

Carbon Emission Disclosure, ESG, Assets Growth on Financial Performance: The Moderating Role of Firm Size

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ABSTRACT

Purpose – The objective of this study is to analyze the effect of CED, ESG and AG on company financial performance, measured by Tobin's Q and ROA, while evaluating the moderating role of company Size across energy businesses in the ASEAN-5 countries. **Methodology/approach** – The study uses a quantitative causal research design with panel data regression analysis. The sample comprises 141 firm-year observations, from 47 publicly listed energy businesses in Indonesia, Malaysia, Singapore, Thailand and the Philippines throughout the period 2022-2024. Secondary data were acquired from annual reports, sustainability reports and Refinitiv Eikon database. The postulated ideas were tested using REM and MRA. **Findings** – Both CED and AG yield a highly positive effect regarding Tobin's Q alongside ROA, according to the empirical data. Conversely, ESG shows an absence of significant consequences for either indicator of firm financial performance. Furthermore, Firm Size operates as an essential moderating element concerning the links uniting CED with Tobin's Q as well as ESG with Tobin's Q, whereas it alters neither the connection binding AG to Tobin's Q nor any interplay linking the independent variables with ROA. **Novelty/value** – Insights from this research design enrich the existing sustainability and corporate finance literature by jointly evaluating CED, ESG, AG, and the moderating effect of Firm Size across market-based and accounting-based financial performance dimensions within a cross-country ASEAN-5 energy sector environment. These conclusions supply actionable guidance for investors, managers, and policy authorities regarding the value of clear environmental disclosure alongside sustainable asset management intended for advancing firm financial performance.

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INTRODUCTION

Climate change and sustainability issues have increased pressure on organizations, particularly in the energy sector, to become more environmentally accountable and adopt sustainable

business practices. As one of the largest contributors to greenhouse gas emissions due to its dependence on fossil fuels, the ASEAN-5 energy sector faces growing demands to improve environmental transparency, sustainability practices, and operational efficiency to maintain long-term financial performance and stakeholder confidence (Widia & Wibisono, 2024).

The ASEAN-5 countries (Indonesia, Malaysia, Singapore, Thailand, and the Philippines) continue to experience rapid economic growth accompanied by rising energy demand. According to the ASEAN Centre for Energy (2024), primary energy consumption has increased by more than 70% over the past two decades, while coal and petroleum remain the dominant energy sources. These conditions have intensified environmental challenges and regulatory pressure, making CED and sustainability reporting increasingly important for corporate accountability and sustainable development.

At the same time, digitalization has transformed corporate sustainability reporting by improving the accessibility, transparency, and timeliness of environmental information. As investors increasingly rely on digital information, CED and ESG reporting have become important tools for reducing information asymmetry, strengthening stakeholder confidence, and supporting investment decisions (Burki et al., 2024).

This study is grounded in Stakeholder Theory and Signaling Theory. Stakeholder Theory argues that companies should fulfill the expectations of stakeholders through transparent sustainability reporting (Le, 2024; Kandil et al., 2025). Complementing this perspective, Signaling Theory explains that companies convey information to investors through voluntary disclosures that reflect both their current condition and prospects (Thanh, 2023). Good quality ESG reporting and CED are good signs on a firm's commitment to sustainability, which enhance investor trust and firm value (Demiraj et al., 2025). These signals are expected to be stronger in firms with greater Firm Size and higher Asset Growth because they generally possess more resources to implement sustainability initiatives.

Firm financial performance is commonly measured using market-based (Tobin's Q) and accounting-based (ROA) indicators (Chancharat & Kumpamool, 2022). Sustainability-related practices, including CED, ESG performance, and AG, are widely recognized as factors that may influence firm financial performance. However, previous empirical findings remain inconclusive. Several studies report that CED enhances firm value by providing positive signals to investors (Kurnia et al., 2021; Siddique et al., 2021), alternative research contends that expenditures linked to environmental disclosure might diminish short-term profitability (Bedi & Singh, 2024). Likewise, previous studies on ESG performance have produced inconsistent results (Ali et al., 2025; Burki et al., 2024; Le, 2024), the effect of asset growth relies upon the capability of the company to translate corporate expansion into operational efficiency and profitability (Dumilah, 2020; Fauzi & Puspitasari, 2021). These inconsistencies may reflect differences in industry characteristics, institutional environments, sustainability reporting, and financial performance measures. Sustainability initiatives may also generate long-term benefits that are reflected more strongly in market-based than accounting-based performance.

Nonetheless, several empirical and theoretical gaps remain regarding the relationships among CED, ESG performance, Asset Growth, and corporate financial performance. First, most

previous studies examine these variables separately, providing only a partial understanding of their combined effects. Second, existing evidence mainly focuses on developed economies or individual ASEAN countries, with limited cross-country research on the ASEAN-5 energy sector. Third, few studies simultaneously investigate both market-based (Tobin's Q) and accounting-based (ROA) financial performance while incorporating Firm Size as a moderating variable. Moreover, limited theoretical attention has been given to explaining why CED, ESG performance, and Asset Growth may affect these two dimensions of financial performance differently or how Firm Size may strengthen or weaken these relationships. Therefore, integrating Stakeholder Theory and Signaling Theory provides a stronger theoretical foundation for explaining the influence of sustainability-related practices on firm financial performance.

Firm Size is expected to moderate these relationships because larger firms generally possess stronger financial resources, governance systems, technological capabilities, and public visibility, enabling them to implement sustainability initiatives more effectively (Bedi & Singh, 2024). However, empirical findings regarding the moderating influence of business size remain limited and contradictory, notably within energy companies operating across the ASEAN-5 countries, where regulatory environments and sustainability practices differ considerably.

Given the increasing importance of sustainability practices in enhancing corporate financial performance, understanding the joint effects of CED, ESG performance, Asset Growth, and Firm Size has become an important research issue. This study contributes to the literature in three ways. It develops an integrated framework by simultaneously examining CED, ESG performance, and Asset Growth. It distinguishes firm financial performance into Tobin's Q and ROA measures, providing a more comprehensive assessment of sustainability-related performance. It investigates the moderating role of Firm Size using cross-country evidence from ASEAN-5 energy companies, extending previous studies that have primarily focused on single-country contexts.

LITERATURE REVIEW

Stakeholder Theory

Stakeholder Theory, proposed by Freeman (1984) argues that firms create long-term value by balancing and fulfilling the expectations of various stakeholders, including investors, employees, customers, regulators, and society. From this perspective, sustainability practices such as CED and ESG reporting enhance stakeholder trust, strengthen corporate legitimacy, and contribute to improved financial performance by reducing conflicts between corporate and stakeholder interests (Kandil et al., 2025; Le, 2024). Therefore, Stakeholder Theory provides the theoretical foundation for explaining how sustainability practices and effective resource management can improve financial performance.

Signaling Theory

Signaling Theory, created by Spence (1973) is one of the popular theories used in explaining voluntary reporting. Environmental reporting in the sustainability realm is a credible positive signal about the long-run prospects, quality of governance and risk management skill of the firm (Thanh, 2023). Both theories indicate that CED and ESG are expected to positively affect financial performance by improving investor's confidence and stakeholder relationships, while asset growth signifies increased operational capacity and earnings potential.

Financial Performance

Firm financial performance refers to a company's ability to efficiently utilize its resources to generate sustainable economic value and achieve both short-term profitability and long-term growth (Bedi & Singh, 2024). Since no single indicator fully captures corporate performance, this study employs both Return on Assets (ROA) and Tobin's Q to evaluate firm financial performance from accounting-based and market-based perspectives, respectively (Abdullahi & Muhammad, 2023). Therefore, combining Tobin's Q and ROA enables this study to evaluate firm financial performance from two complementary perspectives, namely market valuation and internal operating efficiency

Tobin's Q

Tobin's Q is a market-based measure of firm financial performance that compares a company's market value with the replacement cost of its assets, reflecting investors' expectations regarding the firm's future growth and value creation (Ghani et al., 2023). A Tobin's Q value greater than one indicates that the market values the firm above the replacement cost of its assets, whereas a value below one suggests that the firm's assets are not expected to generate sufficient value. As a forward-looking indicator, Tobin's Q captures market perceptions of corporate performance, where transparent sustainability practices and effective resource management can enhance investor confidence and increase firm value (Bedi & Singh, 2024; Demiraj et al., 2025).

Return on Assets (ROA)

Return on Assets (ROA) is an accounting-based measure of firm financial performance that evaluates a company's ability to generate profits from its total assets, reflecting management's efficiency in utilizing available resources (Abdullahi & Muhammad, 2023). A higher ROA indicates more effective asset utilization and stronger operational profitability, making it an important indicator of short-term financial performance and managerial efficiency (Demiraj et al., 2025). Consequently, ROA provides valuable information to investors regarding a firm's capability to convert its assets into earnings and sustain profitable operations.

Carbon Emission Disclosure and Tobin's Q

Carbon Emission Disclosure (CED) is expected to enhance firm value by reducing information asymmetry and demonstrating a company's commitment to environmental sustainability. Stakeholder Theory and Signaling Theory transparent carbon disclosure serves as a positive signal of corporate responsibility, strengthens stakeholder trust, and improves investors' perceptions of the firm's long-term growth prospects. Empirical evidence also suggests that companies with more comprehensive CED tend to receive higher market valuations, as reflected in Tobin's Q (Siddique et al., 2021). Therefore, firms with greater CED are expected to achieve higher market valuation through enhanced transparency and investor confidence.

H₁: CED has a significant relationship with financial performance (Tobin's Q).

ESG and Tobin's Q

Environmental, Social, and Governance (ESG) performance reflects a firm's commitment to sustainable business practices through responsible environmental management, social responsibility, and sound corporate governance (Choi et al., 2024). Stakeholder Theory and Signaling Theory, strong ESG performance enhances corporate reputation, reduces information asymmetry, and signals long-term sustainability, thereby increasing investor confidence and market valuation. Empirical evidence also indicates that firms with higher ESG

performance tend to achieve higher Tobin's Q, as investors perceive them to have stronger long-term growth prospects and lower business risk (Burki et al., 2024). Therefore, firms with stronger ESG performance are expected to achieve higher financial performance at Tobin's Q. H₂: ESG has a significant relationship with financial performance (Tobin's Q).

Asset Growth and Tobin's Q

Asset Growth reflects a firm's ability to expand its resources and operational capacity, indicating future business development and growth opportunities (Hutabarat et al., 2025). From the perspective of Signaling Theory, higher asset growth provides a positive signal of a firm's prospects and earning potential, leading to greater investor confidence and higher market valuation. Empirical studies also suggest that firms with sustainable asset growth tend to achieve higher Tobin's Q because investors associate business expansion with stronger long-term value creation (Hutabarat et al., 2025). Therefore, firms with sustainable asset growth are expected to increase Tobin's Q.

H₃: Assets Growth has a significant relationship with financial performance (Tobin's Q).

Carbon Emission Disclosure and ROA

Carbon Emission Disclosure (CED) reflects a firm's transparency in reporting greenhouse gas emissions and demonstrates its commitment to environmental sustainability (Bedi & Singh, 2024). According to Stakeholder Theory and Signaling Theory, comprehensive carbon disclosure strengthens stakeholder trust, reduces information asymmetry, and encourages more efficient environmental management, which can improve operational performance and profitability. Empirical evidence also indicates that firms with higher-quality CED tend to achieve better Return on Assets (ROA) through enhanced operational efficiency and stronger stakeholder support (Maryanti et al., 2025). Therefore, firms with greater CED are expected to improve ROA financial performance.

H₄: CED has a significant relationship with financial performance (ROA).

ESG and ROA

Strong Environmental, Social, and Governance (ESG) performance reflects a firm's commitment to sustainable business practices and effective corporate governance, which can improve operational efficiency and stakeholder relationships (Burki et al., 2024). Based on Stakeholder Theory and Signaling Theory, transparent ESG practices enhance stakeholder trust, strengthen corporate reputation, and support profitability through better resource management and reduced business risk. Empirical evidence suggests that firms with higher ESG performance tend to achieve higher Return on Assets (ROA), indicating that sustainability practices contribute positively to accounting-based financial performance (Ali et al., 2025; Burki et al., 2024; Javaid et al., 2025). Therefore, firms with stronger ESG performance are expected to improve ROA.

H₅: ESG has a significant relationship with financial performance (ROA).

Asset Growth and ROA

Asset Growth reflects a firm's ability to expand its asset base and operational capacity, indicating effective resource allocation and greater potential for future profitability (Fauzi & Puspitasari, 2021). According to Signaling Theory, sustainable asset growth sends a positive signal regarding a firm's financial strength and future earning potential, while efficient asset utilization is expected to improve profitability. Previous studies also indicate that firms with higher asset growth tend to achieve better ROA because business expansion supported by efficient asset management enhances operational efficiency and earnings generation

(Anjasmara et al., 2024; Rohmansari et al., 2023). Therefore, firms with sustainable asset growth are expected to generate higher ROA through more efficient utilization of their assets. H₆: Assets Growth has a significant relationship with financial performance (ROA).

Firm Size as Moderating

Firm size refers to the scale of a company's operations and resources and is commonly measured by the natural logarithm of total assets (Hashmi et al., 2020). According to Stakeholder Theory and Signaling Theory, larger firms possess greater financial resources, stronger governance structures, and higher public visibility, enabling them to implement sustainability initiatives and disclose environmental information more effectively. Consequently, larger firms are expected to strengthen the positive effects of CED, ESG performance, and Asset Growth on financial performance because they have greater capacity to convert sustainability practices and business expansion into improved profitability and market value (Bedi & Singh, 2024; Razak et al., 2024). However, previous studies have reported mixed findings regarding the moderating role of firm size, suggesting that its effectiveness may vary across industries and business environments (Hm, 2022; Risal et al., 2024; Sitorus, 2024). Therefore, firm size is expected to strengthen the positive relationship between CED, ESG performance, and Asset Growth with financial performance because larger firms possess greater resources, stronger governance, and higher public visibility to maximize the benefits of sustainability initiatives and business expansion.

H₇: Firm size moderates the association between CED and financial performance (Tobin's Q).

H₈: Firm size moderates the association between ESG and financial performance (Tobin's Q).

H₉: Firm size moderates the association between AG and financial performance (Tobin's Q).

H₁₀: Firm size moderates the association between CED and financial performance (ROA).

H₁₁: Firm size moderates the association between ESG and financial performance (ROA).

H₁₂: Firm size moderates the association between AG and financial performance (ROA).

Research Framework

Based on the theoretical background and previous studies, this study establishes a research framework that illustrates the effects of independent variables on the dependent variable, as well as the role of firm size as a moderating variable.

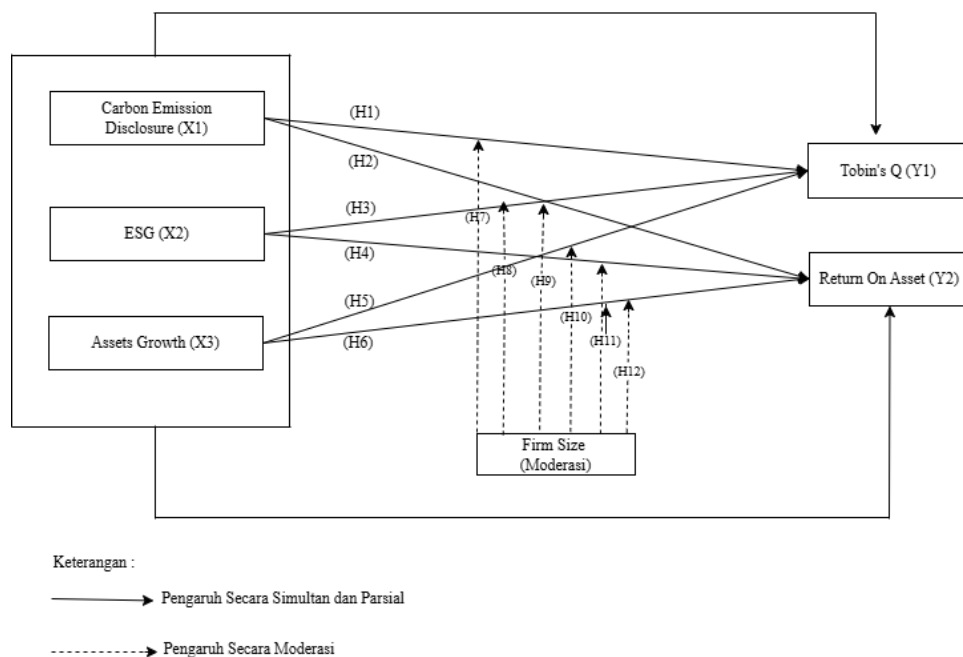


Figure 1. Research Framework

Source: Author's Processed by the authors (2026)

METHOD

This research adopts a quantitative approach utilizing a causal explanatory design that aims to examine the influence of CED, ESG, and AG on company financial performance along with the moderating influence of Firm Size (Pandoyo & Sofyan, 2018). The topic for this research study is of a public-listed energy company. The study uses data from energy companies listed in the ASEAN-5 countries (Indonesia, Malaysia, Singapore, Thailand, and the Philippines) during the 2022–2024 period.

The dataset utilized in this study comprises secondary data obtained from annual reports, sustainability reports, and the Refinitiv Eikon database. The population comprised all public listed energy companies in the ASEAN-5 countries. Purposive sampling was employed using the following criteria: (1) companies continuously listed throughout the observation period, (2) companies consistently publishing annual and sustainability reports, and (3) companies with complete CED and ESG data available in the Refinitiv database. The initial population consisted of 246 companies. After excluding 53 companies that did not consistently publish annual and sustainability reports and 146 companies without complete Carbon Emission Disclosure and ESG data in Refinitiv, the final sample comprised 47 companies, resulting in 141 firm-year observations. The sample consisted of 10 companies from Indonesia, 22 from Malaysia, 3 from Singapore, 11 from Thailand, and 1 from the Philippines. To examine the overall relationships among the proposed variables across the ASEAN-5 energy sector, all observations were pooled into a single balanced panel dataset rather than analysed separately by country.

Companies with missing ESG or carbon emission data were excluded; therefore, no missing values were imputed. The final dataset is a balanced panel in which all sampled firms have complete observations for each variable throughout the 2022–2024 period. No observations were identified as outliers, and all firms meeting the sampling criteria were retained. Corporate financial performance was measured using Tobin's Q (market-based) and ROA (accounting-

based). CED was proxied using the Refinitiv environmental indicator based on companies' reported Scope 1, Scope 2, and Scope 3 carbon emissions, transformed into their natural logarithm. ESG performance was measured using the Refinitiv ESG Score, Asset Growth as the year-on-year percentage change in total assets, and Firm Size as the natural logarithm of total assets.

Data were analyzed using panel data regression. The appropriate panel model was selected based on the Chow, Hausman, and Lagrange Multiplier tests. The moderating role of Firm Size was examined using Moderated Regression Analysis (MRA) by interacting Firm Size with each independent variable. Firm Size was interpreted as a quasi-moderator when both its direct and interaction effects were significant, and as a pure moderator when only the interaction effect was significant. Moderating effects were interpreted based on the significance and direction of the interaction coefficients. Model adequacy was evaluated using multicollinearity and heteroscedasticity tests, while hypothesis testing was conducted using the t-test, F-test, and coefficient of determination (R^2). All statistical analyses were performed using EViews.

RESULT AND DISCUSSION

Descriptive Statistics

To outline the distribution and specific attributes of every variable in this research design, descriptive statistics were applied.

Tabel 1. Descriptive statistics

	CED	ESG	AG	TOBIN'S Q	ROA	FS
Mean	15.32	56.65	5.83%	0.79	6.56%	21.87
Maximum	19.59	85.59	62.12%	1.88	58.34%	32.76
Minimum	10.80	8.45	-62.45%	0.14	-49.00%	16.57
Std. Deviasi	2.44	18.16	17.70%	0.35	12.86%	3.20
Observasi	141	141	141	141	141	141

Source: Processed data (2026).

Table 1 presents the descriptive statistics of CED, ESG performance, AG, Firm Size (FS), Tobin's Q, and ROA. The average ESG score of 56.65 indicates a moderate level of sustainability performance among ASEAN-5 energy companies. The mean Tobin's Q of 0.79 suggests that most firms were valued below the replacement cost of their assets, while the average ROA of 6.56% reflects moderate during the observation period. The relatively high standard deviations of Asset Growth and ROA indicate substantial heterogeneity in firms' growth opportunities and financial performance. Overall, the descriptive statistics demonstrate sufficient variation in the data to support subsequent panel data regression analysis.

Add validity test Reliability test

Tests of Classical Assumption

Classical assumption tests were conducted to verify that the regression models satisfied the Best Linear Unbiased Estimator (BLUE) assumptions. The tests included normality, multicollinearity, and heteroscedasticity, while autocorrelation was not examined because the study employed panel data. The Jarque-Bera probabilities for Tobin's Q (0.113396) and ROA (0.079236) exceeded 0.05, indicating normally distributed residuals. The Harvey heteroscedasticity test produced probability values of 0.1978 (Tobin's Q) and 0.4339 (ROA),

confirming the absence of heteroscedasticity. Furthermore, VIF values ranged from 1.0425 to 3.1527, well below the threshold of 10, indicating no multicollinearity. Overall, the results confirm that the regression models satisfy the classical assumptions and are appropriate for subsequent panel data regression analysis.

Model Selection for Panel Data

Using panel data regression, this study examined the effects of CED, ESG performance, and Asset Growth on corporate financial performance, with Firm Size as a moderating variable. The most appropriate estimation model was selected using the Chow, Hausman, and Lagrange Multiplier tests to compare the Common Effect, Fixed Effect, and Random Effect models.

Table 2. Model Selection

Test	Tobin's Q	Decision	ROA	Decision
Chow Test (Prob.)	0,0000	FEM	0.0000	FEM
Hausman Test (Prob.)	0,1259	REM	0.1716	REM
LM Test (Prob.)	0,0000	REM	0.0000	REM

Notes: Coefficients are reported outside parentheses, while p-values are reported inside parentheses. *indicates significance at the 5% level

Source: Processed data (2026)

Referring to Table 2, the Chow test produced probability values of 0.0000 for both Tobin's Q and ROA, indicating that the Fixed Effect Model (FEM) was preferred over the Common Effect Model (CEM). The Hausman test yielded probabilities of 0.1259 (Tobin's Q) and 0.1716 (ROA), indicating that the Random Effect Model (REM) was more appropriate than the FEM. This result was confirmed by the Lagrange Multiplier test, which produced probability values of 0.0000 for both models. Therefore, the Random Effect Model (REM) was selected for hypothesis testing.

Hypotheses Tests

Hypothesis testing was conducted using the coefficient of determination (R^2), F-test, and t-test to assess the model's explanatory power and the partial and simultaneous effects of the independent variables on corporate financial performance.

Tabel 3. Hypotheses Tests

Variabel	Tobin's Q (β)	p-value	Decision	ROA (β)	p-value	Decision
CED	0,0474	0,0194	Significant Effect	0,0164	0,0178	Significant Effect
ESG	0,0006	0,7704	No Significant Effect	0,0001	0,8043	No Significant Effect
AG	0,1829	0,0234	Significant Effect	0,1983	0,0000	Significant Effect
CEDxFS	0,0615	0,0000	Moderating Effect	-0,0001	0,9268	No Moderating Effect

Variabel	Tobin's Q (β)	p-value	Decision	ROA (β)	p-value	Decision
ESGxFS	0,0023	0,0412	Moderating Effect	-0,0001	0,6718	No Moderating Effect
AGxFS	0,0354	0,2058	No Moderating Effect	-0,0108	0,3428	No Moderating Effect
Adjusted R ²	0,0635	-	-	0,2350	-	-
F-statistic		0,0073	Simultaneously Significant		0,0000	Simultaneously Significant

Source: Processed data (2026)

Table 3 presents the Random Effect Model (REM) regression results. The adjusted R² values indicate that CED, ESG performance, and AG explain 6.35% of the variation in Tobin's Q and 23.50% in ROA, while the remaining variation is attributable to other factors outside the model. The F-test results (Tobin's Q = 0.0073; ROA = 0.0000) confirm that the independent variables jointly have a significant effect on corporate financial performance, indicating that both regression models are statistically appropriate for hypothesis testing hypothesis.

Mediator analysis

Discussion

The Effect of Carbon Emission Disclosure on Tobin's Q

As presented in Table 3, CED has a positive and significant effect on Tobin's Q ($\beta = 0.0474$; $p = 0.0194$), indicating that H1 is supported. Consistent with Signaling Theory, transparent CED reduces information asymmetry, strengthens investor confidence, and increases firm market value. This finding supports Siddique et al.(2021), who found that greater CED enhances firm value through improved transparency and investors' perceptions of long-term sustainability. The result suggests that investors increasingly regard CED as an indicator of effective environmental management and long-term sustainability. But, differs from Bedi & Singh (2024), which may reflect differences in research context, sample characteristics, and institutional environments, as this study focuses on energy companies across the ASEAN-5 countries.

The Effect of ESG on Tobin's Q

As presented in Table 3, ESG has no significant effect on Tobin's Q ($\beta = 0.000627$; $p = 0.7704$), indicating that H2 is not supported. According to Signaling Theory, ESG disclosure is expected to enhance investor confidence; however, the insignificant result suggests that investors in ASEAN energy companies still prioritize financial performance over sustainability information when valuing firms. This finding is consistent with Fatmala & Pertiwi (2025), who found no significant effect of ESG on firm value, indicating that ESG information alone may not influence market valuation unless it generates clear economic benefits. However, this finding

differs from Demiraj et al. (2025), possibly due to differences in ESG implementation, reporting standards, and institutional environments across ASEAN countries.

The Effect of Asset Growth on Tobin's Q

As presented in Table 3, Asset Growth has a positive and significant effect on Tobin's Q ($\beta = 0.182979$; $p = 0.0234$), indicating that H3 is supported. Consistent with Signaling Theory, higher asset growth signals stronger future growth opportunities, encouraging investor confidence and increasing market valuation. In the ASEAN energy sector, asset expansion reflects greater production capacity and long-term investment, leading investors to expect higher future cash flows and firm value. This finding is consistent with Hutabarat et al. (2025), who reported that firms with higher asset growth tend to achieve higher Tobin's Q because business expansion is perceived as an indicator of future value creation. These results suggest that investors value asset expansion when it is expected to generate future cash flows and competitive advantages.

The Effect of Carbon Emission Disclosure on ROA

As presented in Table 3, CED has a positive and significant effect on Return on Assets (ROA) ($\beta = 0.016415$; $p = 0.0178$), indicating that H4 is supported. Consistent with Stakeholder Theory, transparent CED strengthens stakeholder trust and encourages more efficient environmental management, thereby improving ROA from financial performance. This finding supports Maryanti et al. (2025), who reported that CED enhances ROA through better environmental management and corporate reputation. The results suggest that transparent carbon disclosure contributes to higher ROA by improving environmental efficiency. But, differs from Bedi & Singh (2024), who argued that sustainability initiatives may reduce short-term ROA because of their implementation costs.

The Effect of ESG on ROA

As presented in Table 3, ESG has no significant effect on ROA ($\beta = 0.000194$; $p = 0.8043$), indicating that H5 is not supported. According to Stakeholder Theory, although ESG practices are expected to strengthen stakeholder relationships, their financial benefits may not be immediately reflected in accounting performance. This finding is consistent with Priadi & Wahyudi (2026), who found no significant effect of ESG on ROA because ESG implementation is largely compliance-driven and requires time to generate financial benefits. But, differs from Burki et al. (2024) and Ali et al. (2025), who found that ESG improves ROA through greater operational efficiency, corporate reputation, and stakeholder trust. These differences may reflect variations in industry characteristics, institutional environments, and the maturity of ESG implementation.

The Effect of Asset Growth on ROA

In Table 3, Asset Growth has a positive and significant effect on ROA ($\beta = 0.198342$; $p = 0.0000$), indicating that H6 is supported. Consistent with Stakeholder Theory, higher asset growth reflects firms' ability to expand operations and utilize resources efficiently, thereby improving accounting-based financial performance. This finding supports Rohmansari et al. (2023), and Anjasmara et al. (2024), who reported that firms with higher asset growth achieve higher ROA through efficient asset utilization. These results suggest that asset expansion enhances ROA only when additional assets are managed efficiently.

Firm Size as Moderating Carbon Emission Disclosure on Tobin's Q

In Table 3, the interaction between Firm Size and CED has a positive and significant effect on Tobin's Q ($\beta = 0.061567$; $p = 0.0000$), indicating that H7 is supported. Firm Size therefore functions as a quasi-moderator, as it has a direct effect on Tobin's Q while strengthening the positive relationship between CED and firm value. Consistent with Signaling Theory, larger firms are better able to convert carbon disclosure into higher market value because they possess greater resources, more comprehensive sustainability reporting, and stronger visibility among investors and regulators. This finding is consistent with Bedi & Singh (2024) and Sitorus (2024), who reported that Firm Size strengthens the positive relationship between CED and firm value. These results indicate that sustainability disclosures by larger firms are perceived as more credible, leading to stronger Tobin's Q.

Firm Size as Moderating ESG on Tobin's Q

As presented in Table 3, the interaction between Firm Size and ESG has a positive and significant effect on Tobin's Q ($\beta = 0.002319$; $p = 0.0412$), indicating that H8 is supported. Accordingly, Firm Size functions as a quasi-moderator by strengthening the positive influence of ESG performance on Tobin's Q while also having a direct effect on firm value. Consistent with Signaling Theory, larger firms are better able to translate ESG practices into higher market value because they possess greater resources, more comprehensive ESG disclosures, and stronger visibility among investors and regulators. This finding is consistent with Adhia & Paramita(2025), and Fathihani et al. (2025), who reported that Firm Size strengthens the relationship between ESG and firm value. These results suggest that larger firms gain stronger Tobin's Q recognition because their ESG implementation is perceived as more credible.

Firm Size as Moderating Asset Growth on Tobin's Q

As presented in Table 3, the interaction between Firm Size and Asset Growth has no significant effect on Tobin's Q ($\beta = 0.035448$; $p = 0.2058$), indicating that H9 is not supported. Since the interaction term is statistically insignificant, Firm Size cannot be classified as either a pure moderator or a quasi-moderator in the relationship between Asset Growth and Tobin's Q. Although Signaling Theory suggests that asset growth signals future business expansion, the findings indicate that this signal is not strengthened by firm size, as investors place greater emphasis on asset utilization efficiency than on firm scale. This finding is consistent with Susanti et al. (2025), who reported that Firm Size does not moderate the relationship between Asset Growth and firm value. These results suggest that investors value the efficiency of asset utilization rather than firm size when assessing whether business expansion increases Tobin's Q.

Firm Size as Moderating Carbon Emission Disclosure on ROA

As presented in Table 3, the interaction between Firm Size and CED has a negative but insignificant effect on Return on Assets ($\beta = -0.000191$; $p = 0.9268$), indicating that H12 is not supported. Therefore, Firm Size does not moderate the relationship between CED and accounting-based financial performance. According to Stakeholder Theory, although CED strengthens stakeholder trust and environmental accountability, its impact on profitability depends more on operational efficiency than firm size. This finding is consistent with Razak et al. (2024) and Puspita & Budiasih (2024), who reported that Firm Size does not moderate the relationship between sustainability disclosure and financial performance. It differs from Bedi & Singh (2024) and Lina (2024), who found stronger financial benefits for larger firms due to

greater resources and visibility. These findings suggest that the accounting benefits of CED depend primarily on environmental management efficiency rather than firm size.

Firm Size as Moderating ESG on ROA

As presented in Table 3, the interaction between Firm Size and ESG has a negative but insignificant effect on Return on Assets ($\beta = -0.000114$; $p = 0.6718$), indicating that H13 is not supported. Accordingly, Firm Size does not moderate the relationship between ESG performance and ROA. Consistent with Stakeholder Theory, firm size does not strengthen the effect of ESG on ROA because accounting performance depends more on the effective integration of sustainability practices into business operations than on firm scale. This finding is consistent with Wijaya et al. (2026), who also found no moderating effect of Firm Size on the ESG–ROA relationship. It contrasts with Bedi & Singh (2024), who reported that ESG improves ROA through greater operational efficiency and stakeholder trust. These differences may reflect variations in ESG implementation, institutional environments, and industry characteristics, suggesting that firm size alone cannot improve ROA without effective ESG integration.

Firm Size as Moderating Asset Growth on ROA

As presented in Table 3, the interaction between Firm Size and Asset Growth has a negative but insignificant effect on Return on Assets ($\beta = -0.010869$; $p = 0.3428$), indicating that H14 is not supported. Accordingly, Firm Size does not moderate the relationship between Asset Growth and ROA. Consistent with Stakeholder Theory, although asset growth reflects resource expansion, its contribution to ROA depends more on efficient asset utilization and operational management than on firm size. This finding is consistent with Apriliansyah & Naibaho (2022) and Budiharjo et al. (2023), who reported that Firm Size does not strengthen the effect of firm growth on firm performance. These findings suggest that asset expansion improves ROA only when additional assets are utilized efficiently, regardless of firm size.

Overall, the moderation results indicate that Firm Size strengthens the relationships only when financial performance is measured by Tobin's Q, but not by ROA. This suggests that larger firms receive stronger market recognition for sustainability-related disclosures, whereas accounting-based performance depends primarily on operational efficiency rather than firm size. The insignificant moderation effects may also reflect institutional differences across ASEAN-5 countries, including variations in ESG regulations, disclosure standards, investor awareness, and capital market development. However, this study focuses on identifying the overall pattern across ASEAN-5 energy companies rather than country-specific effects.

CONCLUSION

This study investigates the effect of Carbon Emission Disclosure (CED), Environmental, Social, and Governance (ESG) performance and Asset Growth on firm financial performance based on Tobin's Q and Return on Assets (ROA) with Firm Size as a moderating variable among ASEAN-5 energy companies (2022–2024). The results show that CED and Asset Growth significantly impact Tobin's Q and ROA. This implies that the environmental transparency and sustainable business growth contribute to the company's value and profitability. However, the effect of ESG performance on Tobin's Q and ROA is not significant, indicating that the impact of ESG implementation has not been fully reflected in investors' decisions or short-term financial performance of enterprises in ASEAN energy industry.

The findings are generally consistent with previous studies. The positive influence of CED on financial performance supports the findings of Siddique et al., (2021; Yuliandhari et al., 2023), who reported that transparent environmental disclosure enhances firm profitability and market value. Likewise, the positive effect of Asset Growth is in line with Fauzi & Puspitasari, (2021); and Hutabarat et al., (2025), indicating that business expansion supported by efficient asset utilization contributes to stronger financial performance. However, the insignificant effect of ESG differs from several prior studies, suggesting that the financial benefits of ESG practices may depend on institutional settings, industry characteristics, and the time horizon considered.

The moderation analysis shows that Firm Size strengthens the positive relationships of CED and ESG performance with Tobin's Q, supporting Stakeholder Theory and Signaling Theory that larger firms receive stronger market responses to sustainability initiatives due to their greater resources and visibility. This finding is consistent with Bedi & Singh, (2024). However, Firm Size does not moderate the relationship between Asset Growth and Tobin's Q or the relationships between CED, ESG performance, Asset Growth, and ROA, indicating that its moderating role is more evident in market-based than accounting-based financial performance because investors place greater value on sustainability-related information disclosed by larger firms.

This study has several limitations. The relationships among CED, ESG performance, Asset Growth, and firm financial performance were estimated using conventional panel data regression, which cannot fully eliminate the possibility of endogeneity or reverse causality. In addition, the relatively low explanatory power of the Tobin's Q model (Adjusted $R^2 = 6.35\%$) and the ROA model (Adjusted $R^2 = 23.50\%$) suggests that firm financial performance is also influenced by other firm-specific, industry-specific, and macroeconomic factors. Therefore, future studies are encouraged to apply more advanced estimation techniques, such as dynamic panel models (GMM), lagged regression, or instrumental variable approaches, while incorporating additional explanatory variables.

Based on these findings, energy companies are encouraged to improve the quality and consistency of CED and optimize asset utilization to enhance Tobin's Q and ROA. Although ESG performance was not found to significantly affect financial performance, firms should continue integrating ESG into their long-term business strategies. Another limitation is that firms from five ASEAN countries were analyzed using a pooled regression model without controlling for country-specific effects. Since differences in ESG regulations, disclosure requirements, corporate governance, and capital market development may influence the results, future research should incorporate country dummy variables, country fixed effects, or comparative cross-country analyses.

Investors are encouraged to consider CED and Asset Growth alongside conventional financial indicators, while regulators should continue promoting standardized and transparent sustainability reporting across ASEAN. Future studies are also recommended to extend the observation period, examine other industries or regions, include variables such as corporate governance, leverage, liquidity, green innovation, and macroeconomic factors, and apply alternative financial performance measures or analytical methods to better explain the relationship between sustainability practices and firm financial performance.

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