THE IMPACT OF CLIMATE CHANGE DISCLOSURE PERFORMANCE ON FINANCIAL DISTRESS AMONG ENERGY SECTOR COMPANIES

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ABSTRACT

This study examines the effect of Climate Change Disclosure Performance (CCDP) and audit quality on financial distress and investigates the moderating role of audit quality in the relationship between CCDP and financial distress among energy sector companies listed on the Indonesia Stock Exchange during the 2018-2024 period. A quantitative approach was employed using panel data selected through purposive sampling. Financial distress was measured using the AC_Dis proxy, CCDP was assessed based on the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD), and audit quality was proxied by the use of Big Four and non-Big Four accounting firms. Hypotheses were tested using Moderated Regression Analysis (MRA). The results show that CCDP is negatively and significantly associated with financial distress, suggesting that greater transparency regarding climate-related information can help reduce a firm's risk of financial distress. In contrast, audit quality is not significantly associated with financial distress. The findings also reveal that audit quality weakens the negative relationship between CCDP and financial distress, indicating a substitution effect between external monitoring and voluntary disclosure in mitigating information asymmetry. Overall, the results highlight the strategic role of climate change disclosure in strengthening the financial resilience of energy sector firms.

Keywords: Climate Change Disclosure Performance, audit quality, financial distress, energy sector, TCFD.

1. INTRODUCTION

The energy sector plays a vital role in the economy and is characterized by high capital intensity and substantial reliance on debt financing, making it particularly vulnerable to external shocks that may lead to financial distress (Duong et al., 2025). Financial distress reflects a condition in which firms experience financial difficulties that impair their ability to meet obligations and sustain business operations as a going concern (Alshahrani et al., 2023; Felicia & Lindrianasari, 2025). Beyond commodity price volatility, climate-related risks have increasingly become embedded in firms' financial conditions (Aguilar-Gomez et al., 2024; Liu et al., 2025).

In Indonesia, these risks have intensified following the implementation of the national energy transition agenda, including the carbon tax roadmap under UU RI No. 7 Tahun 2021 (UU RI Nomor 7 Tahun 2021, 2021) and the gradual phase-down of coal-fired power plants through Perpres No. 112 Tahun 2022 (Peraturan Presiden Nomor 112 Tahun 2022, 2022). These developments place additional pressure on the cash flows of energy companies, particularly those with highly leveraged capital structures that are more vulnerable to green regulatory shocks (Chatjuthamard et al., 2025).

As one of the largest contributors to greenhouse gas emissions, Indonesia's energy sector faces increasing pressure from regulators and investors to demonstrate effective climate risk management. Regulatory requirements such as POJK No. 51 Tahun 2017 (POJK No. 51/POJK.03/2017, 2017) and SEOJK No. 16 Tahun 2021 (SEOJK No. 16/SEOJK.04/2021, 2021), alongside growing investor concerns regarding climate-related risks (IPCC, 2021),

have encouraged firms to enhance climate-related transparency. Climate change disclosure serves as an important communication mechanism that can reduce information asymmetry, lower perceived risk, strengthen investor confidence, improve reputation, and ultimately enhance firms' resilience against financial difficulties (Liu et al., 2025; Salvi et al., 2025).

However, increasing demands for transparency may also encourage symbolic disclosure and greenwashing practices, particularly among financially pressured firms seeking to maintain legitimacy and investor confidence (Park et al., 2023). Consequently, the credibility of climate-related disclosures becomes critical. Similar concerns have emerged in controversies surrounding Indonesia's energy transition initiatives that have fueled investor skepticism (Pristiandaru, 2023). In this context, audit quality plays an important role in enhancing disclosure credibility. High-quality audits, particularly those conducted by Big Four Public Accounting Firms (PAFs), function as an external monitoring mechanism that supports stakeholder confidence by ensuring that corporate disclosures are reported more accurately and credibly (Du & Lai, 2018; Jensen & Meckling, 1976; Saeed et al., 2024).

Stakeholder theory argues that firms must balance the interests of multiple stakeholder groups to ensure long-term success (Freeman, 1984). Climate-related disclosure therefore serves as an important communication mechanism for addressing stakeholder information needs and maintaining stakeholder support (Freeman & MCVea, 2001; Salvi et al., 2025). Transparent disclosure may also contribute to intangible assets such as reputation, which can strengthen resilience against climate-related risks (Liu et al., 2025). At the same time, stakeholder trust depends on disclosure credibility, making audit quality an important safeguard against misstatements and reporting manipulation (Du & Lai, 2018; Freeman & MCVea, 2001).

From an agency theory perspective, Climate Change Disclosure Performance (CCDP) can be viewed as a bonding mechanism that reduces information asymmetry between managers and shareholders by signaling management's commitment to climate risk management (Jensen & Meckling, 1976; Salvi et al., 2025). However, managers experiencing financial pressure may have incentives to reduce disclosure quality or conceal unfavorable information (Du & Lai, 2018; Jensen & Meckling, 1976). Consequently, high-quality audits serve as an important monitoring mechanism that constrains opportunistic behavior and enhances reporting credibility (Alshahrani et al., 2023; Du & Lai, 2018).

Previous studies provide mixed evidence regarding climate-related disclosure. Park et al. (2023) found that firms with high emissions often increase disclosure while simultaneously engaging in greenwashing practices. In contrast, Salvi et al. (2025) reported that climate-related disclosure can reduce the cost of capital and enhance firm value. From the perspective of physical climate risks, Liu et al. (2025) showed that extreme temperature shocks increase the likelihood of financial distress, whereas Alam et al. (2025) found that a strong integrity culture can mitigate such risks. More directly, Alshahrani et al. (2023) documented that higher Climate Change Disclosure Performance (CCDP) is associated with lower financial distress and that the relationship becomes stronger among firms audited by Big Four accounting firms. Meanwhile, Fajarini et al. (2025) demonstrated that governance mechanisms can transform symbolic transparency into substantive carbon performance, although the overall level of carbon disclosure among Indonesian firms remains relatively low.

Despite the growing literature, several important gaps remain. First, most studies focus on developed economies or broad cross-

industry samples, leaving limited evidence from energy firms in developing countries (Alshahrani et al., 2023; Park et al., 2023; Salvi et al., 2025). Second, Indonesian evidence remains limited and generally covers periods ending in 2022 (Fajarini et al., 2025), which may not fully capture recent developments in carbon-related regulation and energy transition policies. Third, previous studies primarily focus on physical climate risks (Liu et al., 2025), disclosure determinants (Park et al., 2023), corporate integrity culture (Alam et al., 2025), or carbon performance (Fajarini et al., 2025). In contrast, this study positions Climate Change Disclosure Performance (CCDP) as the primary independent variable and examines audit quality as a moderating variable to assess whether disclosure credibility influences the effectiveness of climate transparency in reducing financial distress.

According to stakeholder theory, transparent climate-related disclosure signals stronger climate risk management capabilities, reduces information asymmetry, strengthens stakeholder support, and improves firms' ability to withstand financial difficulties (Al-hadi et al., 2017; Alshahrani et al., 2023; Jia & Li, 2022; Malik, 2014). Therefore, the following hypothesis is proposed:

H_1: Climate Change Disclosure Performance (CCDP) has a negative effect on financial distress.

Agency theory suggests that high-quality audits provide stronger monitoring, reduce opportunistic behavior, improve reporting quality, and lower the likelihood of financial distress (DeAngelo, 1981; Jensen & Meckling, 1976; Santosa et al., 2020; Šušak, 2025). Therefore, the following hypothesis is proposed:

H_2: Audit quality has a negative effect on financial distress.

Climate-related disclosure and audit quality both function as mechanisms for reducing information asymmetry. Consequently, a substitution effect may emerge between internal transparency and external monitoring mechanisms (Ho & Wong, 2001). The credibility signal provided by Big Four auditors may reduce stakeholders' reliance on additional climate-related disclosure because part of the information asymmetry has already been mitigated through external monitoring (DeAngelo, 1981; Saeed et al., 2024; Salvi et al., 2025). Conversely, among firms audited by non-Big Four auditors, climate-related disclosure may play a more important role in maintaining stakeholder confidence, particularly when concerns regarding greenwashing are present (Park et al., 2023). Therefore, the following hypothesis is proposed:

H_3: Audit quality weakens the negative relationship between Climate Change Disclosure Performance (CCDP) and financial distress.

Based on these arguments, this study investigates the effect of Climate Change Disclosure Performance (CCDP) and audit quality on financial distress among Indonesian energy sector firms during the 2018-2024 period and examines whether audit quality moderates the relationship between CCDP and financial distress.

2. RESEARCH METHOD

This study adopts a quantitative explanatory research design to examine the causal relationships among variables using panel data covering the period from 2018 to 2024. The population consists of all energy sector companies listed on the Indonesia Stock Exchange (IDX) based on The Refinitiv Business Classification (TRBC). The sample was selected using purposive sampling based on the following criteria: (1) companies were consistently listed on the IDX throughout the 2018-2024 period; (2) annual reports and/or sustainability reports were available from the base year of 2018 onward; and (3) data were available for all research variables. Missing observations in a particular year did not result in the exclusion of a firm from the sample.

Instead, only the affected firm-year observations were omitted, resulting in an unbalanced panel dataset.

The dependent variable is financial distress, measured using the Almeida and Campello (AC_Dis) model (Almeida & Campello, 2007). Because the AC_Dis model was originally developed to measure a firm's external financing capacity based on asset tangibility, the resulting AC_Dis values were multiplied by negative one (-1) to represent financial distress. The primary independent variable is Climate Change Disclosure Performance (CCDP), measured using a disclosure index based on the eleven recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) (Alshahrani et al., 2023; TCFD, 2017). Audit quality (BIG4) is included as both an independent variable and a moderating variable and is measured using a dummy variable that distinguishes between Big Four accounting firms (1) and non-Big Four accounting firms (0) (DeAngelo, 1981). To reduce the risk of model misspecification, several control variables are also included, namely firm size (SIZE), firm age (AGE) (Alshahrani et al., 2023), and the long-term debt-to-equity ratio (LTDER) (Agus et al., 2022).

The study relies on secondary data obtained from the Refinitiv Eikon (LSEG Workspace) database, annual reports, and sustainability reports collected from the official IDX website and the respective companies' websites. Data for the receivables variable were manually hand-collected from firms' annual reports due to the complete absence of receivables data (missing values/NULL) for energy sector firms in the Refinitiv database. This procedure was undertaken to address the data limitation while ensuring the accuracy of the AC_Dis calculations.

Hypotheses were tested using Moderated Regression Analysis (MRA) through a full interaction model . This approach satisfies the hierarchical principle and helps minimize omitted variable bias (Cohen et al., 2003). The panel regression model is specified as follows.

$$AC_DIS_{it} = \alpha + \beta_1 CCDP_{it} + \beta_2 BIG4_{it} + \beta_3 (CCDP_{it} \times BIG4_{it}) + \beta_4 SIZE_{it} + \beta_5 AGE_{it} + \beta_6 LTDER_{it} + \varepsilon_{it}$$

Model fit was evaluated using overall significance tests (F-test or Wald chi-squared test) and the coefficient of determination (R^2). Individual hypotheses were assessed based on the probability values associated with the estimated coefficients ($P > |t|$ for the Fixed Effects Model and $P > |z|$ for the Random Effects Model) using a significance level of 5% (0.05).

To assess the robustness and consistency of the findings, three sensitivity analyses were performed. First, year fixed effects (i.YEAR) were incorporated to control for macroeconomic shocks and time-specific influences throughout the observation period. Second, a firm-size subsample analysis was conducted by dividing observations into large and small firms based on SIZE, allowing the consistency of the results to be evaluated across different operational scales. Third, separate regression models were estimated for each TCFD pillar (governance, strategy, risk management, and metrics and targets) with each pillar serving as the primary independent variable. This analysis was intended to identify which dimensions of climate-related disclosure exert the strongest influence on corporate financial stability.

3. RESULT AND DISCUSSION

3.1. Descriptive Analysis and Econometric Diagnostic

Table 4. 1 Descriptive Statistics

Variable	N	Mean	Std. dev.	Min	Max
AC_Dis	304,000	-0,424	0,141	-0,711	-0,006
CCDP	304,000	0,255	0,287	0,000	1,000
GOV	304,000	0,176	0,339	0,000	1,000
STR	304.000	0.172	0.244	0.000	1.000
RM	304.000	0.281	0.370	0.000	1.000
MT	304.000	0.365	0.390	0.000	1.000
BIG4	304.000	0.365	0.482	0.000	1.000
SIZE	304.000	19.461	2.071	13.746	23.025
AGE	304.000	29.128	12.218	7.000	56.000
LTDER	304.000	0.515	0.910	-1.281	4.467

Source: Processed panel data (Stata, 2026)

Descriptive statistics were calculated using 304 firm-year observations with no missing values. The mean value of the financial distress variable (AC_Dis) was -0.424, suggesting that most sample firms were in relatively sound financial condition. In contrast, the average CCDP score was only 0.255, indicating a relatively low level of climate-related disclosure among energy sector firms in Indonesia. This limited degree of transparency is evident across all CCDP pillars, with average scores of 0.176 for governance, 0.172 for strategy, 0.281 for risk management, and 0.365 for metrics and targets. The audit quality variable (BIG4) recorded a mean value of 0.365, implying that only 36.5% of the observations were audited by Big Four accounting firms. The control variables SIZE, AGE, and LTDER had average values of 19.461, 29.128, and 0.515, respectively.

Table 4. 2 Model Selection Test Results

	Keterangan	Nilai
Uji Chow	F Statistik (F(43.254))	13.560
	Prob > F	0.000
Uji Hausman	Chi2 (6)	10.710
	Prob > Chi2	0.098
Uji Lagrange Multiplier	Chibar2 (01)	334.970
	Prob > Chibar2	0.000

Source: Processed panel data (Stata, 2026)

Before estimating the regression model, a series of panel data model selection tests was conducted, as reported in Table 4.2. The Chow test results indicate that the Fixed Effects Model (FEM) outperforms the Common Effects Model, with a Prob > F value of 0.000. However, the Hausman test produced a Prob > Chi^2 value of 0.098, exceeding the 0.05 threshold and supporting the use of the Random Effects Model (REM). This conclusion is further reinforced by the Lagrange Multiplier (LM) test, which yielded a Prob > Chi-square value of 0.000. Taken together, these results support the selection of the Random Effects Model (REM) as the most appropriate estimation approach.

The regression model also satisfies the assumptions required for panel data analysis.

The diagnostic tests indicate no evidence of multicollinearity or heteroscedasticity. The normality assumption is considered satisfied based on the Central Limit Theorem (CLT), given the relatively large sample size. Potential autocorrelation issues were addressed through the use of cluster-robust standard errors. Overall, the Chow, Hausman, and Lagrange Multiplier tests consistently identify the Random Effects Model (REM) as the most appropriate specification for hypothesis testing.

3.2. Main Regression Analysis and Hypothesis Testing

Table 4. 3 Main Regression Results

	AC_Dis
CCDP	-0.087**
	(0.018)
BIG4	-0.023
	(0.218)
CCDP×BIG4	0.105**
	(0.017)
SIZE	-0.017*
	(0.083)
AGE	-0.001
	(0.287)
LTDER	-0.005
	(0.122)
Constant	-0.060
	(0.401)
Observations	304.000
Overall R-Squared	0.132
Wald chi2	11.280
Prob > chi2	0.008

Source: Processed panel data (Stata, 2026)

P-values are reported in parentheses. Significance levels are denoted as follows: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. All significance tests are based on one-tailed hypotheses.

The hypotheses were tested using Moderated Regression Analysis (MRA) through the full interaction model. As reported in Table 4.6, the overall model demonstrates an acceptable level of fit, with a Wald chi² probability value of 0.008 and an R-squared value of 13.2%. Climate Change Disclosure Performance (CCDP) is negatively and significantly associated with financial distress, with a coefficient of -0.087 ($p < 0.05$), supporting Hypothesis 1 (H_1). In contrast, audit quality (BIG4) does not exhibit a significant direct association with financial distress, as indicated by a coefficient of -0.023 ($p = 0.435$). Therefore, Hypothesis 2 (H_2) is not supported.

The moderation analysis shows that the CCDP×BIG4 interaction term has a positive and significant coefficient of 0.105 ($p < 0.05$). Because the interaction coefficient is opposite in sign to the main CCDP coefficient, the results suggest that audit quality weakens the negative relationship between CCDP and financial distress. This finding supports Hypothesis 3 (H_3). None of the control variables (SIZE, AGE, and LTDER) exhibited a statistically significant association with financial distress in the estimated model.

3.3. Sensitivity Analysis

Table 4. 4 Sensitivity Analysis Results: Inclusion of Year Fixed Effect

	AC_Dis
CCDP	-0.088**
	(0.042)
BIG4	-0.025
	(0.212)
CCDP×BIG4	0.115**
	(0.015)
SIZE	-0.017*
	(0.084)
AGE	-0.001
	(0.326)
LTDER	-0.005
	(0.128)
YEAR=2019	0.007
	(0.361)
YEAR=2020	-0.019
	(0.192)
YEAR=2021	-0.017
	(0.215)
YEAR=2022	-0.025
	(0.148)
YEAR=2023	-0.005
	(0.431)
YEAR=2024	0.000
	(0.497)
Constant	-0.046
	(0.426)
Observations	304.000
Overall R-Squared	0.142
Wald chi2	18.840
Prob > chi2	0.093

Source: Processed panel data (Stata, 2026)

P-values are reported in parentheses. Significance levels are denoted as follows: * p < 0.10, ** p < 0.05, and *** p < 0.01. All significance tests are based on one-tailed hypotheses.

The first sensitivity analysis incorporated year fixed effects to control for time-specific influences and macroeconomic shocks. As reported in Table 4.4, the results remain highly consistent with those of the main model. CCDP continues to exhibit a significant negative coefficient (-0.088), BIG4 remains insignificant, and the CCDP×BIG4 interaction remains positive and significant with a coefficient of 0.115. The overall R-squared value also increases to 14.2%. These findings suggest that the main results remain robust after controlling for year-specific macroeconomic conditions.

Table 4. 5 Sensitivity Analysis Results: Firm Size Subsample Analysis

	SMALL FIRM	LARGE FIRM
	AC_Dis	AC_Dis
CCDP	-0.203**	-0.071**
	(0.049)	(0.048)
BIG4	-0.029	-0.036
	(0.265)	(0.131)
CCDP×BIG4	0.129	0.083**
	(0.180)	(0.045)
AGE	0.000	-0.001
	(0.392)	(0.239)
LTDER	-0.017*	-0.003
	(0.070)	(0.216)
Constant	-0.360***	-0.390***
	(0.000)	(0.000)
Observations	148.000	156.000
Overall R-Squared	0.199	0.0194
Wald chi2	6.530	3.930
Prob > chi2	0.258	0.559

Source: Processed panel data (Stata, 2026)

P-values are reported in parentheses. Significance levels are denoted as follows: * p < 0.10, ** p < 0.05, and *** p < 0.01. All significance tests are based on one-tailed hypotheses.

The firm-size subsample analysis presented in Table 4.5 shows that CCDP maintains a negative and significant association with financial distress in both small firms (coefficient = -0.203) and large firms (coefficient = -0.071). However, the moderating effect of the CCDP×BIG4 interaction is significant only among large firms, where the coefficient reaches 0.083. This pattern suggests that the substitution effect associated with auditor reputation is more pronounced among firms with greater market visibility.

Table 4. 6 Sensitivity Analysis Results: CCDP Pillar Subsample Analysis

	AC_Dis	AC_Dis	AC_Dis	AC_Dis
GOV	-0.051*			
	(0.060)			
STR		-0.072*		
		(0.080)		
RM			-0.054**	
			(0.039)	
MT				-0.052**
				(0.038)
BIG4	0.001	-0.009	-0.013	-0.019
	(0.491)	(0.367)	(0.320)	(0.260)
GOV×BIG4	0.054*			
	(0.061)			

	AC_Dis	AC_Dis	AC_Dis	AC_Dis
STR×BIG4		0.110**		
		(.034)		
RM×BIG4			0.063*	
			(0.055)	
MT×BIG4				0.071**
				(0.038)
SIZE	-0.019*	-0.019**	-0.017*	-0.018*
	(0.060)	(0.047)	(0.078)	(0.061)
AGE	-0.001	-0.001	-0.001	-0.001
	(0.225)	(0.179)	(0.222)	(0.273)
LTDER	-0.003	-0.004	-0.004	-0.003
	(0.201)	(0.173)	(0137)	(0.207)
Constant	-0.026	0.000	-0.050	-0.031
	(0.457)	(0.500)	(0.417)	(0.448)
Observations	304.000	304.000	304.000	304.000
Overall R-Squared	0.114	0.116	0.122	0.133
Wald chi2	10.840	7.330	9.180	8.810
Prob > chi2	0.094	0.291	0164	0.185

Source: Processed panel data (Stata, 2026)

P-values are reported in parentheses. Significance levels are denoted as follows: * p < 0.10, ** p < 0.05, and *** p < 0.01. All significance tests are based on one-tailed hypotheses.

Finally, separate analyses were conducted for each of the four TCFD pillars. The results show that governance (-0.051), strategy (-0.072), risk management (-0.054), and metrics and targets (-0.052) all exhibit negative and statistically significant associations with financial distress. In terms of moderation, audit quality consistently weakens the negative relationship between each TCFD pillar and financial distress, as evidenced by the positive and significant interaction coefficients across all four pillars.

3.4. Discussion

3.4.1. The Effect of Climate Change Disclosure Performance (CCDP) on Financial Distress

The results support the first hypothesis (H_1), indicating that greater transparency regarding climate-related risks is associated with a lower likelihood of financial distress among energy sector firms in Indonesia. This evidence reinforces the view that climate-related risks have become increasingly embedded in firms' financial outcomes, supporting the notion that climate risk is financial risk. In this context, climate disclosure extends beyond the fulfillment of sustainability obligations and reflects a firm's commitment to transparent risk management. Achek & Gallali (2015) argue that audit quality and timely disclosure enhance corporate transparency, reduce information asymmetry, and lower monitoring costs borne by creditors, particularly in industrial firms.

These findings are consistent with stakeholder theory, which views climate-related disclosure as an important communication mechanism for building and maintaining stakeholder trust (Freeman & MCVea, 2001; Salvi et al., 2025). Such trust is particularly valuable during Indonesia's ongoing energy transition, where stakeholders are increasingly concerned about sustainability-related issues. By providing more transparent climate information, energy companies can strengthen stakeholder support while

demonstrating greater accountability in managing climate-related risks.

From the perspective of agency theory, climate-related disclosure can be interpreted as a bonding cost incurred by management (the agent) to reduce information asymmetry with shareholders (the principal) (Jensen & Meckling, 1976). Consistent with the arguments of (Ho & Wong, 2001), effective monitoring mechanisms encourage firms to engage in broader voluntary disclosure, thereby further reducing information asymmetry between managers and investors. Greater transparency signals that management possesses the capability and commitment to address climate-related risks, which may lower perceived risk among investors and contribute to firm value (Salvi et al., 2025). The findings therefore reinforce the evidence reported by Alshahrani et al. (2023) and Al-hadi et al. (2017) suggesting that sustainability-related practices can function as a risk mitigation mechanism that reduces the likelihood of financial distress. Nevertheless, the relatively low level of climate-related disclosure observed among Indonesian energy firms suggests that many companies have yet to fully utilize CCDP as a strategic mechanism for strengthening financial resilience.

3.4.2. The Effect of Audit Quality on Financial Distress

The findings do not support the second hypothesis (H_2), suggesting that the use of a highly reputable external auditor, such as a Big Four accounting firm, does not directly reduce the likelihood of financial distress. From the perspective of agency theory, high-quality auditors serve as an external monitoring mechanism designed to constrain opportunistic managerial behavior and reduce information asymmetry between managers (agents) and shareholders (principals) (Jensen & Meckling, 1976). Through this monitoring function, reputable auditors are expected to enhance the credibility of financial information and strengthen oversight of managerial actions. However, the results indicate that the benefits associated with stronger monitoring do not necessarily translate into immediate improvements in a firm's financial condition.

Stakeholder theory offers a complementary explanation for this finding. Audit quality appears to contribute more to maintaining stakeholder confidence in the credibility of financial reporting (Freeman, 1984), than to directly improving a firm's financial performance. In other words, auditor reputation primarily serves as a signal of credibility that helps sustain investor confidence and access to funding rather than directly altering the financial structure of firms experiencing financial pressure. This interpretation is consistent with the fundamental role of auditors, which is limited to providing assurance regarding the fairness and reliability of historical financial information rather than participating in operational or strategic decision-making processes (IAPI, 2025). By contrast, financial distress is largely driven by underlying business fundamentals, including operational efficiency, leverage, commodity price fluctuations, and broader economic uncertainty, all of which remain largely under managerial control (Santosa et al., 2020).

The findings are also consistent with prior empirical evidence. Du & Lai (2018) reported that Big Four auditors do not significantly influence discretionary accruals, while Kurniawati & Panggabean (2020) found no significant relationship between audit quality, proxied by Big Four affiliation, and earnings management. Taken together, these studies suggest that affiliation with a Big Four audit firm does not automatically generate measurable improvements in all aspects of corporate behavior or financial outcomes. Accordingly, audit quality appears to function primarily as a source of reporting credibility and stakeholder assurance rather than as a direct determinant of financial health.

3.4.3. The Role of Audit Quality in Moderating the Relationship between CCDP and Financial Distress

The findings support the third hypothesis (H_3) and provide evidence of a substitution effect between internal governance mechanisms, represented by voluntary climate-related disclosure through Climate Change Disclosure Performance (CCDP), and external governance mechanisms, represented by audit quality, in reducing information asymmetry (Ho & Wong, 2001). The results suggest that climate-related disclosure plays a more prominent role in mitigating financial distress among firms that are not audited by Big Four accounting firms. In emerging markets such as Indonesia, Big Four auditors often compensate for weaknesses in conventional governance and monitoring mechanisms (Achek & Gallali, 2015). Firms audited by Big Four auditors generally benefit from higher levels of stakeholder confidence because rigorous quality-control procedures help reduce the risk of material misstatements (Du & Lai, 2018). In addition, Big Four auditors can enhance the reliability and credibility of non-financial disclosures through more stringent audit processes (Saeed et al., 2024). As a result, the incremental benefit of climate-related disclosure in reducing financial distress risk becomes less pronounced among firms audited by Big Four accounting firms.

A different pattern emerges among firms audited by non-Big Four accounting firms. In these firms, external monitoring may be perceived as less effective, leading stakeholders to express greater concern regarding the possibility of symbolic disclosure practices or greenwashing, particularly during periods of financial pressure (Park et al., 2023). Under such circumstances, comprehensive climate-related disclosure serves as an important mechanism for reducing information asymmetry, maintaining investor confidence, and preserving access to external financing. From an agency theory perspective, auditors function as a monitoring mechanism (monitoring costs) that validates the bonding costs incurred by management through climate-related disclosure (Jensen & Meckling, 1976). Accordingly, for firms that do not benefit from the strong external monitoring typically associated with Big Four auditors, climate transparency becomes a particularly important means of sustaining stakeholder trust and reducing the likelihood of financial distress.

3.4.4. Sensitivity Analysis

The sensitivity analyses provide additional evidence regarding the robustness of the main findings. First, the inclusion of year fixed effects produces results that remain highly consistent with the baseline model. The direction and statistical significance of the relationship between Climate Change Disclosure Performance (CCDP) and financial distress remain unchanged, suggesting that the observed relationship is not driven by year-specific factors or macroeconomic fluctuations during the observation period.

Second, the firm-size subsample analysis shows that the substitution effect associated with audit quality is significant only among large firms characterized by greater operational complexity and public visibility. In contrast, for smaller firms, voluntary disclosure mechanisms such as CCDP appear to play a more important role in reducing information asymmetry between firms and stakeholders (Ho & Wong, 2001). These findings further support the argument that climate-related transparency contributes to the development of reputational capital as an intangible asset while helping firms mitigate the financial pressures associated with climate-related risks (Liu et al., 2025).

Additional insights emerge from the analysis of the four TCFD pillars: governance, strategy, risk management, and metrics and targets. All four pillars exhibit a consistent negative association with financial distress, suggesting that stakeholders evaluate climate transparency in a holistic manner. In other words, the benefits of climate-related disclosure appear to arise from the overall

disclosure framework rather than from any single disclosure dimension. This pattern is consistent with the findings of Maji & Kalita (2022) who report that comprehensive climate-related disclosures based on the TCFD framework are associated with improved corporate performance.

Interestingly, the moderating analysis reveals that audit quality, represented by Big Four auditors, consistently weakens the influence of all four CCDP pillars on financial distress. From an agency theory perspective, this pattern provides further evidence of a substitution effect between external monitoring and voluntary disclosure. The credibility signal supplied by high-reputation auditors partially fulfills the role of reducing information asymmetry that would otherwise be achieved through additional climate-related disclosures. As a result, stakeholders may place less reliance on supplementary information provided through individual TCFD disclosure pillars when strong external assurance is already present.

4. CONCLUSION

This study provides empirical evidence on the relationship between climate-related transparency, audit quality, and financial distress among Indonesian energy sector firms during the 2018–2024 period. The results show that Climate Change Disclosure Performance (CCDP) is negatively associated with financial distress, suggesting that greater climate transparency helps reduce information asymmetry, strengthen stakeholder confidence, and improve firms' financial resilience. By contrast, audit quality, measured through Big Four auditor affiliation, does not exhibit a significant direct association with financial distress. This result suggests that auditor reputation primarily functions as a credibility signal that enhances confidence in financial reporting rather than directly influencing the operational and financial factors that drive financial distress.

The study also finds that audit quality weakens the negative relationship between CCDP and financial distress, providing evidence of a substitution effect between external monitoring and voluntary disclosure. For firms audited by non-Big Four auditors, climate-related disclosure serves as an important mechanism for reducing information asymmetry and maintaining stakeholder support. In contrast, among firms audited by Big Four auditors, the credibility signal provided by high-quality external assurance appears to reduce the incremental value of additional climate-related disclosure in mitigating financial distress risk. The robustness analyses further reinforce these conclusions. The negative association between CCDP and financial distress remains stable after controlling for year-specific effects, indicating that the findings are not driven by annual macroeconomic fluctuations. The substitution effect associated with audit quality is evident primarily among large firms and remains consistent across all four TCFD disclosure pillars: governance, strategy, risk management, and metrics and targets.

From a theoretical perspective, these findings reinforce stakeholder theory by demonstrating that climate-related transparency can function as an effective mechanism for strengthening stakeholder confidence and reducing financial distress. The study also contributes to agency theory by providing evidence of a substitution effect between CCDP as a bonding mechanism and audit quality as a monitoring mechanism in reducing information asymmetry. From a practical perspective, the findings suggest that managers should view climate-related disclosure as a strategic investment in corporate reputation and financial resilience rather than merely a compliance requirement. The results further indicate that investors, creditors, and regulators may utilize CCDP as an additional indicator of financial resilience while encouraging more consistent,

comparable, and measurable climate-related disclosure practices within the energy sector.

5. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study has several limitations that should be acknowledged when interpreting the findings. First, the CCDP index was measured using a dummy-based scoring approach derived from the TCFD recommendations and assessed by a single rater, which may introduce subjectivity and human error. Second, the absence of receivables data for energy sector firms in the Refinitiv Eikon database required manual data collection, which may have introduced data-entry inaccuracies. Third, because the sample is limited to Indonesian energy sector firms, the findings may not be generalizable to other industries with different risk profiles. Fourth, the observation period covers only the years following the publication of the 2017 TCFD recommendations, preventing comparisons with disclosure practices prior to the adoption of this framework. Fifth, audit quality is measured solely through the distinction between Big Four and non-Big Four auditors, which may not fully capture other relevant dimensions of audit quality, such as auditor industry specialization or audit tenure. Sixth, although year fixed effects were included to control for macroeconomic influences, the analysis does not incorporate industry-specific factors such as fluctuations in global energy commodity prices. Finally, the CCDP index captures the presence of disclosed information but does not fully reflect the quality, credibility, or substantive depth of climate-related actions, limiting its ability to detect potential greenwashing practices.

Future studies may improve the reliability of CCDP assessments by involving multiple independent raters and evaluating inter-rater consistency. Researchers may also employ more advanced content analysis techniques, including word-count measures, textual analysis, or Natural Language Processing (NLP) methods, to capture the quality and substance of climate-related disclosures more comprehensively. In addition, future research could adopt broader audit quality measures, such as auditor industry specialization, audit tenure, or audit fees, to provide a more nuanced understanding of external monitoring mechanisms. Incorporating industry-specific variables, including energy commodity price volatility and carbon-related policy measures, may also help explain variations in financial distress more accurately. Finally, extending the analysis to multiple industries or cross-country settings would allow researchers to assess the generalizability of the findings and examine how differences in institutional and regulatory environments influence the relationship between climate-related disclosure and corporate financial resilience.

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