) in 2025 and the lowest value of 0.0000 recorded by Apexindo Pratama Duta Tbk. (APEX) in 2023–2025. Solvency (DER) has a mean of 2.3705, with the highest value of 30.2550 recorded by Delta Dunia Makmur Tbk. (DOID) in 2025. Activity (ITO) has a mean of 24.7237, with the highest value of 138.0610 recorded by DWGL in 2025, while *ESG Disclosure* has a mean of 0.7996, with the highest value of 1.0000 recorded by DOID in 2024 and 2025 and the lowest value of 0.5250 recorded by APEX in 2024 and 2025.

Classical Assumption Tests. The initial normality test on 30 companies (90 observations) yielded a *Jarque-Bera* probability of 0.000000 (< 0.05), so the residuals were not yet normally distributed (Ghozali, 2018). Non-normal residuals can be addressed by data transformation or outlier removal, provided that the data removed does not exceed 50% of all data (Rousseeuw & Leroy, 1987). After outliers were eliminated, reducing the sample by 11 companies (36.7% of the 30 companies, still below the 50% limit), the probability changed to 0.793232 (> 0.05) and the residuals were normally distributed. The multicollinearity test showed that the VIF values of all independent variables ranged from 1.032 to 1.095 (< 10), so there was no multicollinearity. The Breusch-Godfrey LM autocorrelation test yielded a *Chi-Square* probability of 0.1266 (> 0.05), so no autocorrelation was found. The Glejser heteroskedasticity test yielded a *Chi-Square* probability of 0.0802 (> 0.05), so the data variance was homogeneous.

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Panel Data Regression Model Selection. After the model met all classical assumptions, a series of model specification tests was conducted. The Chow test yielded a *cross-section Chi-square* probability of 0.00305 (< 0.05) with a calculated value of 2.9675, so the *Fixed Effect Model* (FEM) was chosen over the *Common Effect Model* (CEM). Next, the Hausman test yielded a *cross-section random* probability of 0.22429 (> 0.05), which pointed the selection to the *Random Effect Model* (REM). As a final confirmation, the *Lagrange Multiplier* test yielded a *Breusch-Pagan Both* probability of 0.01790 (< 0.05). Thus, REM was consistently determined to be the best estimation model.

Table 4: Panel Data Regression Estimation Results with the *Random Effect* Model (REM)

Variable	Coefficient (B)	Std. Error	t-Statistic	Probability	Hypothesis Decision
Constant (C)	-0.027884	0.050422	-0.553015	0.5826	-
CR (X1)	-0.002876	0.003395	-0.847135	0.4008	H1 Rejected
DER (X2)	-0.005498	0.001557	-3.531434	0.0009	H2 Accepted
ITO (X3)	0.000542	0.000312	1.738784	0.0880	H3 Rejected
ESGD (X4)	0.103913	0.060641	1.713574	0.0926	H4 Rejected
R-squared: 0.226878		Adjusted R-squared: 0.167407		Prob(F-statistic): 0.008575	

From Table 4, the following panel data regression equation is obtained:

ROA = -0.027884 - 0.002876(CR) - 0.005498(DER) + 0.000542(ITO) + 0.103913(ESGD) + e

The constant of -0.027884 indicates that if all independent variables are zero, profitability equals -0.027884. The liquidity (CR) coefficient of -0.002876 means that each one-unit increase in CR reduces ROA by 0.002876, assuming the other variables are held constant. The solvency (DER) coefficient of -0.005498 means that each one-unit increase in DER reduces ROA by 0.005498. Conversely, the activity (ITO) coefficient of 0.000542 and the *ESG Disclosure* (ESGD) coefficient of 0.103913 mean that each one-unit increase in each variable raises ROA by 0.000542 and 0.103913, respectively.

Coefficient of Determination and F Test. An *Adjusted* R^2 of 0.167407 shows that 16.74% of the variation in the profitability (ROA) of mining companies can be explained by CR, DER, ITO, and ESGD together, while the remaining 83.26% is explained by other factors outside the model, including macroeconomic variables (inflation, interest rates, and exchange rates), firm size (*firm size*), operating cost efficiency, and global commodity

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price fluctuations. The F test yielded an *F-statistic* of 3.814938 with a probability of 0.008575 (< 0.05), so liquidity, solvency, activity, and *ESG disclosure* have a significant simultaneous effect on profitability.

Partial Test (t Test). At the 0.05 significance level, liquidity (CR) recorded a probability of 0.4008 (> 0.05) with a negative coefficient, so it has a negative and insignificant effect on profitability. Solvency (DER) recorded a probability of 0.0009 (< 0.05) with a negative coefficient, so it has a negative and significant effect. Activity (ITO) recorded a probability of 0.0880 (> 0.05) with a positive coefficient, so it has a positive and insignificant effect. As for *ESG disclosure* (ESGD), it recorded a probability of 0.0926 (> 0.05) with a positive coefficient, so it has a positive but insignificant effect on profitability.

DISCUSSION

This section presents the hypothesis testing results as well as an empirical interpretation of the impact of liquidity (CR), solvency (DER), activity (ITO), and *ESG disclosure* (ESGD) on the profitability (ROA) of 19 mining companies listed on the IDX throughout 2023–2025 (57 observations). The discussion aims to explain the relationships among variables and the reasons behind whether or not the proposed hypotheses are supported.

The Impact of Liquidity on Profitability. The partial test yielded a CR coefficient of -0.002876 with a probability of 0.4008 (> 0.05), so H1 is rejected. This finding shows that liquidity has a negative but insignificant effect on profitability. Excess current assets in the extractive industry are held more defensively to ensure coverage of current debt and routine exploration costs than aggressively rotated to earn profit. Current assets that are not optimally utilized have the potential to create idle cash (*idle cash*), which may actually reduce total asset efficiency. This result is in line with the findings of Tulung et al. (2024), Sukmala et al. (2026), and Sukiyat et al. (2025).

On the other hand, this finding contradicts Atmaja & Muid (2021), Abbas et al. (2020), and Maulana & Sabrina (2024), who found a significant positive effect, and also differs from Sanga et al. (2025) and Widyakto et al. (2024), who found a negative effect on company profitability.

The Impact of Solvency on Profitability. The partial test yielded a DER coefficient of -0.005498 with a probability of 0.0009 (< 0.05), so H2 is accepted. Solvency proved to have a negative and significant effect on profitability. This finding is consistent with Signaling Theory, in which a dominant share of debt signals financial risk that can endanger the entity's stability. Every increase in the level of external debt directly raises the obligation to pay loan interest expense. This swelling of financial costs erodes the net profit margin of mining companies, which ultimately depresses ROA. This result

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reinforces the empirical studies of Inyang et al. (2026), Sukmala et al. (2026), and Subhan (2023).

Nevertheless, this result contradicts Amoa-Gyarteng & Dhliwayo (2022), Maulana & Sabrina (2024), and Octavia et al. (2016), who concluded that solvency has a significant positive effect, while Sukiyat et al. (2025) and Widyakto et al. (2024) held that solvency has no significant effect.

The Impact of Activity on Profitability. The partial test yielded an ITO coefficient of 0.000542 with a probability of 0.0880 (> 0.05), so H3 is rejected. Activity has a positive but insignificant impact on profitability. Although rapid inventory turnover supports the efficiency of mined goods flow, the movement of profitability in the extractive sector is far more sensitive to the volatility of benchmark commodity prices in international markets than to mere physical storage efficiency at the mine site. The results of this study are in line with the studies of Simon-Ilogho (2025), Putri et al. (2026), and Batubara (2018).

On the other hand, this result contradicts Atmaja & Muid (2021), Oyewobi & Adesoye (2024), and Agustina et al. (2018), who state that there is a significant positive effect, while Sitepu (2017) found a significant negative effect.

The Impact of ESG Disclosure on Profitability. The partial test yielded an ESGD coefficient of 0.103913 with a probability of 0.0926 (> 0.05), so H4 is rejected. ESG disclosure has a positive but insignificant impact on profitability. Disclosing environmental and social indicators requires an allocation of compliance investment (*compliance cost*) and significant initial operating expenditure. The strategic benefits of ESG reporting are long-term in building corporate reputation, so they do not yet contribute an instant increase in net profit to the ROA achieved in the current period. This finding is consistent with Terdpaopong et al. (2024), Setiawati & Hidayat (2023), and Priadi & Wahyudi (2026).

Conversely, this result contradicts Ali et al. (2025), Kumar & Firoz (2022), and Erben Yavuz (2023), who found a significant positive effect, and differs from Risal et al. (2024) and Wijaya & Iryanto (2024), who found a negative effect.

Based on the above discussion, Table 5 summarizes the hypothesis testing results.

Table 5: Summary of Hypothesis Testing Results

Hypothesis	Description	Conclusion
Ha1	Liquidity has a significant positive effect on profitability	Ha1 Rejected
Ha2	Solvency has a significant negative effect on profitability	**Ha2 Accepted**
Ha3	Activity has a significant positive effect on profitability	Ha3 Rejected

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Hypothesis	Description	Conclusion
Ha4	*ESG Disclosure* has a significant positive effect on profitability	Ha4 Rejected

CONCLUSION

This study concludes that liquidity (CR), solvency (DER), activity (ITO), and *ESG disclosure* simultaneously have a significant effect on the profitability (ROA) of mining companies listed on the IDX in 2023–2025. Partially, only solvency was proven to have a negative and significant impact on profitability, demonstrating that increased debt adds fixed interest expense that depresses net profit. Meanwhile, liquidity has a negative and insignificant effect, whereas activity and *ESG disclosure* have a positive but insignificant impact on profitability.

Liquidity has no significant impact because mining companies' current assets are used more defensively as a cushion to ensure short-term obligations are met, rather than being turned over productively in profit-generating activities. Activity has no significant effect because the risk of inventory buildup is generally mitigated through allowances for inventory write-downs and a relatively stable turnover rate. *ESG disclosure* has no significant effect because ESG implementation and compliance require large upfront operating costs and social investment, so its long-term benefits have not yet been realized in asset use efficiency throughout the observation period.

The results of this study should be interpreted with consideration of several limitations that bound its scope. First, the observation window covers only three years (2023–2025), so it does not yet capture long-term trends and global commodity cycles. Second, the study uses only four independent variables, even though profitability is also influenced by other factors, such as firm size (*firm size*), capital expenditure (*capital expenditure*), governance structure, and macroeconomic factors. Third, the sample is limited to 19 mining companies with 57 observations, so generalization to other sectors should be done with caution. Fourth, each variable is measured with only one proxy. Fifth, the measurement of *ESG disclosure* relies on content analysis based on GRI indicators, which is potentially subjective and measures only quantity, not the quality of ESG practice implementation.

Based on these limitations, future researchers are expected to extend the observation period (for example, 5 to 10 years), expand the sample to other sectors such as manufacturing, banking, and primary consumer goods, and add internal variables (*capital intensity*, *sales growth*, *firm size*, and *capital expenditure*) as well as external variables (commodity price fluctuations, exchange rates, and interest rates). Researchers are also advised to use alternative proxies such as *Return on Equity* or *Net Profit Margin*

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as measures of profitability, *Quick Ratio* or *Cash Ratio* as measures of liquidity, *Debt to Asset Ratio* as a measure of solvency, and *Total Asset Turnover* as a measure of activity, and to utilize ESG rating scores from independent institutions.

For the management of mining companies, the findings of this study should be used as a guideline for optimizing capital structure and *financial leverage*, by controlling the use of debt so that financial risk and interest expense do not erode net profit. ESG disclosure and implementation should also be positioned as a long-term strategic investment to maintain competitiveness and operational efficiency, rather than merely as an administrative compliance cost. For academics, this study is expected to enrich the empirical literature and serve as a comparative reference in identifying the determinants of financial performance of companies in emerging markets.

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