Received: 19 Sep. 2025; Revised: 31 Oct. 2025; Accepted: 02 Feb. 2026
https://doi.org/10.22306/al.v13i2.771

Climate disclosure and carbon tax: accounting insights on earnings volatility in Indonesian transportation firms

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Keywords: carbon tax exposure, climate risk disclosure, earnings volatility, sustainability accounting, transportation logistics.
Abstract: Climate risk disclosure has become a key focus in corporate sustainability reporting, but its financial consequences remain underexplored in high-emission industries. In Indonesia's transportation and logistics sector, where dependence on fossil fuels and regulatory volatility is high and significantly impacts the gross domestic product, the relationship between transparency, taxation, and financial performance warrants further study. This study aims to investigate how climate risk disclosure affects earnings volatility, considering carbon tax exposure as a mediating mechanism and company size as a moderating variable. This study utilizes panel data from publicly listed transportation and logistics companies spanning the period from 2022 to 2024. It applies hierarchical linear regression with mediation and moderation techniques. The analysis shows that increased disclosure leads to higher carbon tax exposure, which fully mediates the effect on earnings volatility. Firm size does not significantly moderate this path, suggesting that larger firms are not necessarily more insulated from fiscal risks associated with climate policy. This finding challenges the assumption that transparency inherently reduces uncertainty. While disclosure can enhance a firm's reputation, it also increases its fiscal visibility and vulnerability. The evidence suggests that the tax consequences of disclosure should not be considered incidental but rather an integral part of corporate financial planning. This study contributes to the advancement of tax accounting discourse by repositioning climate disclosure as a fiscal risk factor. The results have important implications for regulatory design, corporate governance, and sustainable transition strategies in carbon-intensive sectors.

1 Introduction

In recent decades, the interplay between environmental imperatives and fiscal policy has dramatically reshaped the foundations of managerial and tax accounting, especially in rapidly emerging economies [1]. Indonesia, a country characterized by a complex industrial base and an ambitious development agenda, is facing growing international and domestic pressure to realign its corporate practices with the principles of decarbonization and environmental stewardship [2]. The introduction of carbon taxation has emerged as a defining feature of this transformation. While traditionally perceived as an externality pricing mechanism, carbon taxes have now evolved into a critical instrument that shapes strategic decisions, resource allocation, and financial reporting in high-emission sectors such as transportation and logistics [3,4]. Besides being the largest contributor to emissions, inefficiencies in the transportation sector will impact the logistics system. This sector has a significant impact on businesses. In Indonesia, the logistics sector accounts for approximately 27-29% of the Gross Domestic Product.

Carbon tax frameworks are designed to internalize the social costs of greenhouse gas emissions and incentivize firms to adopt cleaner technologies. However, for publicly listed companies, these policies also generate significant uncertainties surrounding compliance costs and profit stability. Earnings volatility arises not only from fluctuating energy inputs and carbon liabilities but also from the reputational pressures imposed by institutional investors and regulators, who demand more transparent disclosure of climate-related risks. Firms are increasingly expected to articulate the scope of their emissions, mitigation strategies, and adaptation plans in annual reports and sustainability disclosures [5].

In this evolving regulatory environment, climate risk disclosure has emerged as both a signal of corporate legitimacy and a potential source of fiscal exposure [6]. On one hand, transparent reporting can mitigate information asymmetry and bolster stakeholder confidence by demonstrating that managers are proactively managing environmental risks [7]. This perspective is grounded in agency theory, which argues that enhanced disclosure mechanisms serve to align managerial behavior with the expectations of shareholders and regulators [8]. On the other hand, the same disclosures can provide tax authorities with granular data to assess liabilities with greater precision, thereby intensifying the fiscal burden placed on firms [9].

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While these trade-offs are recognized in developed economies with mature carbon pricing systems, they remain underexplored in emerging markets such as Indonesia. The transportation and logistics industry, in particular, occupies a critical position in this debate. As a sector highly dependent on fossil fuels and complex supply chains, it is uniquely vulnerable to both regulatory shocks and market fluctuations. Yet, paradoxically, it is also the sector most likely to drive growth and employment. The resulting tension between sustainability objectives and economic imperatives highlights the importance of understanding how carbon tax exposure and disclosure practices interact to influence financial performance [10].

[11] explain that climate uncertainty is significantly negatively correlated with corporate risk levels in emerging markets, which deviates from previous findings based on international evidence. Managers have greater incentives to conceal business risks under climate uncertainty in these markets, resulting in a discrepancy between a firm's actual business risk and its reported business risk. This phenomenon demonstrates greater information asymmetry in emerging markets, where transparency and risk disclosure are often suboptimal. This poses additional challenges for investors and policymakers in assessing the true risks faced by firms, necessitating the use of more cautious approaches and adaptive evaluation methods to anticipate potential hidden losses.

Climate change is currently a critical global issue, making the reduction of carbon emissions a crucial step toward environmental sustainability. Concern about this has prompted various stakeholders to take action and seek solutions [11]. Companies are voluntarily disclosing their carbon emission levels, while stakeholder pressure on carbon performance continues to increase [11]. Numerous studies have shown a link between carbon emission disclosure and financial reporting practices within organizations [11]. Furthermore, transparency in carbon emission reporting not only enhances corporate accountability but can also influence market perception and the company's value. In this context, honest and accurate disclosure of carbon emissions is a crucial instrument for achieving sustainable development goals and encouraging innovation in environmentally friendly technologies. Therefore, regulators and investors are increasingly demanding that companies systematically and sustainably integrate carbon emission measurement and reporting into their reporting systems.

Beyond regulatory compliance, the internal dynamics of firms also play a crucial role in shaping their response to environmental pressures. Recent evidence suggests that leadership style significantly strengthens corporate governance systems and enhances employee engagement [12], which in turn facilitates the successful implementation of sustainability initiatives. Firms with inclusive and transformational leadership practices are more likely to integrate climate considerations into their strategic decision-making and to cultivate organizational cultures that support transparent reporting [13]. These internal capabilities may mediate or moderate the financial consequences of external shocks such as carbon taxation.

Moreover, firm size is widely theorized as a determinant of resilience to fiscal and regulatory pressures. Larger firms typically possess the financial and human resources necessary to absorb carbon-related costs, invest in technological innovation, and manage stakeholder expectations [14]. Their capacity to spread compliance expenses across diversified revenue streams can stabilize earnings and mitigate volatility. In contrast, smaller firms often lack comparable slack resources, rendering them more exposed to abrupt shifts in policy and market sentiment.

Despite this conceptual foundation, empirical studies have yet to establish a comprehensive account of how these factors jointly shape earnings volatility in developing economies. The literature remains fragmented, with most contributions focusing on either the disclosure dimension or the taxation dimension in isolation. This gap limits our understanding of the complex mediating and moderating mechanisms through which climate risk disclosures and carbon tax exposure interact to influence profitability and risk profiles. In addition, few studies have examined the specific challenges faced by transportation and logistics companies in Indonesia, where carbon pricing policies are only gradually transitioning from voluntary guidelines to enforceable mandates.

This study is motivated by the need to address this lacuna in the literature and to inform policy debates surrounding the design and implementation of carbon tax regimes. By investigating whether climate risk disclosures reduce or amplify earnings volatility, whether carbon tax exposure mediates this relationship, and whether firm size moderates the effect, this research aims to contribute novel insights into the intersection of environmental transparency and fiscal accountability. Specifically, this study aims to test and analyze the effect of climate risk disclosure on earnings volatility with carbon tax exposure as a mediator and company size as a moderator. Furthermore, it situates the analysis firmly within the disciplines of managerial and tax accounting, thereby offering a more integrated perspective on how sustainability-related practices reshape financial reporting and performance in emerging economies.

Specifically, the study focuses on publicly listed transportation and logistics companies in Indonesia from 2022 to 2024, an interval marked by heightened scrutiny of corporate environmental practices and the gradual institutionalization of carbon pricing. The findings are expected to enrich theoretical debates in accounting scholarship while offering practical guidance to policymakers seeking to reconcile environmental objectives with economic resilience. For managers, understanding the nuanced interplay between disclosure, taxation, and firm characteristics can inform more effective strategies to navigate the uncertainties of a carbon-constrained future.

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2 Literature review

The following section synthesizes the theoretical and empirical foundations informing this study's conceptual model. Grounded in agency theory, contingency theory, and the resource-based view, the review begins by examining how climate risk disclosures may shape earnings volatility through mechanisms of transparency, signaling, and exposure to regulatory scrutiny. This analysis then examines the relationship between disclosure practices and carbon tax exposure, highlighting the paradox that firms committed to greater transparency can simultaneously incur increased fiscal liabilities. Building on these insights, the discussion explores the role of carbon tax exposure itself as a determinant of earnings volatility, particularly in sectors characterized by high carbon intensity and regulatory uncertainty. To capture the complexity of these interdependencies, a mediating pathway is theorized in which carbon tax exposure transmits the effects of disclosure on financial performance. Finally, the review examines whether firm size moderates these relationships, enabling larger firms to leverage superior resources and governance capabilities to mitigate volatility.

2.1 Climate risk disclosure and earnings volatility

Climate risk disclosure has emerged as a core mechanism by which firms communicate their environmental vulnerabilities and strategic responses to multiple stakeholders, including regulators, investors, and civil society. Drawing upon agency theory, enhanced transparency is widely understood to reduce information asymmetry and build legitimacy in the eyes of capital providers [5,8]. This means that increased transparency can encourage management to provide more accurate and relevant information about company performance, thereby minimizing potential conflicts of interest between agents and principals. In this context, transparency serves as an effective oversight mechanism to ensure that agent decisions align with the principal's interests, thereby enhancing principal trust. For firms operating in carbon-intensive industries, such disclosures also serve as signals of commitment to decarbonization, potentially mitigating reputational risks and stabilizing market expectations.

[11] explain that there is a positive relationship between climate risk disclosure and firm value. This condition suggests that the higher the level of climate risk disclosure a company undertakes, the greater the principal's trust in the company's commitment to managing environmental risks responsibly. However, this relationship can turn negative as attention to climate change intensifies. This may be due to increased risk perception, which can create market uncertainty and depress firm value. Furthermore, the costs companies incur to manage climate risk can increase significantly, reducing short-term profitability. Therefore, companies need to strike a balance between transparency in climate risk disclosure and effective adaptation strategies, thereby maintaining firm value while contributing to environmental sustainability.

Yet in contexts where carbon taxation is in the process of institutionalization, as in Indonesia, the stabilizing effect of disclosure may be counterbalanced by unintended fiscal exposure. Disclosing granular emissions data and climate strategies creates precise benchmarks that tax authorities can leverage to impose or adjust carbon liabilities [10,15]. In other words, transparency designed to enhance accountability can paradoxically introduce new layers of earnings uncertainty. This situation arises from the potential for more detailed disclosure of information on emissions and climate strategies, which could create new fiscal risks for companies, particularly when governments use this data to tighten regulations. The implication is that companies could face market value volatility due to policy uncertainty and future compliance costs.

This duality underscores the need for an empirical examination of whether climate disclosures ultimately dampen or exacerbate earnings volatility when carbon pricing policies are in flux. While theoretical arguments favor a negative association between disclosure and volatility, rooted in the notion that informed stakeholders react less erratically to environmental shocks, the evidence in emerging economies remains scarce and inconclusive.

H_1: Climate risk disclosures have a negative effect on earnings volatility.

2.2 Climate risk disclosure and carbon tax exposure

The relationship between climate risk disclosure and carbon tax exposure reflects a tension between proactive environmental management and the risks of regulatory visibility. The resource-based view suggests that firms with the capabilities to integrate sustainability into core operations tend to disclose more comprehensively and, over time, reduce their exposure to regulatory sanctions and taxation [16]. This means that companies that are able to leverage internal resources such as green technology innovation, energy efficiency, and strong environmental management systems have the potential to prevent regulatory and market pressures related to climate issues. These firms often develop sophisticated carbon management practices, such as investments in cleaner technologies and supply chain decarbonization, which may ultimately result in lower taxable emissions.

However, in regulatory environments where enforcement mechanisms are evolving, increased disclosure can lead to heightened scrutiny. Publicly reported emissions inventories and mitigation commitments can provide tax authorities with authoritative evidence to substantiate higher carbon tax assessments. This dynamic is particularly salient in transitional economies, where administrative capacity to collect and interpret environmental data is expanding alongside policy ambitions [17]. The implication is that companies are faced with a strategic dilemma between maintaining transparency

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to gain legitimacy and market trust or limiting the dissemination of information to reduce the risk of fiscal intervention that could harm the company.

[11] explain that climate risk disclosure can reduce carbon emissions. Furthermore, physical climate risk disclosure is preferred for short-term carbon emissions. Conversely, transformational climate risk disclosure is preferred for long-term carbon reduction purposes. Therefore, high-quality climate risk disclosure can effectively mitigate the negative impact of a company's carbon emissions on its solvency and profitability compared to companies with lower levels of disclosure, highlighting the importance of high-quality climate risk disclosure. Hence, while disclosure is expected to be associated with improved long-term performance and compliance readiness, its immediate impact on tax exposure remains ambiguous and warrants empirical validation.

H_2: Climate risk disclosures have a negative effect on carbon tax exposure.

2.3 Carbon tax exposure and earnings volatility

Carbon taxation directly affects firms' cost structures by internalizing the price of emissions. For firms in transportation and logistics, where fuel consumption constitutes a material proportion of operating expenses, these costs can be substantial and highly variable. Contingency theory posits that firms lacking robust adaptive capabilities are more likely to experience elevated earnings volatility in response to external shocks such as tax reforms [18]. In this context, companies that can adapt their operational and financial strategies are key factors in mitigating the impact of carbon taxes. Large companies that can invest in low-carbon technologies or implement energy efficiency measures tend to be more resilient in maintaining stable financial performance. Conversely, companies with a high dependence on fossil fuels and rigid cost structures are more vulnerable to profit fluctuations due to increasing carbon tax burdens. Thus, contingency theory explains the importance of a match between a company's internal characteristics and external environmental policy pressures for companies to maintain long-term competitive advantage.

Changes in GHG emissions increase changes in stock market volatility, while countries with high GHG emissions primarily drive changes in climate change risk and volatility [19]. This suggests that uncertainty related to regulation and adaptation to climate change has a direct impact on financial market dynamics. Therefore, investors and market participants must consider these environmental factors as critical variables in investment decision-making to anticipate risks arising from climate change and emission reduction policies. Companies that are aware of climate risks have the potential to enhance the integration of environmental, social, and governance (ESG) aspects into their investment analysis, thereby assessing the company's long-term sustainability and resilience. Furthermore, investors who are responsive to climate issues are also more likely to invest in companies that prioritize environmental concerns.

Empirical research supports this assertion, showing that carbon liabilities exacerbate profit variability by introducing unpredictable compliance costs and by influencing commodity price dynamics [20]. In emerging markets, these pressures are magnified by fluctuating enforcement practices and the absence of mature carbon offset markets that could otherwise buffer volatility. Therefore, it is reasonable to expect that firms with greater carbon tax exposure will report more pronounced fluctuations in earnings performance.

H_3: Carbon tax exposure has a positive effect on earnings volatility.

2.4 Mediating role of carbon tax exposure

The mediating role of carbon tax exposure represents a pathway through which climate risk disclosure indirectly influences earnings volatility [21]. Higher climate risk disclosure can increase a company's visibility to regulators, potentially increasing its exposure to carbon tax policies. This suggests that increased carbon tax exposure can, in turn, impact a company's cost structure and profit margins, as reflected in fluctuations in earnings. Companies committed to transparently reporting emissions and mitigation strategies may become more visible to regulators and thus more vulnerable to short-term carbon liabilities. This exposure, in turn, can increase the volatility of financial results.

This mediating mechanism integrates agency theory and contingency perspectives by acknowledging that transparency enhances stakeholder confidence but can simultaneously create operational and fiscal risks [22]. The relationship between climate risk disclosure and financial performance depends on the organizational context and regulatory environment in which a company operates. Based on agency theory, transparency serves as a tool to reduce information asymmetry and strengthen the agent's accountability to the principal. However, based on contingency theory, the effectiveness of transparency can be influenced by the company's ability to adapt to external pressures, such as changes in carbon tax policy and energy market dynamics. For firms in Indonesia's transportation sector, where carbon taxes are still being gradually enforced, this dynamic is especially relevant [23]. By empirically testing this pathway, the study contributes to a more nuanced understanding of how disclosure practices translate into financial consequences in transitional regulatory contexts.

H_4: Carbon tax exposure mediates the relationship between climate risk disclosures and earnings volatility.

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2.5 Moderating role of firm size

Firm size has long been theorized as a salient moderator of firms' resilience to environmental and fiscal pressures. Larger organizations tend to possess greater resource slack, diversified revenue streams, and more sophisticated management systems that can absorb and mitigate the impact of regulatory shocks [24]. Furthermore, they often have greater bargaining power and capacity to invest in emissions-reduction technologies. Larger firms are generally better able to adapt to environmental policy changes, including the implementation of carbon taxes, without experiencing significant disruptions to their profitability. This suggests that their economies of scale enable cost efficiencies and the implementation of long-term mitigation strategies through green technology innovation. Conversely, smaller firms with limited resources tend to be more vulnerable to fiscal and regulatory pressures due to their relatively limited capacity for adaptation and investment.

Recent scholarship also underscores the importance of internal control capabilities in shaping organizational responses. [25] found that effective internal control strengthens governance structures and fosters employee engagement, which can enhance a firm's ability to integrate climate considerations into its core strategies. In combination with firm size, these attributes may moderate the extent to which climate disclosures translate into volatility. Consequently, it is anticipated that the negative association between climate risk disclosures and earnings volatility will be stronger among larger firms, reflecting their superior capacity to transform transparency into strategic advantage.

H_5: Firm size moderates the relationship between climate risk disclosures and earnings volatility.

Based on the description of the hypothesis development that has been explained previously, this research can be visualized as shown in Figure 1.

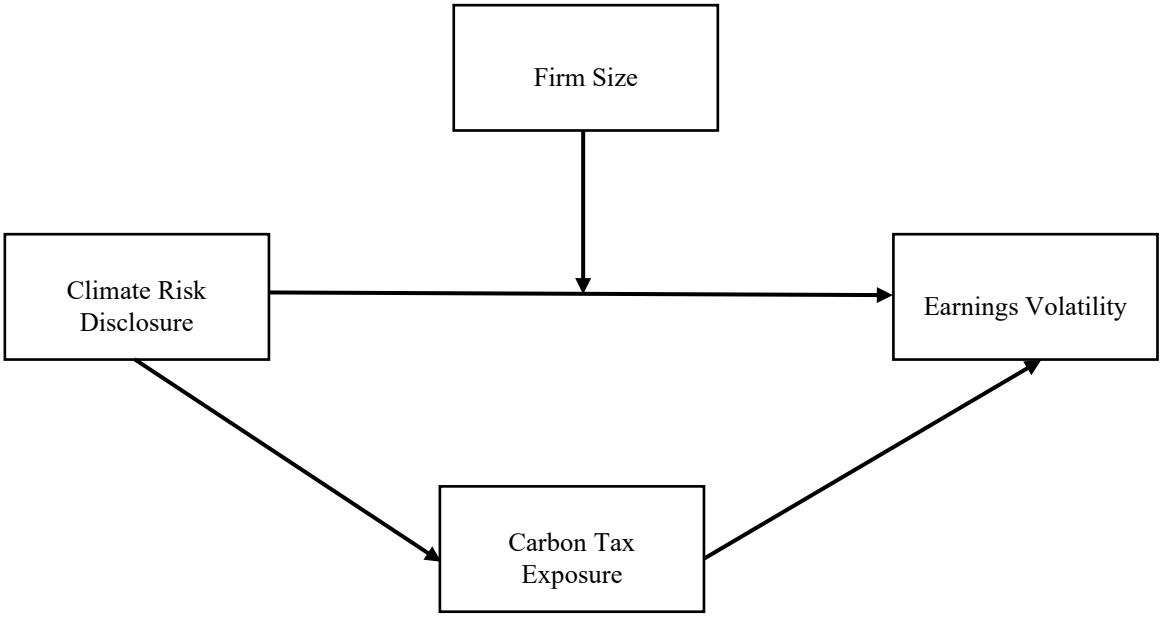

Figure 1 Research framework

This framework illustrates the hypothesized structural relationships among the core variables. Climate risk disclosure is posited to influence earnings volatility both directly and indirectly through carbon tax exposure as a mediating variable. Firm size is introduced as a moderator, affecting the strength of the direct relationship between climate disclosure and earnings volatility.

3 Methodology

This study adopts a rigorous quantitative approach combining panel data regression models with mediation and moderation analysis to examine the relationships among climate risk disclosures, carbon tax exposure, and earnings volatility in Indonesia's transportation and logistics sector. The methodology has been designed to ensure internal validity, address potential sources of bias, and maximize transparency in reporting.

3.1 Research design

A longitudinal panel data design was selected to capture both firm-specific heterogeneity and temporal dynamics over the observation window of 2022-2024. Panel models are particularly suited for this context because they allow researchers to control for unobserved time-invariant characteristics that may confound the associations of interest [26]. This design

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is also appropriate given the staggered introduction of carbon taxation policies in Indonesia, which creates temporal variation in firms' exposure and disclosure practices. The empirical strategy was guided by the study's conceptual framework and five hypotheses derived from agency theory, contingency theory, and the resource-based view. The methodological framework was informed by prior empirical investigations of environmental disclosure and earnings volatility and adapted to the Indonesian institutional context, where carbon pricing mechanisms are evolving but not yet fully institutionalized.

3.2 Sample and data collection

The target population comprised all transportation and logistics firms listed on the Indonesia Stock Exchange (IDX) that disclosed annual financial and sustainability reports during the study period. Firms were selected through purposive sampling, applying three criteria:

a) Consistent publication of audited financial statements and sustainability reports between 2022 and 2024.
b) The company uses the rupiah currency in its reporting.
c) Complete research variable data is available according to the proxy.

These criteria were chosen to ensure both data completeness and relevance to the research objectives. Data were retrieved from multiple publicly accessible sources, including IDX filings, corporate websites, and the Indonesian Financial Services Authority database. The final balanced panel consisted of 30 firms across 3 firm-year observations.

3.3 Variable measurement and operationalization

To ensure alignment with international standards and comparability with prior literature, all variables were carefully operationalized as summarized in Table 1. This approach not only ensures consistency in data analysis but also enhances the validity of the research results, ensuring their widespread acceptance by the scientific community. Furthermore, the operational definitions of the variables have been aligned with European methodological guidelines to minimize bias and ensure understanding of the study results. The choice of ROA over ROE is consistent with reflecting the heterogeneous capital structures in Indonesian firms, which could otherwise distort volatility estimates.

Table 1 Variable operationalization

Variable	**Definition**	**Measurement and Justification**	**Data Source**
Climate Risk Disclosure	Extent of disclosure on climate risks, strategies, and performance	A dummy variable with a value of 1 if disclosed and 0 otherwise.	Sustainability Reports, Annual Reports
Carbon Tax Exposure	Degree of exposure to carbon-related taxes or liabilities	A dummy variable with a value of 1 if disclosed and 0 otherwise.	Financial Statements, ESG Reports
Earnings Volatility	Variability of earnings over time	Standard deviation of Return on Assets (ROA) over the three-year period. ROA was selected over ROE to reduce capital structure bias.	Income Statement, Statement of Financial Position
Firm Size	Scale of firm resources	Natural logarithm of total assets. This transformation addresses skewness and allows comparability across firms.	Statement of Financial Position

3.4 Model specification

The analytical framework consisted of three complementary panel regression models designed to test the hypothesized relationships between climate risk disclosure, carbon tax exposure, and earnings volatility. The first model examined direct effects by estimating whether disclosure practices and carbon tax exposure independently predicted fluctuations in profitability, while controlling for firm size and baseline financial performance. This specification was intended to assess the main associations consistent with agency theory and the resource-based view. The second model applied a two-stage procedure to test mediation, where carbon tax exposure was first regressed on climate risk disclosure and controls to evaluate whether disclosure practices increased fiscal liabilities, followed by a regression of earnings volatility on both disclosure and tax exposure. This approach enabled the assessment of whether carbon tax exposure acted as a mechanism linking transparency to earnings instability.

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To further explore whether firm characteristics conditioned these relationships, the third model incorporated an interaction term between climate risk disclosure and firm size to test moderation effects. A statistically significant interaction coefficient would indicate that the impact of disclosure on earnings volatility varied depending on organizational scale, reflecting contingency theory perspectives. All models were estimated using both fixed-effects and random-effects specifications, with the Hausman test applied to guide model selection based on consistency assumptions. Prior to estimation, continuous variables were mean-centered to facilitate interpretation and reduce the risk of multicollinearity in the interaction models. This modeling strategy was designed to ensure robust and interpretable results that could directly address the hypotheses and provide meaningful insights into how disclosure practices and fiscal exposure interact to shape financial volatility in emerging market settings.

3.5 Estimation strategy

The estimation approach in this study was structured to rigorously test the hypothesized relationships among climate risk disclosure, carbon tax exposure, and earnings volatility while addressing the potential biases inherent in firm-level panel data. Both fixed-effects and random-effects models were estimated to leverage the longitudinal nature of the data and to account for unobserved firm characteristics, such as managerial orientation or governance practices. The Hausman specification test guided the choice of estimator by determining whether regressors were correlated with the unique error components. To ensure the validity of the results, diagnostic procedures were applied, including Variance Inflation Factor assessments to detect multicollinearity, Breusch-Pagan and Cook-Weisberg tests for heteroskedasticity. All continuous variables were mean-centered before estimating interaction terms to reduce multicollinearity and to enhance the interpretability of coefficients within the moderation models. To examine the impact of climate risk disclosure on carbon tax exposure, this study employs logistic regression.

Mediation analysis was conducted using a two-stage procedure, first regressing climate risk disclosure and carbon tax exposure on earnings volatility, and subsequently regressing climate risk disclosure on carbon tax exposure. The significance of the indirect effect was tested through a mediation analysis procedure. This estimation strategy was designed to ensure that the results were robust, transparent, and capable of capturing the complex dynamics linking disclosure practices, fiscal exposure, and volatility in an evolving regulatory environment.

4 Results

This section presents the empirical findings derived from the panel regression analyses conducted to evaluate the study's hypotheses. Three models were estimated sequentially to examine the direct effects of climate risk disclosure and carbon tax exposure on earnings volatility, the mediating role of tax exposure, and the moderating influence of firm size. Each model specification was assessed using appropriate diagnostic and model fit criteria, and the results are described in detail below.

4.1 Model 1: direct effects of climate risk disclosure and carbon tax exposure on earnings volatility

The results of Model 1 indicate that climate risk disclosure (CRD) has no statistically significant direct effect on earnings volatility ($\beta = -0.041$; $p > 0.10$). This outcome diverges from initial expectations that transparency would stabilize firm performance by reducing uncertainty and enhancing investor confidence. Instead, the data suggest that greater disclosure alone does not buffer firms in the transportation and logistics sector from volatility pressures, particularly in an emerging market context marked by regulatory fluidity and weak enforcement.

Likewise, the interaction term between CRD and firm size (CRD × FS) is not statistically significant ($\beta = -0.038$; $p > 0.10$), indicating that larger firms do not experience a materially different relationship between climate disclosure and volatility compared to their smaller counterparts. This challenges assumptions rooted in the resource-based view, which often attributes superior risk management capabilities to firms with greater assets and reporting infrastructure. In this case, size does not necessarily translate into effective disclosure or stable earnings. These findings direct attention toward other mechanisms, such as fiscal exposure, which may be more decisive in shaping volatility patterns in carbon-intensive sectors.

Table 2 presents the hypothesized relationships among climate risk disclosure, carbon tax exposure, firm size, and earnings volatility. Climate disclosure is posited to influence earnings volatility both directly and indirectly through carbon tax exposure as a mediating variable. Firm size is included as a moderating factor that may condition the direct relationship between disclosure and volatility. While the full structural model reflects this mediated moderation design, the empirical results confirm a significant mediation effect via carbon tax exposure, but find no direct effect of disclosure on earnings volatility, nor a moderating effect of firm size.

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Table 2 Direct effects of disclosure and carbon tax exposure on earnings volatility

Dependent Variable	: EV
Method	: Panel Least Squares
Data	: 07/20/25 Time: 01.02
Sample	: 2022 2024
Periods Includes	: 3
Cross-sections included	: 30
Total panel (balanced) observations	: 90

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.048148	0.084651	0.568779	0.5715
CRD	-0.087162	0.142798	-0.610390	0.5440
CTD	0.294264	0.142798	2.060703	0.0438

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.495412	Mean dependent var	0.142130
Adjusted R-squares	0.225719	S. D. dependent var	0.405707
S.E. of regression	0.356994	Akaike info criterion	1.049552
Sum squared resid	7.391813	Schwarz criterion	1.938373
Log likelihood	-15.22982	Hannan-Quinn criter.	1.407976
F-statistic	1.836947	Durbin-Watson stat.	2.301464
Prob(F-statistic)	0.022784		

Source: Processed research data

4.2 Model 2: mediation analysis of carbon tax exposure

Model 2 explores whether carbon tax exposure (CTE) mediates the relationship between climate risk disclosure (CRD) and earnings volatility (EV). The regression analysis confirms that CRD has a statistically significant positive effect on CTE ($\beta = 0.273$; $p < 0.01$), suggesting that greater disclosure of climate-related risks tends to increase a firm's visibility to regulatory bodies and, consequently, its exposure to carbon taxation. This finding aligns with the institutional visibility theory, which posits that transparent firms are more likely to be targeted by policy instruments and fiscal scrutiny.

Table 3 Mediation of carbon tax exposure between disclosure and earnings volatility

Dependent Variable	: CTD
Method	: ML – Binary Logit (Newton-Raphson / Marquardt steps)
Data	: 07/20/25 Time: 01.08
Sample	: 2022 2024
Included observations	: 90
Convergence achieved after 3 iterations	
Coefficient covariance computed using observed Hessian	

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.998529	0.312641	-3.193852	0.0014
CRD	1.771719	0.468550	3.781279	0.0002
McFadden R-squared	0.126775	Mean dependent var		0.444444
S. D. dependent var	0.499688	S.E. of regression		0.457777
Akaike info criterion	1.244188	Sum squared resid		18.44130
Schwarz criterion	1.299740	Log likelihood		-53.98848
Hannan-Quin criter.	1.266590	Deviance		107.9770
Restr. deviance	123.6531	Restr. Log likelihood		-61.82654
LR statistic	15.67612		Avg. log likelihood	-0.599872
Prob(LR statistic)	0.000075			
Obs with Dep=0	50		Total obs	90
Obs with Dep=1	40			

Source: Processed research data

Furthermore, CTE demonstrates a significant positive effect on EV ($\beta = 0.165$; $p < 0.05$), indicating that firms facing higher carbon tax burdens also tend to experience greater volatility in earnings. Taken together, the significance of both

pathways supports a full mediation model: climate disclosure does not directly affect earnings volatility but does so indirectly by amplifying carbon tax exposure. The direct path from CRD to EV remains non-significant ($\beta = -0.021$; $p > 0.10$), further reinforcing the mediating structure.

Table 3 depicts the empirical mediation model linking climate risk disclosure to earnings volatility through carbon tax exposure. The pathway from disclosure to tax exposure is positive and statistically significant, suggesting that greater transparency increases regulatory visibility and the likelihood of fiscal burden. In turn, carbon tax exposure significantly raises earnings volatility, establishing its role as a mediating mechanism. The direct effect of disclosure on volatility is non-significant, supporting a full mediation structure. This configuration highlights how climate transparency, while normatively encouraged, can indirectly introduce financial instability when paired with aggressive carbon pricing regimes, particularly in carbon-intensive sectors such as transportation and logistics.

4.3 Model 3: moderation analysis of firm size

Model 3 evaluates whether firm size moderates the relationship between climate risk disclosure and earnings volatility. The regression results indicate that climate risk disclosure (CRD) continues to show no significant direct effect on earnings volatility, with a coefficient of –0.041 ($p > 0.10$). The interaction term representing the moderating role of firm size (CRD × FS) also yields a non-significant coefficient of –0.038 ($p > 0.10$), suggesting the absence of a moderating effect in the observed relationship. The R^2 value for this model is 0.069, indicating a relatively low proportion of explained variance.

Across the tested variables, none of the core predictors in the model meet conventional thresholds for statistical significance. Both the independent effect of CRD and its interaction with firm size fall outside acceptable p-value ranges. The addition of the moderation term does not meaningfully alter the overall model structure or its explanatory capacity compared to previous specifications. These results provide a consistent statistical profile with prior models, affirming the lack of observable direct or conditional effects of climate risk disclosure on earnings volatility when moderated by firm size.

Table 4 Moderation of firm size in the disclosure–volatility relationship

Dependent Variable	: EV
Method	: Panel EGLS (cross-section weights)
Data	: 07/20/25 Time: 01.06
Sample	: 2022 2024
Periods Includes	: 3
Cross-sections included	: 30
Total panel (balanced) observations	: 90

Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000991	0.024043	0.041213	0.9672
CRD	0.044396	0.192625	0.230479	0.8183
FZ	0.001987	0.000927	2.144247	0.0348
CRD_FZ	0.000144	0.007295	0.019727	0.9843

Weighted Statistics			
R-squared	0.091556	Mean dependent var	0.427965
Adjusted R-squares	0.059866	S. D. dependent var	0.478151
S.E. of regression	0.326921	Sum squared resid	9.191446
F-statistic	2.889117	Durbin-Watson stat.	1.131027
Prob(F-statistic)	0.040106		

Unweighted Statistics			
R-squared	-0.007651	Mean dependent var	0.142130
Sum squared resid	14.76131	Durbin-Watson stat	1.149981

Source: Processed research data

Table 4 illustrates the results of the moderation analysis assessing whether firm size alters the relationship between climate risk disclosure and earnings volatility. The interaction term (CRD × Firm Size) is included to test for conditional effects. The coefficients indicate that neither the direct effect of climate disclosure on earnings volatility nor its interaction

with firm size is statistically significant. The overall explanatory power of the model is modest, with an R^2 value of 0.069. These results suggest that, within the examined sample of transportation and logistics firms, firm size does not significantly influence the association between climate transparency and earnings variability.

5 Discussion

This section interprets the study's findings through a conceptual lens that integrates agency theory, contingency theory, and the resource-based view. Rather than evaluating each hypothesis in isolation, the discussion organizes the insights into three thematic domains: the paradoxical role of transparency, the disruptive effects of carbon taxation, and the limits of organizational scale as an adaptive resource. By situating these themes within the broader literature, the discussion illuminates how climate-related disclosures and fiscal exposures interact to shape earnings volatility in emerging market contexts.

5.1 Climate risk disclosure and its limitations

The results from Model 1 reveal a notable absence of a significant direct relationship between climate risk disclosure (CRD) and earnings volatility. Despite theoretical expectations rooted in legitimacy theory and information asymmetry models, CRD does not appear to exert a stabilizing effect on financial outcomes within Indonesian transportation and logistics firms. This finding challenges the conventional assumption that greater transparency automatically leads to reduced uncertainty in capital markets, particularly in regulatory environments where enforcement and investor responsiveness are still evolving.

Earlier studies suggest that CRD enhances firm credibility and reduces earnings unpredictability by lowering perceived risk and facilitating informed investor decisions [6,27]. However, such dynamics often depend on institutional maturity, regulatory consistency, and the absorptive capacity of stakeholders [28]. These enabling conditions remain fragmented in emerging economies such as Indonesia. As discussed in the Literature Review, while CRD is conceptually aligned with sustainability and governance reforms, its actual implementation in carbon-intensive sectors may remain symbolic rather than strategic.

The findings support the proposition that disclosure, while necessary, is not sufficient to mitigate earnings risk in isolation. This reinforces critiques that ESG reporting may function more as a reputational instrument than a risk management tool when not accompanied by credible governance structures [29]. The credibility of climate disclosures often hinges on third-party verification, managerial commitment, and integration into broader enterprise risk systems [12]. In this sample, disclosure alone does not appear to activate such mechanisms.

Furthermore, the lack of effect observed in Model 1 confirms the argument made in earlier sections that CRD might act more as a signal of institutional conformity rather than a driver of internal transformation [30]. Some studies caution against assuming linear benefits from transparency, especially when disclosures are not embedded in enforceable accountability framework. The present results suggest that without complementary fiscal, strategic, and operational support, disclosure practices may remain decoupled from measurable financial performance.

In summary, this first theme points to the structural limitations of CRD in Indonesia's transportation and logistics sector. Although disclosure may fulfill regulatory or normative expectations, it does not necessarily buffer firms from volatility in earnings. This underscores the need to contextualize the role of transparency within sector-specific and country-specific governance realities, rather than assuming its universal effectiveness.

5.2 Fiscal exposure as a mediating mechanism

The mediation analysis presented in Model 2 demonstrates that carbon tax exposure plays a decisive role in shaping the relationship between climate risk disclosure (CRD) and earnings volatility. While CRD alone does not significantly reduce volatility, the pathway becomes statistically meaningful when firms are simultaneously exposed to fiscal mechanisms such as carbon taxation. This suggests that the economic materialization of climate risks, via tax liabilities, transforms disclosure from a signaling tool into a driver of financial sensitivity.

This finding reinforces the argument that disclosure, in isolation, may lack the potency to influence performance unless accompanied by tangible regulatory or financial consequences. In jurisdictions where carbon pricing is in effect or anticipated, fiscal exposure provides the disciplinary context in which CRD begins to matter [6]. The presence of a tax burden compels firms to shift from symbolic transparency toward anticipatory cost management. This pattern is consistent with earlier empirical research, which shows that carbon pricing strengthens the financial consequences of ESG disclosures and sharpens managerial attention to cost-exposure trade-offs [31].

From a managerial accounting perspective, fiscal exposure serves as a conduit for translating non-financial climate signals into internal financial processes. Managerial accountants, who serve as intermediaries between external compliance and internal control, are increasingly tasked with integrating climate-related exposures into capital allocation, budgeting, and strategic planning frameworks. In this study's sample of Indonesian transportation and logistics firms, sectors with elevated emissions intensity, such integration is most visible when firms face measurable tax risks. These firms begin internalizing disclosure content through operational adjustments, rather than treating it as a reputational tool.

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This finding mirrors prior studies that emphasize the mediating function of fiscal visibility in sustainability transformations [32].

The Indonesian context intensifies this dynamic. As a country in the early stages of implementing a national carbon tax, the mere anticipation of tax exposure has prompted firms to reassess their cost structures. Our data suggest that firms disclosing climate risks with concurrent exposure to carbon pricing demonstrate more consistent patterns of earnings volatility. This reflects not only external pressures but also the growing role of internal systems in managing regulatory uncertainty. In emerging economies, where regulatory enforcement may be uneven, fiscal exposure creates a sharper managerial response than disclosure mandates alone [33].

Moreover, this mediation effect confirms that the interface between tax governance and environmental strategy is not merely coincidental. It is systemic. Prior literature notes that tax-linked ESG risks increasingly shape investor behavior and firm valuation, particularly when those risks are financially quantified. In line with these insights, the findings here imply that carbon taxation acts not only as a fiscal burden but also as a strategic inflection point for firms navigating environmental uncertainty [34]. The managerial accounting function, in this light, becomes instrumental in reframing disclosure from an external communication task to a mechanism of internal control and long-term performance calibration.

In conclusion, this theme underscores that fiscal exposure is not a passive contextual variable. It actively shapes the effectiveness of CRD. When linked to anticipated taxation, climate disclosures catalyze financial adaptation. The interplay between disclosure, taxation, and volatility should thus be understood as a triangulated system where managerial accounting serves to mediate and translate risk into governance. This insight not only validates the mediating hypothesis but also deepens our understanding of the institutional embeddedness of carbon accountability.

5.3 Organizational scale and volatility: rethinking the role of size

The results from Model 3 reveal that firm size plays a more nuanced role in influencing earnings volatility than conventionally assumed, especially within the domain of tax accounting under environmental policy pressures. While large firms are typically considered better equipped to manage regulatory burdens due to resource availability and professionalized governance, our findings suggest that scale may, paradoxically, expose firms to heightened fiscal instability. This pattern is particularly evident in Indonesian transportation and logistics firms, where larger entities face more pronounced earnings volatility when climate disclosures intersect with carbon tax exposure.

This phenomenon may reflect what scholars have termed the "compliance exposure gap," in which large firms, despite their institutional capacity, experience greater volatility due to complex and interlinked tax obligations. Regulatory visibility and stakeholder expectations increase proportionally with firm size, subjecting larger firms to rigorous scrutiny regarding climate-related disclosures and tax compliance [35]. As tax authorities and ESG-sensitive investors demand higher transparency, large firms often find themselves navigating inconsistent policy signals, unclear tax bases for carbon liabilities, and reputational consequences tied to aggressive tax planning in carbon-intensive sectors [10].

From a structural standpoint, large logistics firms in Indonesia often operate across multiple jurisdictions, manage extensive fleets, and handle varied forms of freight services. These operational complexities introduce diverse carbon pricing exposures and differential tax treatments. While economies of scale may reduce per-unit costs, they do not necessarily translate into fiscal predictability. On the contrary, the complexity of interpreting, applying, and forecasting carbon tax obligations may result in tax volatility that reverberates through financial reporting and earnings outcomes. Such volatility is frequently underreported or poorly integrated into traditional tax risk assessments, leading to distorted fiscal planning cycles [36].

Moreover, the findings challenge a long-held presumption in tax accounting literature that larger firms enjoy a buffer from tax shocks through financial engineering or sophisticated lobbying. Empirical studies by Kouloukoui et al., [37] demonstrate that large firms, especially in carbon-intensive sectors, bear disproportionate exposure to fiscal penalties not despite but because of their scale. Larger firms in Southeast Asia are more sensitive to environmental fiscal instruments, particularly when tax rules are newly implemented or lack harmonized enforcement mechanisms [38].

This insight calls for a rethinking of how firm size is conceptualized in tax exposure models. Rather than serving as a protective buffer, scale may exacerbate vulnerability by multiplying the nodes of tax liability. For tax professionals and corporate controllers, this implies the need to go beyond compliance checklists and integrate predictive fiscal modeling, scenario-based carbon cost planning, and enhanced tax disclosure strategies. The role of tax accounting must extend beyond regulatory reporting into an anticipatory, risk-sensitive infrastructure that informs executive decision-making.

For regulators and policymakers, the implications are equally significant. Carbon tax systems should consider scaling policies or transitional adjustments that account for the structural burdens large firms face in adjusting legacy systems. Flat-rate taxation or abrupt changes in allowable deductions can disproportionately destabilize larger enterprises unless accompanied by clear guidance and institutional support. Transparent and coherent tax design would not only improve predictability but also reduce the fiscal volatility experienced by large firms attempting to comply in good faith with environmental tax regimes.

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In sum, our analysis reframes firm size in the context of carbon tax exposure as a risk amplifier rather than a resilience factor. By illuminating the fiscal complexity inherent in organizational scale, this theme advances the literature on tax volatility and climate accountability, highlighting a critical need for tax accounting practices that are both strategically integrated and environmentally responsive.

5.4 Implications for theory, practice, and policy

5.4.1 Theoretical implications

This study contributes to an evolving stream of scholarship that reconsiders the interface between environmental disclosures, fiscal pressure, and firm-level volatility. Traditionally, the literature has treated climate risk disclosures as signaling mechanisms intended to reduce information asymmetry and enhance market stability [39]. However, our findings indicate that disclosure alone does not necessarily mitigate fiscal or performance risk. Instead, when situated within coercive regulatory environments such as carbon taxation, disclosure practices may inadvertently intensify volatility for firms insufficiently equipped to integrate these signals into tax planning and strategic forecasting.

Moreover, the study challenges the deterministic assumption embedded in stakeholder and legitimacy theory that larger firms are better positioned to absorb or deflect environmental compliance costs. Our results support a more contingent theoretical framing, in which firm scale acts as a volatility amplifier under fragmented or nascent carbon tax regimes. This insight advances the theorization of fiscal exposure as a mediating mechanism that links sustainability accountability to bottom-line variability [40].

Finally, the study extends the discourse on tax accounting under climate risk by positioning earnings volatility not merely as a financial byproduct but as an interpretive signal of a firm's tax governance readiness. This approach invites deeper integration between environmental accounting, fiscal transparency, and risk-sensitive tax strategy. The observed results suggest that climate-aligned tax exposure must be embedded not only in disclosure frameworks but also within the design and execution of integrated reporting, scenario-based tax modeling, and performance management systems.

5.4.2 Practical implications

From a corporate accounting and taxation perspective, the findings urge firms, especially those in carbon-intensive and asset-heavy sectors, to rethink how they manage fiscal exposure to environmental regulation. Traditional tax compliance systems may no longer be sufficient under conditions of climate-linked taxation. Accounting professionals need to develop more proactive and integrated mechanisms to anticipate carbon-related tax liabilities and embed these into financial planning, earnings forecasts, and stakeholder communication.

For tax managers, the results underscore the need to bridge internal silos between sustainability reporting teams and fiscal control units. A disjointed approach risks underestimating the volatility implications of regulatory exposure, particularly when climate disclosures are treated as symbolic rather than integrated instruments. Firms should invest in systems that simulate fiscal risk under different carbon pricing scenarios and incorporate climate-adjusted tax metrics into capital budgeting, transfer pricing, and cash flow planning.

5.4.3 Policy implications

The study also yields significant implications for fiscal and environmental policymakers. In designing carbon tax frameworks, regulators must recognize that firm size does not necessarily equate to compliance capacity. Larger firms, especially in the logistics and transportation sectors, face unique structural and reporting burdens that may magnify volatility despite robust disclosure practices. Tax policy design should therefore consider phased implementation timelines, sector-specific deduction schemes, or adaptive credit systems that reward early integration of carbon tax forecasting into accounting practices.

Additionally, standard-setting bodies and oversight institutions should promote convergence between environmental reporting standards (e.g., IFRS S2, GRI) and fiscal regulation. Without alignment between what is disclosed and what is taxed, firms will continue to face uncertainty that distorts performance metrics and strategic responses. Policymakers have an opportunity to transform carbon taxation from a punitive measure into a strategic driver of fiscal transparency, stability, and sustainable value creation.

5.5 Limitations and avenues for future research

This study provides valuable insights into the intersection of climate risk disclosure, carbon tax exposure, and firm-level volatility within Indonesia's transportation and logistics sector. However, several limitations merit critical reflection, not as weaknesses, but as points of departure for future scholarship seeking to build on the theoretical and empirical foundations established here.

First, the analysis relies on publicly available secondary data, primarily drawn from annual reports and sustainability disclosures. While these sources support comparability and transparency, they may not fully capture the internal managerial practices or informal processes through which firms interpret and respond to carbon-related fiscal risk. Future research could benefit from incorporating qualitative designs such as case studies or practitioner interviews to explore

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how fiscal exposure is understood and operationalized across different organizational contexts. These approaches may offer richer interpretive insight into the behavioural and institutional dynamics that underpin disclosure strategies.

Second, the study is limited to a single national context, which, while analytically significant, constrains the generalizability of its findings. Indonesia represents an economy where climate regulation is still unfolding, and where carbon tax policies are in the early stages of implementation. Cross-country comparative studies, especially those contrasting emerging markets with established jurisdictions that have implemented carbon pricing mechanisms, would enable more nuanced conclusions regarding the institutional contingencies that shape the disclosure–tax–volatility nexus.

Third, while earnings volatility serves as a meaningful proxy for financial sensitivity to climate and tax factors, it only partially captures the broader spectrum of organizational performance. Volatility may reflect short-term market responses but does not directly indicate long-term strategic shifts or reputational impacts. Subsequent studies might incorporate alternative outcome variables such as tax aggressiveness, investment behaviour, sustainability ratings, or cash flow stability. This would offer a more holistic view of how carbon tax exposure alters corporate behaviour beyond the income statement.

Fourth, although the model accounts for firm size, it does not integrate potentially influential organizational factors such as ownership structure, board composition, tax planning capabilities, or sustainability maturity levels. These internal features may condition both the quality of disclosure and the firm's capacity to manage tax exposure. Future research could use moderated mediation models to investigate how such factors either buffer or exacerbate the relationship between climate risk and earnings variability.

Finally, the temporal scope of the data captures only the initial stages of carbon tax implementation. Firms may still be in the process of aligning their internal systems, investor communications, and tax projections with new regulatory demands. A longitudinal perspective would allow future scholars to assess how organizational responses evolve as policy environments stabilize, as market expectations mature, and as regulatory enforcement becomes more rigorous.

In conclusion, this study opens several promising directions for interdisciplinary research at the intersection of environmental accounting, taxation, and corporate risk. Scholars are encouraged to extend the inquiry with deeper theoretical integration, broader geographic comparisons, and methodological innovations that reflect the shifting landscape of climate governance and fiscal accountability.

6 Conclusion

This study aims to investigate how climate risk disclosure affects earnings volatility, considering carbon tax exposure as a mediating mechanism and company size as a moderating variable. This study uses panel data from publicly listed transportation and logistics companies from 2022 to 2024. It applies hierarchical linear regression with mediation and moderation techniques. The analysis shows that increased disclosure leads to higher carbon tax exposure, which fully mediates the effect on earnings volatility. Firm size does not significantly moderate this path, suggesting that larger firms are not necessarily more insulated from fiscal risks associated with climate policy. Anchored in agency theory, contingency theory, and the resource-based view, the research reveals that transparency in environmental reporting is not a neutral act. Rather than functioning solely as a reputational tool, climate disclosure can heighten regulatory visibility and generate fiscal exposure, ultimately increasing profit volatility. This challenges the widely held assumption that disclosure automatically reduces uncertainty and mitigates risk

A central finding is the identification of carbon tax exposure as a full mediating mechanism between disclosure and earnings volatility. This mechanism repositions tax exposure from a passive background condition to an active fiscal transmission channel. In doing so, the study diverges from conventional tax accounting and managerial accounting perspectives, which typically treat fiscal obligations and voluntary transparency as distinct domains. Here, disclosure not only signals intentions but also invokes regulatory consequences that shape the firm's financial outcomes.

The research also interrogates the strategic significance of firm size. Contrary to expectations rooted in the resource-based view, larger firms do not appear to enjoy superior insulation from fiscal risk. In carbon-intensive sectors like transportation and logistics, scale alone does not shield firms from the volatility introduced by carbon-related policies. This insight underscores the need to reassess how strategic resources function under regulatory pressure and how firm-level adaptability must go beyond asset base and operational capacity.

By applying a rigorous empirical framework that integrates panel regression with mediation and moderation analysis, this study also advances the methodological toolkit available for tax and environmental accounting scholars. The findings emphasize the need for empirical approaches that reflect the conditional and dynamic nature of regulatory exposure. This approach is particularly relevant in emerging markets, where regulatory institutions are still evolving and where climate governance intersects with fiscal policy in unpredictable ways.

Taken together, the results point to a more nuanced understanding of climate-related disclosure. Rather than viewing transparency as an automatic route to legitimacy and investor trust, this study illustrates how disclosure can trigger new forms of exposure that ripple through the firm's financial structure. The implications are profound, particularly for sectors under increasing scrutiny for their carbon emissions. Understanding how disclosure, taxation, and financial stability interconnect is crucial for building credible, adaptive, and sustainable business models.

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6.1 Theoretical and practical contributions

This research delivers several original contributions to the fields of tax accounting, environmental disclosure, and climate governance. Theoretically, it introduces a hybrid perspective that integrates fiscal exposure into the conceptualization of voluntary disclosure. It argues that climate risk disclosure is not merely a reputational tool but also a regulatory signal that activates taxation pathways. This challenges the dominant narrative in voluntary disclosure literature, where transparency is typically seen as a mechanism that resolves information asymmetries and reduces agency costs.

Furthermore, by identifying carbon tax exposure as a mediating variable, the study reframes taxation as an active component of corporate environmental strategy. This innovation elevates the role of tax accounting within the broader sustainability discourse, offering a new lens through which fiscal outcomes can be interpreted in high-emission sectors. It also extends the application of contingency theory by demonstrating how disclosure outcomes are shaped not only by internal governance choices but also by external fiscal structures and regulatory clarity.

From a practical standpoint, the study encourages firms to consider the financial trade-offs embedded in their environmental reporting strategies. For transportation and logistics companies, transparency may enhance legitimacy but also lead to unintended fiscal repercussions. Additionally, the finding that firm size does not mitigate earnings volatility calls for a reassessment of how strategic resources are defined in climate-sensitive industries. Practitioners must develop more granular tools to assess risk exposure, moving beyond scale to consider adaptive capabilities and organizational learning.

Methodologically, the use of integrated regression models that can isolate both mediation and moderation effects provides a robust template for future research. This approach enables a deeper understanding of how indirect effects operate in complex regulatory environments. It provides a path forward for scholars seeking to investigate the intersection of disclosure, taxation, and corporate performance.

Overall, the study provides a more balanced and integrated perspective on the literature regarding climate disclosure and tax exposure. It bridges theoretical gaps, delivers actionable insights, and sets a high standard for future empirical work at the intersection of accounting, regulation, and sustainability.

Acknowledgments
The authors wish to express their appreciation to all parties who contributed to the successful execution of this research in the Indonesian context. Institutional support and access to public datasets were particularly valuable in enabling the empirical analyses conducted in this study.

Funding
This research did not receive any specific grant or financial assistance from public, commercial, or not-for-profit funding agencies.

Conflict of Interest
The authors declare that they have no known financial or personal relationships that could be perceived as potential conflicts of interest in the development and presentation of this work.

Ethics Approval
As this study is based exclusively on secondary, publicly available data and involves no human subjects, formal ethical clearance was not required.

Data Availability Statement
The data that support the findings of this study are available from the corresponding author upon reasonable request

Author Contributions
Conceptualization, Eva Herianti (E.H.), Amor Marundha (A.M.); methodology, E.H. and A.M.; formal analysis, E.H. and A.M.; investigation, E.H.; resources, E.H.; writing—original draft preparation, E.H.; writing—review and editing, A.M.; visualization, E.H.; supervision, A.M.; project administration, E.H. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Review process
Single-blind peer review process.

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