

ESG Performance, Environmental Controversies, and Environmental Investment Expenditures: Their Impact on Corporate Financial Distress Risk in Indonesia

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Abstract. *This study examines the effects of Environmental, Social, and Governance (ESG) performance, environmental controversies, and environmental investment expenditures on financial distress risk among firms listed on the Indonesia Stock Exchange (IDX). Using balanced panel data from 58 non-financial firms during 2021–2024 (232 firm-year observations), financial distress is measured using the modified Altman Z-Score, while ESG-related variables are obtained from the Refinitiv database. Fixed-effects panel regression with cluster-robust standard errors is employed to test the proposed relationships. The results show that ESG performance does not have a statistically significant effect on financial distress risk. In contrast, environmental controversies significantly reduce Altman Z-Scores, indicating weaker financial conditions and a higher likelihood of financial distress. Environmental expenditures do not exhibit a significant direct effect. Additional analysis reveals that industry environmental risk exposure moderates the relationship between environmental controversies and financial distress. Although environmental controversies remain detrimental to corporate financial health, their adverse impact is less pronounced among firms operating in environmentally sensitive industries, with the marginal effect decreasing from -0.0120 in low-risk industries to -0.0062 in high risk industries. These findings suggest that realized environmental risks exert a stronger influence on corporate financial vulnerability than ESG disclosure scores or environmental spending.*

Keywords: ESG Performance; Environmental Controversies; Environmental Expenditures; Financial Distress.

INTRODUCTION

Environmental, Social, and Governance (ESG) performance has become an important indicator of corporate sustainability, reflecting how firms manage environmental impacts, stakeholder relationships, and governance practices. Beyond disclosure requirements, ESG is increasingly viewed as a strategic tool for risk management and long-term value creation. Consequently, investors, regulators, and other stakeholders increasingly incorporate ESG considerations into corporate performance evaluation.

The importance of ESG has grown rapidly in Indonesia following the implementation of Financial Services Authority Regulation (POJK) No. 51/POJK.03/2017, which encourages firms to integrate sustainability principles into business activities and reporting practices. The Indonesia Stock Exchange (IDX) has further strengthened this initiative through the ESG Reporting module within the SPE-IDXnet platform, improving the transparency and accessibility of sustainability disclosures.

As shown in Table 1, ESG adoption among Indonesian listed firms has increased substantially. The number of firms with ESG reporting rose from 39 in 2016 to 108 in 2024, while the average ESG score increased from 44.25 to 52.71. These trends indicate growing awareness and implementation of sustainability practices in the Indonesian capital market.

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Table 1. Development of ESG Reporting and Average ESG Scores in Indonesia

Year	2024	2023	2022	2021	2020	2019	2018	2017	2016
IDX Firms with ESG Reporting	108	107	103	80	51	46	43	41	39
Average ESG Score	52,71	50,64	50,32	50,09	50,48	50,31	47,72	47,59	44,25

Source: Refinitiv ESG Database and Indonesia Stock Exchange.

Despite this progress, the effectiveness of ESG in enhancing corporate financial resilience remains inconclusive. Prior studies report mixed findings, suggesting that ESG performance may reduce financial distress risk, while sustainability investments can also create short-term financial pressures. Moreover, environmental controversies and environmental expenditures may influence financial outcomes through different mechanisms. Therefore, this study examines the effects of ESG performance, environmental controversies, and environmental investment expenditures on corporate financial distress risk among firms listed on the Indonesia Stock Exchange during 2021–2024.

LITERATURE REVIEW

The increasing importance of Environmental, Social, and Governance (ESG) practices has expanded the assessment of corporate performance beyond traditional financial indicators. Conventional financial distress models primarily rely on accounting-based measures such as profitability, liquidity, and leverage (Altman, 1968). However, these measures often fail to capture environmental, social, and governance risks that may affect corporate sustainability and long-term performance (Boubaker et al., 2020); (García et al., 2024). Consequently, ESG performance has become an important indicator of corporate resilience and risk management capability.

Several theoretical perspectives explain the relationship between ESG and financial distress. Effective ESG practices strengthen stakeholder trust and legitimacy, reducing potential conflicts and enhancing organizational stability (Eccles et al., 2012). Likewise, Signaling Theory suggests that ESG disclosures serve as signals of managerial quality, transparency, and long-term commitment, thereby reducing information asymmetry and improving investor confidence (Spence, 1973); (Alareeni & Hamdan, 2020).

From the perspective of Trade-Off Theory, firms must balance the costs and benefits associated with sustainability initiatives (Modigliani & Miller, 1963). Investments in environmental technologies, governance systems, and sustainability programs may improve competitiveness and reduce risk over time, but they can also impose short-term financial burdens (Krüger, 2015); (Narula et al., 2024). Similarly, Risk Management Theory views ESG as a mechanism for identifying and mitigating non-financial risks such as environmental incidents, regulatory sanctions, and reputational crises (Bansal & DesJardine, 2014). Firms with stronger ESG performance generally exhibit lower financing costs, reduced earnings volatility, and greater resilience during periods of uncertainty (Boubaker et al., 2020); (García et al., 2024); (Binesh et al., 2025).

Financial distress refers to a condition in which a firm experiences substantial financial pressure and difficulties in fulfilling its obligations (Beaver, 1966). It is commonly regarded as an early warning signal of potential bankruptcy (Platt & Platt, 2002). This study employs the modified Altman Z-score to measure financial distress because it is widely used for non-financial firms and provides a comprehensive assessment of corporate financial health (Altman, 1968).

Empirical evidence regarding the relationship between ESG and financial distress remains mixed. Several studies report that stronger ESG performance reduces financial distress risk through improved stakeholder relations, lower risk exposure, and enhanced operational stability (García et al., 2024); (Yadav & Asongu, 2025); (Zhou et al., 2025). Similar findings are reported in the banking sector, where ESG indicators improve risk assessment and distress prediction accuracy (Citterio & King, 2023); (Choi et al., 2024). Furthermore, firms with stronger ESG engagement demonstrated greater resilience during periods of economic uncertainty, including the COVID-19 pandemic (Binesh et al., 2025). Nevertheless, other studies suggest that ESG initiatives may generate substantial implementation costs and do not always produce immediate financial benefits (Krüger, 2015); (Narula et al., 2024). (Berg et al., 2022) further argue that aggregate ESG scores may conceal important differences among individual ESG dimensions.

Recent research highlights the importance of examining environmental-specific factors. Environmental controversies represent realized environmental risks arising from pollution incidents, regulatory violations,

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litigation, or adverse media exposure. Such events can increase compliance costs, damage corporate reputation, and restrict access to financing (Xue et al., 2023). Empirical studies consistently show that environmental controversies increase corporate risk and weaken financial performance (Cosma et al., 2025); (Xing et al., 2025); (Liu & Jia, 2025).

Conversely, environmental expenditures reflect proactive investments intended to reduce environmental risks and improve sustainability performance. These investments may enhance efficiency, reduce regulatory exposure, and create long-term value despite increasing short-term costs (Clark et al., 2015); (Shi et al., 2023); (Jia et al., 2025). However, evidence regarding their direct influence on financial distress remains inconclusive.

METHODS

Research Design and Data Collection

This study employs a quantitative research design using panel data from companies listed on the Indonesia Stock Exchange (IDX) during the period 2021–2024. Financial data were collected from annual reports, while ESG-related information was obtained from the Refinitiv ESG database. Refinitiv was selected because it provides standardized ESG metrics that are widely used in both academic research and professional investment analysis.

Sample Selection

The study population consists of all firms listed on the IDX during the observation period. Financial institutions, including banks, insurance companies, and other financial service firms, were excluded because their financial structures, regulatory environments, and distress characteristics differ substantially from those of non-financial firms. Purposive sampling was employed based on three criteria: (1) firms remained actively listed on the IDX throughout 2021–2024, (2) ESG scores were available in the Refinitiv database, and (3) complete financial statement data were available for all variables included in the analysis.

Variable Measurement

Financial distress serves as the dependent variable and is measured using the modified Altman Z-Score, where lower values indicate a greater likelihood of financial distress. The independent variables consist of ESG Performance, Environmental Controversies, and Environmental Expenditures, all obtained from Refinitiv. To control for firm-specific financial characteristics, the study incorporates firm size, profitability, leverage, and liquidity as control variables. High Risk Industry is a dummy variable used in the moderating analysis. Firms operating in environmentally sensitive industries are classified as high risk industries and assigned a value of 1, while other firms are assigned a value of 0. Consistent with prior ESG and environmental risk literature, high risk industries include sectors with substantial environmental exposure, such as energy, mining, materials, chemicals, utilities, and industrial manufacturing.

Table 2. Variable Measurement

Variable	Measurement
Financial Distress (ZScore)	Modified Altman Z-Score
ESG Performance (ESG)	Refinitiv ESG Score
Environmental Controversies (ENVCONT)	Refinitiv Environmental Controversies Score
Environmental Expenditures (ENVEXP)	Refinitiv Environmental Expenditures Score
Firm Size (SIZE)	Natural logarithm of total assets
Profitability (ROA)	Return on Assets
Leverage (LEV)	Total liabilities divided by total assets
Liquidity (LIQ)	Current ratio
High Risk (HRISK)	High risk industry classification

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Hypotheses and Empirical Model

Drawing upon Stakeholder Theory, Signaling Theory, Trade-Off Theory, and Risk Management Theory, this study examines whether sustainability-related factors influence corporate financial distress risk. Firms with stronger ESG performance are expected to exhibit lower financial distress risk because effective sustainability practices enhance stakeholder trust, improve risk management capabilities, and strengthen long-term financial resilience. Conversely, environmental controversies may increase financial vulnerability through regulatory sanctions, litigation costs, reputational damage, and operational disruptions. Environmental expenditures are expected to mitigate long-term environmental risks and contribute to corporate resilience despite potentially generating short-term costs.

Based on the theoretical framework, the following hypotheses are proposed:

H1: ESG performance negatively affects corporate financial distress risk.

H2: Environmental controversies positively affect corporate financial distress risk.

H3: Environmental investment expenditures negatively affect corporate financial distress risk.

The hypotheses are tested using the following regression specifications:

$$Z_{it} = \alpha + \beta_1 ESG_{it} + \gamma X_{it} + \varepsilon_{it}$$

$$Z_{it} = \alpha + \beta_2 ENVCONT_{it} + \gamma X_{it} + \varepsilon_{it}$$

$$Z_{it} = \alpha + \beta_3 ENVEXP_{it} + \gamma X_{it} + \varepsilon_{it}$$

where X_{it} represents the vector of control variables, including firm size (SIZE), profitability (ROA), leverage (LEV), and liquidity (LIQ).

The baseline model used to test the direct effects of ESG-related variables on financial distress is specified as follows:

$$Z_{it} = \alpha + \beta_1 ESG_{it} + \beta_2 ENVCONT_{it} + \beta_3 ENVEXP_{it} + \beta_4 SIZE_{it} + \beta_5 ROA_{it} + \beta_6 LEV_{it} + \beta_7 LIQ_{it} + \varepsilon_{it}$$

To examine whether the effects of ESG-related factors differ across industries with varying environmental exposure, High Risk Industry (*HRISK*) is incorporated as a moderating variable. The interaction models are specified as:

$$Z_{it} = \alpha + \beta_1 ESG_{it} + \beta_2 HRISK_{it} + \beta_3 (ESG_{it} \times HRISK_{it}) + \gamma X_{it} + \varepsilon_{it}$$

$$Z_{it} = \alpha + \beta_1 ENVCONT_{it} + \beta_2 HRISK_{it} + \beta_3 (ENVCONT_{it} \times HRISK_{it}) + \gamma X_{it} + \varepsilon_{it}$$

$$Z_{it} = \alpha + \beta_1 ENVEXP_{it} + \beta_2 HRISK_{it} + \beta_3 (ENVEXP_{it} \times HRISK_{it}) + \gamma X_{it} + \varepsilon_{it}$$

where Z denotes the modified Altman Z-Score, *ESG* represents ESG Performance, *ENVCONT* denotes Environmental Controversies, *ENVEXP* refers to Environmental Expenditures, and *HRISK* is a dummy variable equal to 1 for firms operating in environmentally sensitive industries and 0 otherwise. X represents the vector of control variables, including firm size (SIZE), profitability (ROA), leverage (LEV), and liquidity (LIQ).

Data Analysis Technique

Panel regression analysis was employed to examine the relationship between sustainability-related factors and financial distress risk. The most appropriate estimation model was determined using the Chow test, Hausman test, and Breusch–Pagan Lagrange Multiplier test. To improve the robustness of statistical inference, cluster-robust standard errors were applied to address potential heteroskedasticity and autocorrelation problems. In addition to estimating separate models for each hypothesis, a full specification including all explanatory variables was estimated to evaluate their combined effects on corporate financial distress.

RESULTS AND DISCUSSION

Sample Selection and Descriptive Statistics

Table 3 summarizes the sample selection process. From 930 firms listed on the Indonesia Stock Exchange (IDX), 108 financial firms, 763 firms without available ESG scores, and one firm with incomplete data were excluded. The final sample comprises 58 non-financial firms observed over the period 2021–2024, resulting in 232 firm-year observations. Of these firms, 25 are classified as high risk industries and 33 as low risk industries.

Table 3. sample selection

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Description	Number
Companies Listed on the Indonesia Stock Exchange (IDX)	930
Financial Sector Companies	(108)
Companies Without ESG Scores	(763)
Companies with Incomplete Data	(1)
Final Sample of Companies (2021–2024)	58
Total Observations (58 × 4 Years)	232
High Risk Industry Firms	25
Low Risk Industry Firms	33

Source: Indonesia Stock Exchange (IDX) and Refinitiv database, processed by the author.

Table 4 presents the descriptive statistics. The average modified Altman Z-Score is 3.853, indicating generally healthy financial conditions, although substantial variation exists across firms. The mean ESG score of 52.793 reflects moderate sustainability performance among Indonesian listed firms. Environmental controversy scores show moderate variation, with some firms having zero controversies while others approach maximum scores whereas environmental expenditure exhibits considerable dispersion, suggesting differences in environmental investment strategies. The sampled firms also exhibit positive profitability, with an average ROA of 6.6%. In addition, the firms maintain moderate leverage of 0.473, and adequate liquidity of 2.185 times.

Table 4. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Altman Z-Score	232	3.8533	3.7741	-8.0836	17.3807
ESG Score	232	52.7934	16.9283	11.2760	88.9822
Environmental Controversies	232	53.6140	6.1672	0.0000	54.9513
Environmental Expenditure	232	36.4911	40.0873	0.0000	89.9083
Firm Size (Ln Total Assets)	232	17.3111	1.2832	12.4005	19.9713
Return on Assets (ROA)%	232	6.6021	8.0024	-13.8750	57.6520
Leverage (LEV)	232	0.4732	0.2207	0.0810	1.4681
Liquidity (LIQ)	232	2.1853	1.8196	0.1822	10.6754

Source: Data processing results (2026)

Model Selection and Diagnostic Tests

Prior to hypothesis testing, several model selection and diagnostic tests were conducted. Table 5 present the Chow and Breusch–Pagan LM tests rejected the pooled OLS specification for all models, while the Hausman test indicated that the Fixed Effects estimator was preferred over the Random Effects estimator. Furthermore, heteroskedasticity and autocorrelation were detected in all model specifications. Therefore, the hypotheses were tested using Fixed Effects regression with cluster-robust standard errors at the firm level to ensure consistent statistical inference.

Table 5. Model Selection and diagnostics test

Model	Chow Test	LM Test	Hausman Test	Final Model
ESG	79.82***	292.84***	16.71***	FE Cluster-Robust
Environmental Controversy	83.76***	293.42***	15.65***	FE Cluster-Robust
Environmental Expenditure	80.52***	295.86***	21.97***	FE Cluster-Robust
Full Model	79.32***	288.14***	22.73***	FE Cluster-Robust

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Notes: All test statistics are significant at the 1% level. Heteroskedasticity and autocorrelation were detected; therefore, Fixed Effects regressions were estimated using cluster-robust standard errors.

Source: Data processing results (2026)

Regression Results and Discussion

Table 6 reports the baseline regression results. ESG performance does not have a statistically significant effect on financial distress risk in either the individual ESG model or the full model. Consequently, H1 is not supported. This finding suggests that higher ESG scores alone do not necessarily improve corporate financial resilience. One possible explanation is that ESG ratings primarily capture disclosure quality and reporting practices rather than the effectiveness of sustainability implementation consistent with (Berg et al., 2022), who argue that aggregate ESG scores may not fully capture underlying sustainability performance. Moreover, the benefits of ESG initiatives may require a longer period to materialize than the four-year observation window used in this study.

In contrast, environmental controversy exhibits a significant negative relationship with the Altman Z-Score in both the individual and full models. The coefficient of Environmental Controversies is negative and statistically significant at the 1% level in both specifications. Since lower Z-Scores indicate greater financial distress risk, H2 is supported. The result implies that environmental incidents, regulatory violations, litigation, and adverse publicity create immediate financial consequences through reputational damage, compliance costs, and financing constraints. Compared with ESG disclosure scores, environmental controversies provide a more direct measure of corporate environmental risk exposure. Environmental expenditure does not demonstrate a significant direct effect on financial distress risk in either the individual model or the full specification, leading to the rejection of H3.

The insignificant relationship may be attributed to the delayed nature of returns from environmental investments, which often require time before translating into measurable financial benefits, as well as Refinitiv’s measurement approach, which reflects disclosed expenditure levels rather than the effectiveness or quality of environmental investments.

Table 6. Baseline regression results

Variables	(1) ESG	(2) ENVCONT	(3) ENVEXP	(4) Full
ESG Score	0.0060			0.0061
Environmental Controversies		-0.0095***		-0.0086***
Environmental Expenditure			0.0010	-0.0004
Controls (SIZE, ROA, LEV, LIQ)	Yes	Yes	Yes	Yes
Observations	232	232	232	232
Firms	58	58	58	58
Overall R ²	0.743	0.723	0.723	0.742

Notes: *** p<0.01, ** p<0.05, * p<0.10.

Source: Data processing results (2026)

To further explore whether the effects of ESG related factors vary according to a firm's environmental risk exposure, an additional analysis was conducted by incorporating High Risk Industry as a moderating variable. Table 7 presents the interaction models examining the moderating role of High Risk Industry. The results show that the interaction terms between ESG performance and High Risk Industry, as well as between Environmental Expenditure and high risk industry, are not statistically significant. This indicates that the effects of ESG performance and environmental expenditures on financial distress risk do not differ between high risk and low risk industries.

In contrast, the interaction between Environmental Controversy and High Risk Industry is positive and statistically significant. While environmental controversies significantly increase financial distress risk by reducing Altman Z-Scores, their adverse impact is weaker among firms operating in high risk industries. The marginal effect of environmental controversy decreases from -0.0120 in low risk industries to -0.0062 in high risk industries.

These findings suggest that firms in environmentally sensitive industries are relatively better equipped to manage and absorb the financial consequences of environmental incidents. Due to greater regulatory scrutiny and

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environmental risk exposure, such firms may have more developed environmental management systems and risk mitigation practices. Overall, the results indicate that environmental controversies remain a significant source of financial vulnerability, although their negative impact is less severe for firms operating in high risk industries.

Table 7. High Risk Industry Interaction models

Variables	(1) ESG × High Risk	(2) ENVCONT × High Risk	(3) ENVEXP × High Risk	(4) Full Model
ESG Score	0.0147			0.0124
ESG Score × High Risk	-0.0174			-0.0128
High Risk Effect of ESG	-0.0027			-0.0004
ENVCONT		-0.0120***		-0.0104***
ENVCONT × High Risk		0.0058***		0.0045***
High Risk Effect of ENVCONT		-0.0062**		-0.0059**
ENVEXP			0.0011	-0.0009
ENVEXP × High Risk			-0.0003	0.0010
High Risk Effect of ENVEXP			0.0008	0.0001
SIZE	-0.2764	-0.2469	-0.2694	-0.2728
ROA	0.0810***	0.0821***	0.0811***	0.0825***
LEV	-8.5059***	-8.3846***	-8.4676***	-8.4425***
LIQ	0.9708***	0.9866***	0.9708***	0.9842***
Constant	9.6793***	9.9054***	9.8331***	10.0293***
Firm Fixed Effects	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes
Observations	232	232	232	232
Firms	58	58	58	58
Overall R ²	0.7425	0.7255	0.7230	0.7074

Notes: High Risk Effect is calculated as the main effect coefficient plus the corresponding interaction coefficient. Robust standard errors are clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Source: Data processing results (2026)

CONCLUSIONS

This paper provides empirical evidence on the relationship between ESG-related factors and corporate financial distress risk among non-financial firms listed on the Indonesia Stock Exchange during 2021–2024. The findings indicate that ESG performance does not have a statistically significant effect on financial distress risk, suggesting that higher ESG scores alone are insufficient to strengthen corporate financial resilience. Likewise, environmental expenditures do not significantly influence financial distress risk during the observation period.

Environmental controversies emerge as a significant determinant of corporate financial vulnerability. Firms exposed to environmental incidents, regulatory violations, or negative environmental publicity tend to experience weaker financial conditions and a higher likelihood of financial distress. These results highlight that realized environmental risks have more immediate financial consequences than ESG disclosure scores or environmental spending.

The moderating analysis further reveals that High Risk Industry does not significantly alter the relationship between ESG performance and financial distress risk, nor the relationship between environmental expenditures and financial distress risk. Nevertheless, High Risk Industry significantly moderates the effect of environmental controversies. Although environmental controversies remain detrimental to corporate financial health, their

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adverse impact is less pronounced among firms operating in environmentally sensitive industries. This finding suggests that firms with greater environmental exposure may possess more established risk management practices and experience in responding to environmental challenges.

This study is limited by its reliance on firms with available Refinitiv ESG data, a relatively short observation period, and the use of aggregate ESG scores. Future research may extend the observation period, incorporate alternative measures of environmental risk and financial distress, and conduct comparative studies across emerging market countries to assess whether the relationship between ESG-related factors and financial distress differs from the evidence observed in Indonesia.

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