



Determinant of Carbon Emission Disclosure and its Impact on Firm Value: Moderating Role of Profitability

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ABSTRACT

This study aims to identify determinants of carbon emission disclosure (CED) and to examine how CED, moderated by profitability, affects firm value. This study employs multiple liner regression to test determinants of CED (firm size, leverage and environmental management system). A moderated regression analysis assesses the effect of CED on firm value with profitability as moderator. Results show firm size is the only significant determinant of CED. This reflects that indicating that larger firms tend to disclose more information related to carbon emissions. Furthermore, this research also revealed that profitability strengthens the positive impact of carbon emission disclosure on firm value, indicating that carbon transparency is more valued by stakeholders when firms demonstrate strong financial performance. This study contributes to the literature on environmental disclosure and firm value by providing empirical evidence on the determinants of carbon emission disclosure and highlighting the moderating role of profitability.

INTRODUCTION

The growing threat of climate change has become a significant global concern, as shown by higher global temperatures, melting polar ice caps, sea level rise, and the increasing occurrence of extreme weather events (Allam & Diyanty, 2020). These changes are largely driven by greenhouse (GHG) emissions resulting from human and corporate activities, including carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). To reduce threat of climate change, companies are expected to implement strategies to reduce carbon emissions and improve environmental management practices (Suherman & Kurniawati, 2023). In response to these challenges, regulators such as Indonesia's Financial Services Authority (OJK) have introduced to sustainability reporting requirements through POJK No.51/POJK.03/2017. However, while companies are required to disclose sustainability-related information, detailed carbon emission disclosure remains largely voluntary in Indonesia. Therefore, firm attributes such as company size, leverage, and the use of Environmental Management Systems (EMS), may play an important role in determining the extent of carbon emission disclosure (CED), as organizations with greater resources and more organized environmental management are more inclined to disclose such information.

Prior to 2020, firm value was primarily associated with financial performance, particularly profitability, which was considered the main determinant of investor valuation. However, the increasing global emphasis on sustainability, including Net Zero Emission Commitments and the Sustainable Development Goals (SDGs), has shifted investor attention toward environmental transparency. Recent studies indicates that carbon emission disclosure has gained increasing attention from investors and may contribute positively to firm value (Kurnia et al., 2020; Maharani et al., 2024). However, empirical evidence regarding the association between carbon emission disclosure and firm value remains mixed and inconclusive. Several studies have reported a negative relationship between carbon emission disclosure and firm value. For example, (Sun et al., 2022), based on a sample of companies included in the Shanghai and Shenzhen 300 (CSI 300) Index, found that carbon emission disclosure has an adverse effect on firm value in China. Consistent with this result, (Aulia et al., 2024) also documented a negative association between carbon emission disclosure and firm value in Chinese context. Likewise, Apriliani et al., 2024 found evidence of a negative relationship between carbon emission disclosure and firm value among Indonesian firms.

A Critical synthesis of this literature reveals two major empirical blind spots that necessitate further inquiry. First, the contradictory evidence regarding how capital markets react to carbon reporting suggests that direct link between environmental transparency and valuation is bounded by contingency factors – such as firm-level characteristics – which have frequently been overlooked in direct-effect models. Second, existing studies systematically decouple the organizational antecedents driving carbon disclosures from its downstream market consequences, evaluating them as separate operational phenomena rather than a continuous sequence. This analytical fragmentation leaves a clear gap in understanding how internal firm determinants ultimately translate into

external market value within emerging economies like Indonesia, where voluntary reporting practices and investor perceptions differ significantly from developed markets.

To address these unresolved issues, this study contributes to the literature by offering a dual-perspective model that integrates both the drivers and market valuation effects of carbon emission disclosure within a single empirical framework. Unlike prior studies that predominantly isolate either the antecedents or the consequences of carbon disclosure, our model captures the complete flow – from organizational determinants (firm size, leverage and EMS) to firm value. Furthermore, by introducing profitability as a moderating mechanism, this research provides new empirical evidence on whether financial strength acts as a boundary condition that amplifies the market's valuation of corporate sustainability transparency. Therefore, the objectives of this study are to investigate the effects of firm size, leverage and environmental managements systems on carbon emission disclosure and to examine whether profitability strengthens the relationship between carbon emission disclosure and firm value.

THEORETICAL REVIEW

Theoretical Foundations: Stakeholder, Signaling and Legitimacy Theory

A theoretical framework, as known as stakeholder theory, revitalizes the traditional shareholder-oriented perspective by expanding the focus beyond shareholders to include a broader range of stakeholders (Freeman, 1984). There are many groups that have an interest in the economic activities carried out by a company, such as employees, consumers, suppliers, creditors, communities, governments, and the environment (Trianaputri et al., 2020). In the context of change, stakeholders increasingly expect companies to disclose environmental information including carbon emissions. Such disclosure serves as a communication tool that enhances transparency, reduces information asymmetry, and strengthens stakeholder trust (Kurnia et al., 2020). From the perspective of signaling theory, carbon emission disclosure functions as an indicator of firm's transparency and commitment to environmental responsibility, thereby helping to reduce information asymmetry and strengthen investor trust. Consequently, investors may view the firm as having lower risk and demand a lower required rate of return, which ultimately decreases the firm's cost of capital (Moussa & Elmarzouky, 2024). Furthermore, a reduced cost of capital can enhance firm value, as it enables firms to obtain financing more efficiently and increases the present value of expected future cash flow.

In addition, legitimacy theory emphasized that firms attempt to ensure their operations are consistent with social values and expectations to preserve their legitimacy within society (Dowling & Pfeffer, 1975). Carbon emission disclosure represents a corporate effort to demonstrate accountability and responsiveness to environmental concerns, thereby strengthening public acceptance and corporate reputation (Angelina & Handoko, 2023).

By enhancing transparency and aligning with stakeholder expectations, carbon emission disclosure can strengthen the legitimacy of companies and improve firm value.

Carbon Emission Disclosure

Carbon Emission Disclosure shown the commitment of the company to managing and reducing its environmental impact, particularly greenhouse gas emissions resulting from these operations (Wahyuningrum et al., 2024). Companies, especially those operating in carbon-intensive industries, are increasingly expected to disclose carbon emission information as part of their broader commitment to sustainable development. Although such disclosure may involve additional costs, it can provide long-term benefits by enhancing corporate transparency, reducing environmental risks, and strengthening stakeholder confidence (Suherman & Kurniawati, 2023). The assessment of corporate value now heavily weighs a firm's carbon footprint and transparency levels as indicators of hidden financial risks and 'un-booked' liabilities. A prominent example is the credit rating adjustments made by S&P Global against major energy players such as Chevron and Exxon Mobil, where environmental pressures were cited as a decisive factor. Empirical data further suggests a 'double penalty' effect: while the market generally devalues heavy emitters, it imposes even stricter financial consequences on those that withhold emission data. This trend is particularly evident in developing economies, where transparency acts as a strategic tool to lower the cost of equity, whereas high carbon output tends to drive capital costs upward (Lee & Cho, 2021).

Globally, carbon emission disclosure is still largely voluntary. Nevertheless, some countries have implemented mandatory carbon disclosure regulations to improve corporate transparency, particularly in developed marked such as the United Kingdom (Houqe & Khan, 2023; Tauringana & Chithambo, 2015). In Indonesia, sustainability reporting is regulated under Financial Services Authority Regulation No.51/POJK.03/2017, which requires public companies to release sustainability reports covering economic, social, and environmental performance (Otoritas Jasa Keuangan (OJK), 2017). However, the regulation does not mandate specific carbon emission standards, allowing companies flexibility in determining the extent and format of their disclosures. Sustainability reports in Indonesia are often prepared based on the Global Reporting Initiative (GRI) Standards, which provide structure guidelines for environmental disclosure (Wahyuningrum et al., 2024).

Carbon emission disclosure is a tool for companies to communicate their environmental responsibility in managing carbon-related risks, and demonstrate accountability to stakeholders (Kurnia et al., 2020). According to sustainability reporting frameworks such as those examined by (Wahyuningrum et al., 2024), carbon disclosure generally includes information on greenhouse gas emissions, energy consumption, emission reduction initiatives, and related. By disclosing such information, companies enhance transparency and support their long-term sustainability objectives.

Hypotheses Development

Firm Size and Carbon Emission Disclosure

Firm size represents the magnitude of a company's assets or resources used in conducting its operations, as indicated by the total assets owned by the firm. Company assets derived from various stakeholders increase the level of pressure and oversight on the firm. As environmental awareness continues to grow, stakeholders increasingly demand greater transparency in environmental management, including carbon emission disclosure. According to stakeholder and legitimacy theories, larger firms tend to enhance transparency to maintain legitimacy and meet stakeholder expectations. In addition, larger firms have more resources to implement environmental initiatives and reporting practices. Empirical evidence suggest that larger firms tend to disclose more carbon emission information, as they are exposed to greater public scrutiny and stronger stakeholder expectations regarding environmental transparency (Abdullah et al., 2020; Sari et al., 2023). Thus, firm size is expected to positively affect carbon emission disclosure.

H₁: Larger firm size leads to higher levels of carbon emission disclosure

Leverage and Carbon Emission Disclosure

Leverage indicates the degree to which a company uses debt in comparison to its equity to support its operational and investment activities. From a stakeholder power perspective, rising corporate indebtedness shifts managerial responsiveness from external environmental advocates to institutional lenders. Firms with higher debt level compared to equity tend to face more intensive oversight from creditors, especially in relation to financial performance indicators such as liquidity, solvency, and profitability ratios. As a result, this condition may constrain the firm's ability to incur additional costs associated with voluntary carbon emission disclosure. From a financial perspective, highly leveraged firms tend to prioritize debt obligations over voluntary disclosure initiatives. Research findings show that firms with greater reliance on debt financing are generally less likely to disclose carbon emission information, since financial obligations and cost constraints may reduce their ability to support voluntary disclosure practices (Sekarini & Setiadi, 2021; Wiguna et al., 2025). Thus, leverage is expected to be negatively associated with carbon emission disclosure.

H₂: Higher leverage leads to lower levels of carbon emission disclosure

Environmental Management System and Carbon Emission Disclosure

An Environmental Management System (EMS) provides a structured framework for managing environmental risks and monitoring environmental performance, including carbon emissions. The implementation of EMS enables firms to systematically collect environmental data, improve environmental accountability, and enhance the quality and credibility of environmental disclosure. The implementation of EMS reflects the firm's commitment to environmental accountability, sending a positive signal to investors and

stakeholders about its environmental performance. At the same time, EMS helps strengthen corporate reputation by aligning the firm's operational practices with societal values and expectations. From the lens of signalling theory, an active EMS equips the firm with rigorous data-gathering capabilities, allowing management to issue standardized, verifiable, and credible carbon disclosures. Empirical evidence also indicates that the firms that have implemented EMS are more likely to disclose carbon emission information. (Pangestu & Permata Hati, 2024; Putri & Yuliandhari, 2024). Therefore, environmental management system is expected to positively influence carbon emission disclosure.

H₃: The implementation of an environmental management system increases carbon emission disclosure

Carbon Emission Disclosure and Firm Value

Carbon emission disclosure reflects a firm's transparency in addressing environmental issues and managing environmental risks. Based on signalling theory, disclosing carbon emission information sends a positive signal to investors regarding the firm's environmental awareness, commitment, and responsibility, which can contribute to long-term business sustainability and value creation. Furthermore, legitimacy theory explains that carbon emission disclosure enables firms to secure social approval and preserve their legitimacy, which in turn strengthens corporate reputation and builds stakeholder confidence. Greater transparency helps reduce information asymmetry between firms and stakeholders, thereby, improving investor trust. This increased investor confidence may ultimately contribute to higher firm value. Empirical studies have also reported a positive relationship between carbon emission disclosure and firm value (Aulia et al., 2024; Kurnia et al., 2021).

H₄: Higher level of carbon emission disclosure leads to an increase in firm value

The Moderating Role of Profitability in the Relationship Between Carbon Emission Disclosure and Firm Value

Profitability reflects a firm's financial capability and its effectiveness in generating returns from its business activities. Increased profits indicate that the company has good performance thereby creating a positive signal for investors (Isaac & Setiawan, 2022). Firms with higher profitability have greater resources to support environmental initiatives and maintain consistent disclosure practices over time. From a signalling perspective, carbon emission disclosure provided by profitable firms is perceived by investors as more credible and relevant for decision-making. Consequently, investors tend to respond more favourably to environmental disclosures when they are accompanied by strong financial performance. Empirical evidence also indicates that profitability enhances the positive effect of carbon emission disclosure on firm value (Zulkifli, 2025).

H₅: Profitability strengthens the positive effect of Carbon Emission Disclosure on Firm Value

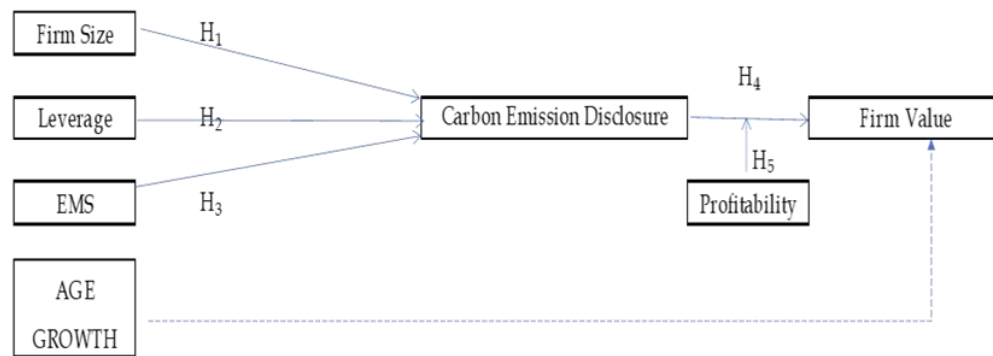


Figure 1: Theoretical Framework

METHODOLOGY

Population & Sample

The Population of this study comprises all companies within consumer non-cyclicals sector listed on Indonesia Stock Exchange (DX) for 2021-2024 period. This study utilized a purposive sampling technique to identify representative samples that fulfilled the specific data requirements based on the following criteria:

1. Non-cyclical sector companies have consistently issued annual reports and/or sustainability reports during 2021-2024.
2. Non-cyclical sector companies present financial data regarding data regarding assets, earnings, market price, and liabilities necessary to calculate research variables
3. Non-cyclical sector companies which public annual reports and financial reports with Rupiah currency during 2021-2024.

Based on those criteria and the outlier screening process, the final sample consisted 26 unique companies, resulting 97 firm-year observations. Given that our largest empirical specification (Model 2 for Firm Value) contains 5 predictor variables – including the core independent variable, moderator, interaction term and two control variables (Firm age and Firm Growth) – the required sample size threshold base on (Green, 1991) is $N \geq 50 + 8(5) = 90$ observations. Thus, our final dataset of 97 firm-year observations provides sufficient statistical power, degree of freedom, to estimate all parameters reliably.

Variable Measurement

Dependent Variables

Carbon Emission Disclosure (CED):

Carbon emissions disclosure involves the systematic reporting of a firm's carbon footprint, serving as a baseline for establishing future mitigation goals (Stefani & Gunawan Juniati, 2024). In the first model, CED serves as the primary dependent variable. Following the framework established by (Choi et al., 2013), it is quantified using an 18-item index. This metric evaluates various dimensions,

including climate change risks, energy use, greenhouse gas emissions, reduction strategies, and related financial costs.

The final score is derived by dividing the number of items disclosed by the company by the maximum possible total.

Firm value (FV)

For the second model, firm value is assessed through Tobin's Q, a ratio representing market sentiment toward a company's performance and growth potential. It is calculated by summing the market value of equity and total debt, then dividing the result by total assets.

Independent Variables

The study examines three main predictors:

1. Firm Size: measured by the natural logarithm of total assets (Sari et al., 2023)
2. Leverage: Defined as the ratio of total debt to total equity (Wahyuningrum et al., 2024).
3. Environmental Management System: Represented by dummy variable where a value of 1 indicates ISO 14001 certification, while 0 indicates its absence (Ardhia Putri & Yuliandhari, 2024).

Moderating variables

To evaluate a firm's efficiency in generating returns, Return on Assets (ROA)—calculated as net income over total assets—is utilized as a moderating factor (Zulkifli, 2025)

Control Variables

To isolate the impact of the main predictors, two control variables are included:

1. Firm Age (AGE): Measured as time elapsed from the IPO date to the current observation year. Older firms are often associated with operational stability and higher market trust.
2. Firm Growth (GROWTH): Measured by sales growth (the percentage change in annual revenue). This reflects the company's expansion capabilities and its attractiveness to investors.

Research Model

Data were sourced through documentation of annual and sustainability reports from the IDX and official corporate websites. The analysis was conducted using IBM SPSS Statistics 26 through multiple linear regression. This research proposed 2 (two) model regression to test the hypothesis:

Model 1: Determinants of Carbon Emission Disclosure

This model examines the effect of firm size, leverage, and environmental management system on carbon emission disclosure:

$$CED_it = \alpha + \beta_1 SIZE_it + \beta_2 LEV_it + \beta_3 EMS_it + \varepsilon_it$$

Model 2: Moderating Effect of Profitability on Firm Value

This model assesses whether profitability strengthens the impact of carbon disclosure on firm value:

$$FV_it = \alpha + \beta_4 CED_it + \beta_5 ROA_it + \beta_6 (CED_it \times ROA_it) + \beta_7 AGE_it +$$

$$\beta_8 \text{ GROWTH}_{it} + \varepsilon_{it}$$

Where:

CED_{it} = Carbon Emission Disclosure of firm i in year t

SIZE_{it} = Firm Size

LEV_{it} = Leverage

EMS_{it} = Environmental Management System

FV_{it} = Firm value PROF_{it} = Profitability

CED_{it} x PROF_{it} = interaction term representing the moderating effect

AGE_{it} = AGE

GROW = Growth of SALES

RESULTS

Descriptive Statistic Analysis

Table 1 presents the descriptive statistics of the variables used in this study. Firm size (SIZE), measured as the natural logarithm of total assets, has a mean value of 29.82, equivalent to approximately IDR 26 trillion, indicating that the sampled firms are predominantly large-sized firms. The relatively narrow range of values (25.55–32.93) suggests a fairly homogeneous distribution of firm size across the sample. Leverage (LEV) has an average value of 1.13, indicating that firms rely substantially on debt financing in their capital structure. The maximum value of 6.46 indicates that some firms are highly leveraged, contributing to considerable variability in leverage levels among the sampled firms. Environmental management system (EMS), proxied by ISO 14001 certification and measured as a dummy variable, has a mean value of 0.34, indicating that approximately 34% of firms have adopted ISO 14001 certification. This suggests that a relatively limited proportion of firms have implemented formal environmental management systems that are structured, documented, and verified by independent certification bodies.

Carbon emission disclosure (CED) has a mean value of 0.5097, indicating a moderate level of carbon disclosure, with firms disclosing approximately half of the expected carbon-related information on average. The wide range of values (0.11–0.88) indicates substantial cross-sectional variation in disclosure practices, reflecting differing levels of commitment to environmental transparency among firms. Firm value (FV), measured using Tobin's Q, has a mean value of 1.56, suggesting that, on average, the market values firms above their book value, which reflects positive investor expectations regarding future growth prospects. However, the wide range (0.52–8.99) indicates significant variation in market valuation, suggesting heterogeneity in firm performance and market perception. Profitability (PROFIT), measured by return on assets (ROA), has an average value of 0.0899, indicating that firms generate an average return of approximately 9% on their total assets. The variation in profitability is notable, with some firms exhibiting very low profitability and others achieving substantially higher returns.

Firm age (AGE) has a mean value of approximately 21 years, indicating that the sample primarily consists of relatively mature firms. The wide range (1–43 years) reflects substantial variation in firm maturity, which may influence operational stability, resource availability, and financial performance. Finally, firm growth (GROWTH) has a mean value of 0.1313, indicating that firms experienced positive growth on average during the observation period. However, the broad range of values (–0.404 to 1.1602) suggests considerable variation in growth performance, indicating that while some firms experienced significant expansion, others faced contraction. Overall, these results indicate substantial heterogeneity across firms in terms of financial characteristics, environmental practices, and market performance.

Table 1. Descriptive Statistical Analysis

	<i>N</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Std.Dev</i>
SIZE	97	25.5566	32.9378	29.8242	1.6220
LEV	97	.0344	6.4658	1.1385	1.2445
EMS	97	0	1	.34	.476
CED	97	.111	.8888	.5097	.1773
FV	97	.5266	8.996	1.5561	1.393
PROFIT	97	.0031	.3319	.0894	.0678
AGE	97	1	43	20.93	11.113
GROWTH	97	-.4047	1.1602	.1313	.2012

Source: Processed Data, SPSS 26

Assumption Test

Normality Test

The normality test was conducted to examine whether the residuals of the regression models follow a normal distribution, which is an important assumption in regression analysis (Ghozali, 2018). Assessing residual normality ensures the validity and reliability of statistical inference. In this study, the Kolmogorov–Smirnov (K–S) test was employed to evaluate the normality of the residuals. Residuals are considered normally distributed when the significance value exceeds the threshold of 0.05. To satisfy the normality assumption, seven outlier observations were identified and removed from the dataset, resulting in a final sample of 97 firm-year observations. As reported in Table 2, both Model 1 and Model 2 exhibit Asymp. Sig. values greater than 0.05, indicating that the residuals are normally distributed. Therefore, it can be concluded that the normality assumption is satisfied for both regression models.

Table 2. Normality Test Result

	<i>Unstandardized Residual Model1</i>	<i>Unstandardized Residual Model2</i>
N	97	97
Mean	.0000000	.0000000

<i>Normal Parameters^{a,b}</i>	Std. Deviation	.15670117	.77051214
<i>Most Extreme Differences</i>	Absolute	.071	.085
	Positive	.050	.085
	Negative	-.071	-.072
Test Statistic		.071	.085
Asymp. Sig. (2-tailed)		.200 ^d	.081

Source: Processed Data, SPSS 26

Multicollinearity Test

The multicollinearity was conducted to examine whether a high correlation existed among the independent variables in the regression (Ghozali, 2018). This study evaluated multicollinearity using the tolerance value and variance inflation factor (VIF), with threshold criteria of tolerance values greater than 0.10 and VIF values less than 10. As shown in Table 3, the tolerance values for all variables in each model exceed 0.10 and the VIF values are below 10. These results indicated that there was no evidence of multicollinearity in either model.

Table 3. Multicollinearity Test Result

	Collinearity Statistics Model 1		Collinearity Statistics Model 2	
	Tolerance	VIF	Tolerance	VIF
SIZE	.999	1.001		
LEV	.995	1.005		
EMS	.996	1.004		
CED			.934	1.071
ROA			.779	1.284
AGE			.803	1.245
GROWTH			.930	1.075
CED*ROA			.886	1.128
a. Dependent Variable: CED			a. Dependent Variable: Tobin's Q	

Source: Processed Data, SPSS 26

Autocorrelation Test

The autocorrelation test was conducted to examine whether the residuals in the regression model are correlated across observations (Ghozali, 2018). This study employed the Runs Test, a non-parametric method used to assess the randomness of residuals. Table 4 shows that the Asymp. Sig. (2-tailed) value exceeds 0.05. Therefore, it can be concluded that the regression model does not exhibit autocorrelation, indicating that the residuals are independently distributed

Table 4. Autocorrelation Test Result

	Sig. (model 1)		Sig. (model 2)	
<i>Asymp. Sig. (2-tailed)</i>		.759		.759

Source: Processed Data, SPSS 26

Heteroskedasticity Test

The heteroskedasticity test was conducted to examine whether the variance of the residuals differed across observations in the regression model. In this study, heteroskedasticity was assessed using the Spearman's Rho test. As presented in Tables 5 and 6, both Model 1 and Model 2 showed that all independent and control variables had significance values greater than 0.05. These results indicated that heteroskedasticity was not present in either model.

Table 5. Heteroskedasticity Test Result- Model 1

	<i>Sig. (2-tailed)</i> <i>Model 1</i>
SIZE	.930
LEV	.219
EMS	.886

Source: Processed Data, SPSS 26

Table 6. Heteroskedasticity Test Result - Model 2

	<i>Sig. (2-tailed)</i> <i>Model 2</i>
CED	.625
ROA	.101
AGE	.794
GROWTH	.865
CED*ROA	.481

Source: Processed Data, SPSS 26

DISCUSSION

Results & Discussion Model 1

Multiple regression analysis is used in Model 1 to investigate the variable effecting carbon emission disclosure (CED). The findings of the regression shown in Table 7. Larger firms are more likely than smaller firms, according to results, which also show that firm size (SIZE) has positive and highly significant effect on CED ($B=0.051$; $p < 0.001$). According to legitimacy theory (Kouloukoui et al., 2019; Luo & Tang, 2014; Pangestu & Permata Hati, 2024; Surjadi et al., 2023), companies that are more visible to the public and subject to stakeholder scrutiny are more likely to increase environmental disclosure in order to preserve their legitimacy and social acceptance. According to stakeholder theory, a variety of stakeholders, such as investor and regulators, put more pressure on larger companies to disclose environmental information in a more transparent manner (Freeman et al., 2021).

In contrast, leverage (LEV) shows a negative but statistically insignificant effect on CED ($B = -0.005$; $p = 0.720$), suggesting that financial risk does not significantly influence carbon disclosure practices. This finding indicates that creditors may prioritize financial stability over environmental transparency, thereby weakening the role of debt as a monitoring mechanism for environmental disclosure (Clarkson et al., 2015; Luo, 2019). This result also reflects the concept of decoupling, where disclosure practices are driven more by institutional pressures, such as social legitimacy and stakeholder expectations, rather than financial considerations (Bromley & Powell, 2012). This finding is

consistent with prior studies that also found no significant relationship between leverage and carbon emission disclosure (Nurromah & Ambarwanti, 2024).

Similarly, environmental management systems (EMS) show a positive but statistically insignificant effect on CED ($B = 0.016$; $p = 0.633$). This finding is also consistent with prior studies in Indonesia showing that EMS does not significantly influence carbon emission disclosure due to relatively weak regulatory pressure and the voluntary nature of such disclosure (Iswati & Setiawan, 2020; Jannah & Narsa, 2021). Although EMS adoption, such as ISO 14001 certification, reflects a formal commitment to environmental management, it does not necessarily lead to more extensive carbon disclosure. To overcome this limitation, corporate leaders must shift from treating EMS as a mere compliance cost and instead leverage it as a strategic asset for gathering precise, verifiable carbon emission data. Consequently, managers in emerging markets must actively embed emission reporting systems into their core operational strategies, ensuring that sustainability disclosures drive substantive efficiency and transparency rather than remaining a symbolic compliance exercise.

Overall, the findings demonstrate that organizational characteristics, particularly firm size, play a more significant role in influencing carbon emission disclosure than financial structure or formal environmental management systems. This highlights the importance of external visibility and stakeholder pressure as key drivers of environmental disclosure. Furthermore, the results suggest that carbon emission disclosure may function as a strategic legitimacy tool, reflecting firms' efforts to maintain their sustainability image rather than being driven solely by financial risk or formal environmental management practices.

Table 7. Results of Model 1

	<i>Expected Sign</i>	<i>Unstandardized coefficient</i>	<i>Sig</i>
<i>Constant</i>		-1.008	.001
<i>SIZE</i>	+	.051	.000***
<i>LEV</i>	+	-.005	.720
<i>EMS</i>	+	.016	.633
<i>Adj R² = 0.194</i>			
<i>Prob < F = 0.000</i>			
<i>*, **, *** significant level $\alpha = 10\%, 5\%, 1\%$</i>			

Source: Processed Data, SPSS 26

Results & Discussion Model 2

Table 8 presents the results of the moderation regression analysis, showing that the interaction between carbon emission disclosure and profitability has a positive and significant effect on firm value ($\beta = 43.026$; $p < 0.001$). Meanwhile, the direct effect of carbon emission disclosure on firm value is not significant, whereas profitability has a positive and significant effect on firm value. Regarding the control variables, firm age shows a positive effect, while sales growth has a negative effect on firm value.

These results suggest that the impact of carbon emission disclosure on firm value depends on how profitable the company is. Carbon disclosure is seen by the market as a sign of company's credibility, financial strength, and strong managerial ability to implement sustainability strategies in highly profitable business. On the other hand, such disclosure is unlikely to add value in less successful business since it might be seen as an extra expense. This finding aligns with resource-based view and signalling theory, which contend that the firm's internal resource capacity to absorb sustainability-related risks and costs determines how effective sustainability disclosure (Broadstock et al., 2021; Connelly et al., 2024).

Table 8. Results of Model 2

	<i>Expected Sign</i>	Unstandardized coefficient	Sig
<i>Constant</i>		1.282	.001
CED	+	.800	.093
ROA	+	15.839	.000***
AGE	+	.018	.031
GROWTH	+	-.873	.039
CED*ROA	+	43.026	.000***
Adj R² = 0.678			
Prob < F = 0.000			
*, **, *** significant level α = 10%, 5%, 1%			

CONCLUSIONS AND RECOMMENDATIONS

Overall, the findings from both models provide a comprehensive understanding of the determinants and economic implications of carbon emission disclosure. The first model shows that carbon emission disclosure is primarily driven by firm characteristics, particularly firm size, indicating that larger firms are more likely to disclose carbon-related information due to greater visibility and stakeholder pressure. The second model demonstrates that carbon emission disclosure does not automatically enhance firm value; rather, its positive effect emerges only when supported by sufficient profitability.

This study also contributes to the sustainability literature by emphasizing that the key issue is not only whether firms disclose carbon emissions, but also under what conditions such disclosure enhances firm value (Gerged et al., 2021). Furthermore, these empirical results offer key strategic direction for capital market participants in emerging economies. For corporate management, carbon emission disclosure should be strategically aligned with financial to enhance long-term firm value and market credibility. For regulators, the findings highlight the necessity of strengthening and standardizing carbon disclosure framework to foster greater market transparency and reporting consistency. For investors, carbon disclosures must be contextualized alongside a firm's financial performance to ensure rigorous valuation.

This study has several limitations, particularly within the context of developing countries such as Indonesia. First, carbon emission disclosure is measured based on voluntary reporting, which remains heterogeneous and not

fully standardized, potentially limiting its ability to reflect actual emission levels or environmental performance. Second, while firm size is identified as a key determinant, this study does not explicitly examine other relevant factors such as regulatory pressure, industry characteristics, or state ownership. Third, profitability is measured using a single proxy (ROA), and firm value is measured using Tobin's Q, which may limit the generalizability of the findings.

FURTHER STUDY

To address these limitations, several opportunities exist for future research. First to overcome the heterogeneity of voluntary carbon reporting, future studies should adopt standardized framework (e.g., TFCF or GRI guidelines). Second, researchers should broaden the analytical model by incorporating critical contextual factors such as regulatory pressure, industry-specific characteristics, state ownership, and corporate governance mechanisms. Finally, employing multi-proxy measurements for financial performance and market valuation – such as combining ROA with ROE or Tobin's Q with Price-to-Book Value (PBV) – would enhance the robustness and generalizability of the empirical findings across emerging economies

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