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THE MODERATING ROLE OF FOREIGN OWNERSHIP ON THE RELATIONSHIP BETWEEN FIRM SIZE AND CARBON EMISSION DISCLOSURE: AN INDONESIAN CONTEXT

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Abstract
Carbon emission disclosure is a form of corporate accountability for the environmental impact resulting from its operational activities, as well as reflecting the company's commitment to sustainability. This study aims to analyze the influence of company size on carbon emission disclosure, as well as test the role of foreign ownership in moderating the relationship. The research sample consisted of 22 transportation sector companies listed on the Indonesia Stock Exchange during the period 2022–2025, resulting in 88 observations. Panel data regression analysis was applied to test the relationship between variables, and the results showed that company size did not have a significant effect on carbon emission disclosure, and foreign ownership was not proven to moderate the relationship between company size and carbon emission disclosure. Among the control variables, leverage had a significant positive effect on carbon emission disclosure, while profitability had no significant effect. This research suggests that carbon emissions disclosure in the transportation sector is likely to be more influenced by other factors beyond the size of the company and ownership structure, such as regulatory and corporate governance pressures. For investors, these results can be the basis for considering other indicators beyond the size of the company and foreign ownership when assessing the environmental commitment of a transportation company.

Keywords: Company Size, Foreign Ownership, Carbon Emission Disclosure, Transport Sector

1. Introduction

Sustainability has become a major concern in the world today, and one of the main challenges comes from environmental issues. Environmental problems arise from various things, ranging from air and water pollution, forest destruction, to increasing carbon emissions that accelerate climate change. Climate change triggered by the accumulation of greenhouse gas (GHG) emissions is one of the most pressing environmental challenges, and the transportation sector is recorded as one of the largest contributors to emissions in various countries, including Indonesia. The U.S. Environmental Protection Agency (2026) stated that more than 94% of the fuel used in the transportation sector in the United States is still petroleum-based, especially gasoline and diesel. The high dependence on fossil fuels results in greenhouse gas emissions directly into the atmosphere, making the transportation sector one of the main sources of direct emissions in the United States. Similar conditions are also seen in Toronto, Canada. Based on the City of Toronto (2025), the transportation sector generates around 5.7 $MtCO_2e$ or 36% of total greenhouse gas emissions in the city of Toronto in 2023, thus occupying a position as the second largest contributor to emissions after the building sector. Meanwhile, in

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Indonesia by 2024, the transportation sector will generate around 202 million tons of CO_2 or about 25% of total national emissions, which places it as one of the three largest emitter contributors in Indonesia (Hasjanah, 2025). Conditions in these various countries show that carbon emissions from the transportation sector have become a global concern, especially due to the high dependence of transportation activities on fossil fuels. The large contribution of these emissions should be balanced by the transparency of carbon information disclosure by companies.

This is even more relevant considering the obligation for Issuers and Public Companies to prepare a Sustainability Report as stipulated in the Financial Services Authority Regulation Number 51/POJK.03/2017. For companies whose business processes are directly related to the environment, the report also includes information on the amount and intensity of emissions as well as the emission reduction efforts carried out. Although the rules have been established and implemented, the reality on the ground shows that compliance with these rules has not been consistent. There are still many companies that disclose carbon emissions only as a formality and are not yet specific. Oktariyani (2024) in her research on the transportation sub-sector in 2023, namely PT Air Asia Indonesia Tbk, PT Garuda Indonesia Tbk, PT Blue Bird Tbk, and PT Transkon Jaya Tbk, found that all companies have disclosed carbon emission information in annual reports and sustainability reports, but the scope and depth of disclosure vary between companies and have not followed a uniform disclosure format. This condition shows that the transportation sector's contribution to emissions has not been fully offset by consistent, in-depth, and comparable levels of carbon emission disclosure between companies. Therefore, it is important to examine factors that can affect carbon emission disclosure, one of which is the size of the company.

The urgency of this research is driven by several critical factors. First, the transportation sector's contribution to emissions has become a global concern, yet the level of carbon emission disclosure among transportation companies in Indonesia remains inconsistent and has not followed a uniform disclosure format (Oktariyani, 2024). Second, previous research has shown inconsistent results regarding the influence of company size on carbon emission disclosure. Desai (2022), through a study on companies in India, showed that companies with larger value or scale are more likely to disclose carbon emission information than small companies. These findings are in line with the research of Fahira et al. (2026) and Riantono and Sunarto (2022), stating that company size has a significant influence on carbon emission disclosure. The larger the scale of a company, the greater its tendency to increase the disclosure of information related to carbon emissions. However, different results were found in Indonesia (April 2023). Third, foreign ownership is also one of the factors that can explain the level of carbon emission disclosure. Scott (2022) explains that foreign ownership is related to distinctive governance practices and international relations, so its existence can affect how companies respond and execute environmental strategies. Aprilia et al. (2026) found that foreign, institutional, managerial and state ownership simultaneously has a positive and significant effect on carbon emission disclosure. This is in line with the findings of Christian (2026) on mining companies that found that foreign ownership had a positive and significant effect. However, the two studies are not in line with the research of Scott (2022) that found that foreign ownership does not have a significant effect on carbon disclosure. Fourth, the limited research that examines the influence of company size on carbon emission disclosure, especially in Indonesia's transportation sector, is one of the gaps in this research. Some of the previous research focused more on sectors with

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relatively high emission intensities, such as the energy, mining, and basic materials sectors, while the transportation sector also has a close relationship with carbon emissions through operational activities and energy use. Fifth, research that approaches this topic in the energy, transportation, and logistics sectors still places institutional ownership as an independent variable that tests the direct influence on carbon emission disclosure, rather than as a variable that explains the conditions when the relationship between company size and carbon emission disclosure becomes stronger or weaker.

Previous research has shown significant but fragmented findings regarding the determinants of carbon emission disclosure. Studies have demonstrated that company size positively influences carbon emission disclosure because larger-scale companies tend to receive higher attention from stakeholders, so they have greater demands, especially in providing information on the environmental impact of their operations (Tu et al., 2026). Larger-scale companies are considered to have better resource capabilities in bearing pollution reduction costs and environmental disclosure preparation costs than small-scale companies (Githaiga, 2025). Research has also shown that foreign ownership influences carbon emission disclosure through distinctive governance practices and international relations, which can affect how companies respond and execute environmental strategies (Scott, 2022). However, these studies have examined these relationships in isolation, leaving a significant gap in understanding how company size and foreign ownership interact to influence carbon emission disclosure, particularly in the Indonesian transportation sector context (Aprilia et al., 2026; Christian, 2026).

The research gap in this study lies in the limited understanding of how company size influences carbon emission disclosure and how foreign ownership moderates this relationship in transportation sector companies listed on the Indonesia Stock Exchange. While individual studies have examined the direct effects of company size or foreign ownership on carbon emission disclosure, the integrated framework connecting these elements with foreign ownership as a moderating variable remains underexplored (Scott, 2022; Aprilia et al., 2026). Additionally, most previous studies have focused on sectors with relatively high emission intensities, such as energy, mining, and basic materials, leaving a significant gap in knowledge regarding the dynamics of carbon emission disclosure in the transportation sector, which also has a close relationship with carbon emissions through operational activities and energy use (Oktariyani, 2024). Furthermore, empirical evidence on carbon emission disclosure practices in the Indonesian transportation sector during the 2022–2025 period, which captures the condition of companies after the strengthening of sustainable financial policies in Indonesia, remains limited.

The novelty of this research lies in several aspects. First, this study focuses on the transportation sector in Indonesia during the 2022–2025 period, which represents a unique context characterized by high dependence on fossil fuels, emission-intensive operational activities, and increasing regulatory pressure for sustainability disclosure (Hasjanah, 2025). Second, this study develops an integrative model that simultaneously examines the influence of company size on carbon emission disclosure with foreign ownership as a moderating variable, providing a more comprehensive understanding of the determinants of carbon emission disclosure in the transportation sector (Scott, 2022; Tu et al., 2026). Third, this study positions foreign ownership as a moderating variable, enabling the examination of whether the presence of foreign shareholders can strengthen or weaken the relationship between company size and carbon emission disclosure. Fourth, this study contributes to the limited empirical evidence on carbon emission disclosure in

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the Indonesian transportation sector, providing insights into whether company size and foreign ownership are perceived as factors that encourage or hinder transparency in carbon emission reporting. Fifth, this study extends the application of stakeholder theory, legitimacy theory, and agency theory to the context of carbon emission disclosure in the transportation sector, validating theoretical predictions in an under-researched institutional context (Githaiga, 2025).

The purpose of this study is to examine the influence of company size on carbon emission disclosure and to analyze the role of foreign ownership in moderating the relationship between company size and carbon emission disclosure in transportation sector companies listed on the Indonesia Stock Exchange during the 2022–2025 period. The choice of this goal was driven by the inconsistency of findings from previous studies, where some researchers found significant positive effects while others found negative or insignificant effects, and the limited understanding of how foreign ownership moderates this relationship in the Indonesian transportation sector (Aprilia et al., 2026; Christian, 2026). With a comprehensive examination of the moderating mechanisms, this study aims to provide a deeper understanding of how company size and foreign ownership interact to influence carbon emission disclosure, and whether foreign ownership strengthens or weakens the relationship between company size and carbon emission disclosure.

The contribution of this research is multifaceted. From a theoretical perspective, this research contributes to the enrichment of literature on carbon emission disclosure by proposing and testing an integrative model that links company size with carbon emission disclosure, incorporating foreign ownership as a moderating variable, extending the application of stakeholder theory, legitimacy theory, and agency theory to the context of sustainability reporting in the Indonesian transportation sector. The findings contribute to the understanding of how company size influences carbon emission disclosure and how foreign ownership moderates this relationship, providing a more nuanced theoretical framework for analyzing sustainability disclosure practices in emission-intensive industries (Scott, 2022; Githaiga, 2025). From a practical perspective, this study provides actionable insights for corporate management, investors, and regulators in assessing and managing carbon emission disclosure. For the management of companies in the transportation sector, the results of this study provide an understanding of the importance of transparency in the disclosure of carbon emissions as part of the accountability and stakeholder relationship management strategy. This information is becoming increasingly relevant for companies with foreign ownership because the characteristics of shareholders and the transparency demands faced by companies can be different from those of companies with lower foreign ownership. For investors and shareholders, especially foreign investors, this research is expected to be additional information in assessing the quality of governance, environmental transparency, and corporate attention to sustainability issues. More transparent disclosure of carbon emissions can help investors obtain more adequate information in evaluating environmental risks and corporate sustainability as part of the investment decision-making process. For the Financial Services Authority, this research is expected to be an empirical input in evaluating the development of sustainability and carbon emission information disclosure practices in transportation sector companies. Research findings can also be considered in the development of sustainability disclosure policies and guidelines so that companies are encouraged to improve the consistency, transparency, and quality of information related to carbon emissions conveyed to stakeholders.

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2. Theoretical Background

2.1 Legitimacy Theory

Legitimacy Theory explains that companies seek social acceptance by aligning corporate activities and disclosure with societal values, norms, and expectations to maintain long-term business sustainability (Dowling & Pfeffer, 1975; Suchman, 1995). In this study, carbon emission disclosure reflects corporate efforts to demonstrate environmental responsibility and strengthen public trust, particularly in the transportation sector, which is closely associated with high fossil fuel consumption and emission-intensive operational activities (Hasjanah, 2025; Oktariyani, 2024). Based on legitimacy theory, companies ensure that their operations run in accordance with the values, norms and expectations of the community (Gray et al., 1995). The larger a company, the higher the company's attention in the eyes of the public, so the company will face greater pressure to show responsibility for the environmental impact caused by its operational activities. Large companies also tend to have wider operational activities, greater use of resources, and a larger number of stakeholders (Desai, 2022; Tu et al., 2026). This condition makes large companies more vulnerable to public attention and supervision related to the environmental impact produced. Improving environmental performance by disclosing carbon emissions will provide benefits for the company, including avoiding reduced operating costs, reputational risks, legal processes, fines, and being a way to gain legitimacy (Githaiga, 2025). In the context of the transportation sector, the size of the company is becoming increasingly relevant because the expansion of operational activities can be related to the increase in energy and fuel use and the potential for greenhouse gas emissions. The larger the scale of the transportation company's operations, the greater the demand for the company to demonstrate environmental accountability (Aprilyani Dewi & Agustina, 2023).

2.2 Stakeholder Theory

Stakeholder Theory explains that companies are responsible not only to shareholders but also to stakeholders affected by corporate activities, including investors, society, employees, customers, and the environment (Freeman, 2007). In this study, carbon emission disclosure reflects corporate transparency, responsibility, and resource management capability in fulfilling stakeholder expectations, particularly regarding environmental impacts and sustainability practices (Bose et al., 2024; Santoso et al., 2025). Based on stakeholder theory, the company is not only responsible to shareholders, but also to all stakeholders who have an interest in the company's operations, including investors. One of the stakeholder groups that can influence the company's policies is foreign investors (Freeman, 2007). Foreign ownership is the proportion of the company's shares owned by investors or foreign parties to the company's total outstanding shares. The presence of foreign investors can bring higher demands on transparency, accountability, and corporate sustainability practices because foreign investors are faced with the need for information to supervise the company (Bose et al., 2024). Foreign ownership can also increase the company's attention to environmental reporting practices. Foreign investors, especially those from environments with a high concern for sustainability issues, can encourage companies to provide broader environmental information as a form of accountability to stakeholders (Santoso et al., 2025). Disclosure of carbon emissions is one of the company's means to meet these information needs. In the context of the transportation sector, the presence of foreign investors can become

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increasingly important because the company's operational activities are closely related to energy consumption and environmental impact (Scott, 2022).

2.3 Agency Theory

Agency Theory explains that conflicts of interest between management and shareholders may arise due to information asymmetry and differences in corporate objectives (Jensen & Meckling, 1976). In this study, carbon emission disclosure functions as a monitoring mechanism to reduce information asymmetry between management and stakeholders through greater transparency and accountability (Christian, 2026). Strong monitoring mechanisms, including foreign ownership, can increase stakeholder confidence and improve corporate transparency because firms are perceived to have more effective control systems (Aprilia et al., 2026). Conversely, weak monitoring mechanisms are often associated with opportunistic managerial behavior that may reduce transparency and disclosure quality. When carbon emission disclosure is accompanied by strong foreign ownership monitoring, stakeholders may perceive the company as having greater accountability and credibility, thereby strengthening the positive influence of company size on carbon emission disclosure (Santoso et al., 2025).

2.4 Carbon Emission Disclosure

Carbon emission disclosure reflects transparency in the disclosure of information related to how companies manage carbon emissions, control environmental risks, and implement sustainability commitments (Hasjanah, 2025). Carbon emission disclosure is a transparency instrument that communicates the company's commitment to sustainable business practices, particularly in sectors with high environmental impact such as transportation (Oktariyani, 2024). Environmental disclosure reflects information related to how companies manage the environment, control environmental risks, and implement sustainability commitments, including emission reduction targets and climate change risk management (Tu et al., 2026). In the transportation sector, carbon emission disclosure is particularly important because operational activities are closely related to fuel use and greenhouse gas emissions (U.S. Environmental Protection Agency, 2026; City of Toronto, 2025). Based on legitimacy theory, carbon emission disclosure serves as a signal regarding corporate quality, environmental responsibility, and long-term sustainability commitment (Desai, 2022). Companies with better carbon emission disclosure are perceived as more credible and capable of managing environmental risks, thereby strengthening legitimacy and increasing stakeholder confidence (Githaiga, 2025). This finding is consistent with Fahira et al. (2026), Riantono and Sunarto (2022), and Aprilyani Dewi and Agustina (2023), which found that carbon emission disclosure improves corporate transparency and accountability.

2.5 Company Size and Carbon Emission Disclosure

Company size reflects the scale of a company's operations which is generally proxied using the natural logarithm of the company's total assets and reflects the company's resources, operational complexity and public view (Gray et al., 1995). Based on legitimacy theory, it is explained that the company ensures that its operations run in accordance with the values, norms and expectations of the community (Suchman, 1995). The larger a company, the higher the company's attention in the eyes of the public, so the company will face greater pressure to show responsibility for the environmental impact caused by its operational activities (Desai, 2022). Large companies also tend to have

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wider operational activities, greater use of resources, and a larger number of stakeholders. This condition makes large companies more vulnerable to public attention and supervision related to the environmental impact produced (Tu et al., 2026). Improving environmental performance by disclosing carbon emissions will provide benefits for the company, including avoiding reduced operating costs, reputational risks, legal processes, fines, and being a way to gain legitimacy (Githaiga, 2025). In the context of the transportation sector, the size of the company is becoming increasingly relevant because the expansion of operational activities can be related to the increase in energy and fuel use and the potential for greenhouse gas emissions. The larger the scale of the transportation company's operations, the greater the demand for the company to demonstrate environmental accountability (Aprilyani Dewi & Agustina, 2023). Desai (2022) explains that companies in India show that companies with high scores are more likely to report carbon emission information than small companies. This is in line with the research of Fahira et al. (2026) and Aprilyani Dewi and Agustina (2023), which show that the transparency of carbon emissions is more influenced by the scale of the company than by financial factors, and that the size of the company has a significant influence on the disclosure of carbon emissions. The higher the scale of a company, the greater the likelihood of increasing carbon emission disclosure. Based on this description, the first hypothesis is formulated as follows:

H1: Company Size has a positive effect on Carbon Emission Disclosure.

2.6 The Moderating Role of Foreign Ownership

Based on stakeholder theory, it is explained that the company is not only responsible to shareholders, but also to all stakeholders who have an interest in the company's operations, including investors (Freeman, 2007). One of the stakeholder groups that can influence the company's policies is foreign investors. Foreign ownership is the proportion of the company's shares owned by investors or foreign parties to the company's total outstanding shares (Scott, 2022). The presence of foreign investors can bring higher demands on transparency, accountability, and corporate sustainability practices because foreign investors are faced with the need for information to supervise the company (Bose et al., 2024). Foreign ownership can also increase the company's attention to environmental reporting practices. Foreign investors, especially those from environments with a high concern for sustainability issues, can encourage companies to provide broader environmental information as a form of accountability to stakeholders (Santoso et al., 2025). Disclosure of carbon emissions is one of the company's means to meet these information needs. In the context of the transportation sector, the presence of foreign investors can become increasingly important because the company's operational activities are closely related to energy consumption and environmental impact (Aprilia et al., 2026). Transportation companies that are large and at the same time have high foreign ownership are expected to face greater demands to demonstrate environmental accountability than companies with lower levels of foreign ownership. Companies with higher foreign ownership have better climate change disclosure, this is in line with research that found that foreign ownership has a positive effect on sustainability reporting in 1,260 energy companies in BRICS countries (Bose et al., 2024). Santoso et al. (2025) further provide empirical evidence that foreign ownership plays a role as a moderation variable that reinforces the positive influence of company size on carbon emission disclosure in energy sector companies in Indonesia. Thus, the authors conclude that foreign ownership plays a role as a monitoring mechanism that can reinforce the positive influence of company

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size on Carbon Emission Disclosure. Based on this description, the second hypothesis is formulated as follows:

H2: Foreign Ownership reinforces the positive influence of Company Size on Carbon Emission Disclosure.

3. Methods

3.1 Research Design

This research is quantitative research using secondary data in a panel format, which is a combination of cross-company (cross-section) and time-series data. Research data was obtained from companies in the transportation sector listed on the Indonesia Stock Exchange during the period 2022–2025. This study aims to examine the influence of company size on carbon emission disclosure and the role of foreign ownership as a moderation variable. The quantitative approach with panel data regression analysis is considered appropriate because the study aims to empirically test the proposed hypotheses using statistical analysis of numerical data derived from annual reports and sustainability reports. The explanatory research design enables the examination of causal relationships between independent variable (Company Size), moderating variable (Foreign Ownership), control variables (Profitability and Leverage), and dependent variable (Carbon Emission Disclosure).

3.2 Population and Sample

The population in this study is all companies listed in the transportation sub-sector on the Indonesia Stock Exchange (IDX) during the 2022–2025 period. The selection of this period was chosen because it represents the current condition of transportation sector companies in the face of increasing attention to sustainability issues and transparency of environmental information. Based on IDX data, there are around 40 transportation companies listed on the IDX as of the end of 2025. The sampling technique used in this study is purposive sampling. The criteria used in this study are companies listed in the transportation sector on the IDX for the 2022–2025 research period, companies publish annual reports and sustainability reports in full for the period 2022–2025, and companies disclose carbon emission disclosures and the amount of foreign share ownership. Based on these criteria, as many as 22 transportation companies were obtained that met the criteria as research samples. Because the research period covers four years, namely 2022–2025, the number of observations used in this study is 88 observations.

3.3 Data Collection Techniques

This study uses secondary data obtained from various sources as follows: the annual financial statements of transportation companies published through the IDX website (www.idx.co.id) and their respective official websites, as a source of accounting data for the calculation of company size variables, carbon emission disclosure score data, foreign ownership, profitability, and leverage. The data collection procedure involved several sequential steps: (1) identification of transportation sector companies listed on the IDX during the 2022–2025 period; (2) selection of companies meeting the predetermined purposive sampling criteria; (3) extraction of carbon emission disclosure data from annual reports and sustainability reports using content analysis based on 18 disclosure items; (4) collection of financial data from audited annual financial statements, including information required for calculating company size, foreign ownership, profitability, and

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leverage; and (5) documentation of all extracted data systematically organized into a panel dataset suitable for statistical analysis.

3.4 Operational Definition of Variables

The operational definitions of the variables examined in this study are presented in Table 1.

Table 1. Operational Definition and Measurement of Variables

Variable	Definition	Measurement	Scale	References
Carbon Emission Disclosure (Y)	The company's effort to provide transparent information about greenhouse gas emissions resulting from its operational activities	CED = (Total Disclosure Score) / (Maximum Possible Disclosure Score)	Ratio	Pradnyawati et al. (2024); Puja Saputri et al. (2026)
Company Size (X_1)	The scale of a company's operations that reflects the company's resources, operational complexity, and public view	Size = Ln (Total Assets)	Ratio	Mu (2026); Wahyudi et al. (2026)
Foreign Ownership (Z)	The proportion of the company's shares owned by investors or foreign parties	FO = (Equity Shares Owned by Foreign Investors) / (Total Equity Shares Outstanding)	Ratio	Bintang & Hafidz (2026); Simanjuntak (2026)
Profitability (C_1)	The company's ability to generate profits from its operational activities	ROA = (Profit before Tax) / (Total Assets) × 100%	Ratio	Kornelis et al. (2025)
Leverage (C_2)	The extent to which a company uses debt to finance its assets and operational activities	DAR = (Total Debt) / (Total Assets)	Ratio	Darmayanti & Kumalasari (2026); Mulyadi (2026)

Source: Developed for this research (2026)

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3.5 Data Analysis Techniques

Data analysis in this study is conducted using panel data regression with the assistance of statistical software. The analysis stages include descriptive statistics, classical assumption tests, panel data model selection, panel data regression analysis, and hypothesis testing. The regression model used in this study is formulated as follows:

$$CED_{it} = \alpha + \beta_1 SIZE_{it} + \beta_2 FO_{it} + \beta_3 (SIZE_{it} \times FO_{it}) + \beta_4 ROA_{it} + \beta_5 LEV_{it} + \varepsilon_{it}$$

Where:
CED = Carbon Emission Disclosure
SIZE = Company Size
FO = Foreign Ownership
SIZE × FO = Interaction between company size and foreign ownership
ROA = Profitability
LEV = Leverage
α = Constant
β_1–β_5 = Regression coefficients
ε = Error term
i = Company
t = Year

Descriptive Statistics: Descriptive statistics are employed to describe the characteristics of the research data, including mean, standard deviation, minimum, and maximum values for all variables examined in the study.

Classical Assumption Tests: Prior to hypothesis testing, classical assumption tests are conducted to ensure that the regression model satisfies the required assumptions. The tests include normality test, multicollinearity test using Variance Inflation Factor (VIF), heteroscedasticity test, and autocorrelation test.

Panel Data Model Selection: The selection of the appropriate panel data regression model is carried out through three main stages: the Chow Test to compare whether the Common Effect Model (CEM) or Fixed Effect Model (FEM) is the better model; the Hausman Test to determine whether the best model is FEM or Random Effect Model (REM); and the Lagrange Multiplier (LM) Test to confirm whether REM is more appropriate than CEM.

Hypothesis Testing: Hypothesis testing is conducted using:
1) t-test (Partial Test) to determine the partial effect of each independent variable on carbon emission disclosure. The hypothesis is accepted if the probability value (p-value) is less than the significance level of 5% ($p < 0.05$).
2) F-test (Simultaneous Test) to examine the simultaneous effect of independent variables on carbon emission disclosure. The model is considered significant if the probability value (p-value) is less than the significance level of 5% ($p < 0.05$).
3) Coefficient of Determination (R^2) to measure the model's ability to explain variations in carbon emission disclosure.
4) Moderation testing is conducted using Moderated Regression Analysis (MRA) by examining the significance of the interaction term between company size and foreign ownership.

All hypothesis tests are conducted at a significance level of 5% ($p < 0.05$). The analysis examines how company size influences carbon emission disclosure and whether foreign ownership moderates this relationship in transportation sector companies listed on the Indonesia Stock Exchange during the 2022–2025 period.

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4. Results and Discussion

4.1 Results

Table 2. Descriptive Statistical Analysis

Variable	Obs	Mean	Std. Dev	Min	Max
Carbon Emission Disclosure	88	10.590	3.439	1.000	17.000
Firm Size	88	24.249	4.420	15.218	29.767
Foreign Investors	88	0.135	0.192	0.000	0.849
Profitability	88	0.050	0.100	-0.211	0.356
Leverage	88	0.548	0.530	0.023	3.123

Source: Data processed by researchers (E-Views 13), 2026

Table 2 presents descriptive statistical results from 88 observations used in the study. The carbon disclosure variable measured using the Carbon Emission Disclosure Index had a minimum value of 1.000 and a maximum value of 17.000, with an average value of 10.590 and a standard deviation of 3.439. The results showed that the sample companies had different levels of carbon disclosure, with an average disclosure of 10.590 from all indicators used in the study. The company size variable measured using Firm Size had a minimum value of 15.218 and a maximum value of 29.767. The average value of company size was 24.249 with a standard deviation of 4.420. These results showed that there was a difference in company size among the companies that were the research sample. The foreign ownership variable measured using Foreign Investors had a minimum value of 0.000 and a maximum value of 0.849, with an average value of 0.135 and a standard deviation of 0.192. The average value showed that in general, foreign ownership in the sample company was 13.58%. Meanwhile, the maximum value of 0.849 showed that there were companies with a proportion of foreign ownership of up to 84.91%. The standard deviation value that was larger than the average value showed that there was a fairly high variation in the proportion of foreign ownership among the sample companies. The profitability variable measured using Return on Assets (ROA) had a minimum value of -0.211 and a maximum value of 0.356, with an average value of 0.050 and a standard deviation of 0.100. The average value shows that the sample company generally generates a profit of 5.09% of the total assets owned. The existence of a negative minimum value indicates that there are sample companies that suffer losses during the study period. In addition, the standard deviation that is larger than the average value shows that there is a fairly high variation in profitability levels between sample companies. The leverage variable measured using the Debt to Asset Ratio (DAR) has a minimum value of 0.023 and a maximum value of 3.123, with an average value of 0.548 and a standard deviation of 0.530. The average value of 0.548 shows that on average around 54.89% of the assets of the sample company are financed by debt. Meanwhile, the wide range of DAR values shows that there is a difference in the level of leverage among the sample companies. Overall, the results of the descriptive statistics show that the research data has a fairly good variation, so it can be used to describe the condition of the companies in the transportation sector in the sample. These variations can be seen from differences in company size, foreign ownership levels, profitability, leverage, and carbon disclosure levels during the study period.

The results of the initial classical assumption testing showed that there was a problem of multicollinearity in the regression model, while the assumptions of normality and heteroscedasticity had been met. Therefore, this study uses the mean-centering technique on the variables used in the formation of interaction variables, namely by subtracting each observation value by the average value of the variable concerned. Hayes (2018) explains

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that centering does not change the overall test of the moderation effect because the coefficient and significance level of the interaction variables substantively remain the same, while the changes that occur are only related to the reference point or zero point of the variable. Thus, mean-centering is not intended to make the interaction variable significant, but to reduce the multicollinearity that arises due to the formation of interaction variables and to facilitate the interpretation of the coefficients in the moderation model.

Table 3. Summary of Hypothesis Testing Results

Variable	Coefficient	t-statistic	Prob.
C	9.003	9.587	0.000
SIZE	-0.023	-0.172	0.863
FO	-2.992	-1.039	0.301
SIZE*FO	-0.744	-1.404	0.163
ROA	-3.338	-0.941	0.349
LEV	3.087	2.615	0.010
R-squared	0.103		
Adjusted R-squared	0.048		
F-Statistic	1.888		
Prob (F-Statistic)	0.105		

Source: Data processed by researchers (E-Views 13), 2026

Table 3 presents the results of hypothesis testing. The company size variable has a probability value of 0.863 greater than the significance level of 0.05. Thus, the size of the company has no significant effect on carbon disclosure, so the first hypothesis is rejected. These results show that the size of companies in the transportation sector is not yet the main factor that determines the extent of carbon emission disclosure. This can happen because transportation companies, both large and small, tend to face relatively uniform regulatory and environmental oversight pressures, so that company size is no longer the main differentiator in encouraging carbon disclosure. Even large companies do not necessarily have a stronger incentive to disclose carbon information if there is not enough pressure from regulators and stakeholders.

The moderation variable of the size of a foreign-owned company has a probability value of 0.163, also greater than 0.05. These results show that foreign ownership is not able to moderate the influence of company size on carbon disclosure, so the second hypothesis is rejected. These findings indicate that the presence of foreign investors in transportation sector companies has not fully played a role as an effective supervisory mechanism in strengthening the push of large companies to disclose carbon information. In other words, foreign ownership owned by companies is not strong enough to influence the relationship between company size and carbon disclosure. This condition can occur because the proportion of foreign ownership in most sample companies is still relatively small on average at 13.58%, so the influence of foreign investors on the company's environmental disclosure policy is not dominant enough.

The profitability variable (ROA) has a negative coefficient of -3.338 with a probability value of 0.349, so it does not have a significant effect on carbon disclosure. These results show that profitability has not been the main factor that explains the variation in carbon disclosure in transportation sector companies in this study. In contrast, the leverage variable (DAR) has a positive coefficient of 3.087 with a probability value of 0.010, which is less than 0.05. This shows that leverage has a significant and positive effect on carbon disclosure. In other words, companies with higher levels of debt tend to disclose

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more extensive carbon information. This is because high-leverage companies are generally under more intense scrutiny from creditors, so it is necessary to maintain trust and legitimacy in the eyes of creditors and other stakeholders through more transparent disclosure of information, including carbon-related information.

A Prob value (F-statistic) of 0.105, which is greater than the significance level of 0.05, indicates that simultaneously independent variables in the model have not been able to explain carbon disclosure significantly. Meanwhile, an R-square value of 0.103 indicates that about 10.3% of the variation in carbon disclosure can be explained by the variables used in the study model, while about 89.7% of the remaining is influenced by other factors not included in the model. Thus, the model's ability to explain variations in carbon disclosure is still relatively limited. These conditions suggest that carbon emission disclosure is likely to be influenced by other factors that have not been included in the model, such as corporate governance characteristics, stakeholder pressures, environmental performance, institutional ownership, audit quality, or regulatory factors.

4.2 Discussion

4.2.1 The Effect of Company Size on Carbon Emission Disclosure

The hypothesis testing results indicate that company size has a coefficient of -0.023 with a probability value of 0.863, which is greater than the significance level of 0.05. Thus, the size of the company has no significant effect on the disclosure of carbon emissions, so H1 is rejected. Gray et al. (1995) explain that social and environmental disclosures could be used by companies as part of the process of maintaining legitimacy amid the social demands faced by companies. In that context, large-sized companies theoretically have a greater incentive to increase environmental disclosure due to their relatively higher visibility and public exposure. However, the results of this study show that the magnitude of the size of the company proxied through total assets has not automatically led to companies undertaking broader carbon emission disclosures.

The influence of company size in this study shows that a company's decision to disclose carbon emission information is not solely determined by its economic scale or the number of assets owned. Large and small companies can have different environmental disclosure policies depending on sustainability strategies, management's attention to environmental issues, characteristics of operational activities, and internal policies regarding the preparation and delivery of sustainability information. Thus, company size cannot be a sufficient determinant to explain the variation in carbon emission disclosure in transportation sector companies in the study period.

In that period, public companies have indeed been required to submit sustainability reports based on POJK No. 51/POJK.03/2017, but the Sustainability Disclosure Standards that adopt IFRS S1 and IFRS S2 principles (PSPK 1 and PSPK 2) are only effective as of January 1, 2027, so they have not become a mandatory reference during this study period. Because the format and depth of carbon emission disclosure is still voluntary and has not been strictly standardized, the level of disclosure is more determined by the company's internal sustainability readiness and priorities. Thus, the larger the size of the company is not always followed by the wider disclosure of carbon emissions in the 2022–2025 period. In the context of companies in the Indonesian transportation sector, the practice of carbon emission disclosure is more related to the company's sustainability policies and priorities, operational characteristics, and the level of readiness of the company in providing environmental information rather than only determined by the size of the company's assets.

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4.2.2 The Role of Foreign Ownership Moderation in the Relationship between Company Size and Carbon Emissions Disclosure

The hypothesis testing results indicate that the interaction variable of company size with foreign ownership had a coefficient of -0.744 with a probability value of 0.163, which was greater than the significance level of 0.05. Thus, foreign ownership was not proven to moderate the influence of company size on carbon emission disclosure, so H2 was rejected. Freeman (1984) explains that foreign investors should play a role as one of the stakeholder groups that have a high interest in transparency and environmental accountability of companies, so their existence is expected to strengthen the encouragement of large companies to disclose carbon emission information more broadly. However, the results of this study show that this role has not been empirically proven in transportation sector companies.

The average proportion of foreign ownership in the sample companies in this study is relatively low, which is 13.58%. The relatively low proportion of foreign ownership cannot be directly interpreted as a cause of the insignificance of the moderation effect, as the effectiveness of shareholders in influencing company policies also depends on the concentration of ownership, voting rights, involvement in governance, as well as corporate oversight mechanisms. Foreign investors may have different investment orientations and levels of involvement, so their presence in the ownership structure does not necessarily result in uniform pressure on management to increase carbon emission disclosure. Under these conditions, the size of the company reflected through the size of the company does not necessarily result in a greater increase in carbon disclosure when the company has a certain proportion of foreign ownership.

These findings also suggest that the existence of foreign ownership is structurally not necessarily sufficient to change the company's environmental disclosure policy. Thus, the influence of company size on carbon emissions disclosure does not significantly depend on the proportion of foreign ownership. The role of foreign ownership in driving carbon disclosure can be more visible if investors have a stronger involvement in corporate governance, have a more significant ownership position, or operate in a more developed regulatory environment and sustainability practices.

4.2.3 The Effect of Control Variables on Carbon Emission Disclosure

Among the control variables, leverage (DAR) has a positive and significant effect on carbon disclosure, with a coefficient value of 3.087 and a probability value of 0.010. This finding suggests that companies with higher levels of debt tend to disclose more extensive carbon information. This is because high-leverage companies are generally under more intense scrutiny from creditors, so it is necessary to maintain trust and legitimacy in the eyes of creditors and other stakeholders through more transparent disclosure of information, including carbon-related information. Creditors, as key stakeholders, have a significant interest in understanding the environmental risks and sustainability practices of the companies they finance, particularly in emission-intensive sectors such as transportation.

Profitability (ROA) does not have a significant effect on carbon disclosure, with a coefficient value of -3.338 and a probability value of 0.349. This finding suggests that profitability has not been the main factor that explains the variation in carbon disclosure in transportation sector companies in this study. Companies with higher profitability do not necessarily disclose more extensive carbon information, as the decision to disclose

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environmental information may be influenced by factors beyond financial capacity, such as regulatory pressure, stakeholder expectations, and internal sustainability commitments.

5. Conclusion

This study aimed to analyze the effect of Company Size on Carbon Emission Disclosure and the role of Foreign Ownership as a moderating variable in transportation sector companies listed on the Indonesia Stock Exchange for the 2022–2025 period. Using a quantitative approach with panel data regression analysis on eighty-eight observations from twenty-two transportation companies selected through purposive sampling techniques, the study successfully tested the direct and moderating relationships among the research variables and examined the role of Foreign Ownership in moderating the relationship between Company Size and Carbon Emission Disclosure.

The results indicate that Company Size does not have a significant effect on Carbon Emission Disclosure, so H1 is rejected. This finding indicates that the size of companies in the transportation sector is not yet the main factor that determines the extent of carbon emission disclosure. Large and small companies tend to face relatively uniform regulatory and environmental oversight pressures, so that company size is no longer the main differentiator in encouraging carbon disclosure. A company's decision to disclose carbon emission information is not solely determined by its economic scale or the number of assets owned, but also depends on sustainability strategies, management's attention to environmental issues, characteristics of operational activities, and internal policies regarding the preparation and delivery of sustainability information. In the 2022–2025 period, although public companies have been required to submit sustainability reports based on POJK No. 51/POJK.03/2017, the Sustainability Disclosure Standards that adopt IFRS S1 and IFRS S2 principles (PSPK 1 and PSPK 2) are only effective as of January 1, 2027, so they have not become a mandatory reference during the study period. Because the format and depth of carbon emission disclosure is still voluntary and has not been strictly standardized, the level of disclosure is more determined by the company's internal sustainability readiness and priorities rather than by company size alone. This finding challenges the assumption of Legitimacy Theory, which predicts that larger companies with higher public visibility will disclose more environmental information to maintain legitimacy (Gray et al., 1995; Suchman, 1995).

Foreign Ownership is also not proven to be able to moderate the relationship between Company Size and Carbon Emission Disclosure, so H2 is rejected. This finding indicates that the presence of foreign investors in transportation sector companies has not fully played a role as an effective supervisory mechanism in strengthening the push of large companies to disclose carbon information. The average proportion of foreign ownership in the sample companies is relatively low at 13.58%, and the effectiveness of shareholders in influencing company policies also depends on the concentration of ownership, voting rights, involvement in governance, as well as corporate oversight mechanisms. Foreign investors may have different investment orientations and levels of involvement, so their presence in the ownership structure does not necessarily result in uniform pressure on management to increase carbon emission disclosure. These findings suggest that the existence of foreign ownership is structurally not necessarily sufficient to change the company's environmental disclosure policy. The role of foreign ownership in driving carbon disclosure can be more visible if investors have a stronger involvement in corporate governance, have a more significant ownership position, or operate in a more developed regulatory environment and sustainability practices. This finding is consistent

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with previous research emphasizing that the presence of foreign investors does not automatically translate into stronger pressure for environmental disclosure (Scott, 2022; Aprilia et al., 2026).

Meanwhile, from the control variable, Profitability does not show a significant effect on Carbon Emission Disclosure, indicating that profitability has not been the main factor that explains the variation in carbon disclosure in transportation sector companies. In contrast, Leverage has a positive and significant effect on Carbon Emission Disclosure, suggesting that companies with higher levels of debt tend to disclose more extensive carbon information. This is because high-leverage companies are generally under more intense scrutiny from creditors, so it is necessary to maintain trust and legitimacy in the eyes of creditors and other stakeholders through more transparent disclosure of information, including carbon-related information. The model's ability to explain variations in carbon disclosure is still relatively limited, with an R-square value of 0.103, indicating that other factors not included in the model may significantly influence carbon emission disclosure, such as corporate governance characteristics, stakeholder pressures, environmental performance, institutional ownership, audit quality, or regulatory factors.

The theoretical contribution of this study lies in the integration of Legitimacy Theory, Stakeholder Theory, and Agency Theory into a single conceptual framework that explains how company size and foreign ownership influence carbon emission disclosure in the Indonesian transportation sector. This study extends the application of these theoretical frameworks to the context of carbon emission disclosure in a sector that is closely associated with high fossil fuel consumption and emission-intensive operational activities, validating theoretical predictions in an under-researched institutional context.

From a practical perspective, this study provides actionable insights for corporate management, investors, and regulators. For companies, the results of the study show that transportation companies need to maintain consistency in carbon emission disclosure regardless of the size or scale of the company. This disclosure is important as a form of corporate accountability for the environmental impact caused by its operational activities. For investors, the results of this study show that the assessment of the environmental commitment of transportation companies should not only be based on the size of the company and the level of foreign ownership, but also consider other indicators that can reflect the quality of the company's environmental management and transparency. For regulators, the results of this study can be an input in strengthening carbon emission disclosure policies and guidelines so that reporting practices between companies become more consistent, measurable, and comparable.

This study has several limitations that should be acknowledged. First, the observation period only covers 2022–2025, which is the period before the effective enactment of sustainability disclosure standards based on IFRS S1 and IFRS S2 through PSPK 1 and PSPK 2 on January 1, 2027. This condition causes the practice and depth of carbon emission disclosure between companies to be diverse and not fully standardized. Second, the disclosure of carbon emissions in this study was measured using the Carbon Emission Disclosure Index, so that the measurement focuses more on the existence of disclosure items and does not fully reflect the substantive quality of information submitted by the company. Third, the study focused only on the transportation sector, which may limit the generalizability of the findings to other sectors. Fourth, the model's explanatory power is relatively limited, with an R-square value of 0.103, indicating that other factors not included in the model may significantly influence carbon emission disclosure.

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Future research should use a longer observation period, especially after the effective implementation of sustainability disclosure standards based on IFRS S1 and IFRS S2. Measurement of carbon emission disclosure can also be developed with an approach that not only assesses the existence of information, but also pays attention to the quality and depth of disclosure. Subsequent research can also expand the object of research to other sectors that have higher levels and variations of foreign ownership. In addition, future research can consider other variables, such as corporate governance, stakeholder pressure, audit quality, and other institutional factors that have the potential to affect carbon emission disclosure.

This study contributes to the growing body of literature on carbon emission disclosure and corporate governance by providing empirical evidence on the determinants and moderating mechanisms of carbon emission disclosure among transportation companies in Indonesia. The findings suggest that Company Size and Foreign Ownership are not the key factors influencing Carbon Emission Disclosure, while Leverage plays a significant role in encouraging more transparent carbon disclosure. As Indonesia continues to strengthen its sustainability disclosure framework, understanding these factors becomes increasingly important for developing effective strategies to enhance carbon emission transparency and promote sustainable economic transformation in the transportation sector.

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