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Ownership Structure, Board Size, and Carbon Emission Disclosures: Empirical Evidence from ASEAN-5 Countries

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ABSTRACT

This study aims to investigate the influence of institutional ownership structure and managerial ownership on corporate carbon emissions disclosure in ASEAN-5 with the size of the board of commissioners as a moderator. Large-cap companies listed on each ASEAN-5 countries' stock exchange were selected as research samples. The sample companies have published sustainability reports and integrated annual reports that disclose carbon emissions between 2018 and 2022 (175 company-year observation). Using multiple linear regression analysis, this study found that institutional ownership and managerial ownership have a negative impact on carbon emissions disclosure. The role of board of commissioner size was found weakening the negative relationship between institutional ownership and managerial ownership on carbon emissions disclosure.

Struktur Kepemilikan, Ukuran Dewan, dan Pengungkapan Emisi Karbon: Bukti Empiris dari Negara ASEAN-5

ABSTRAK

Penelitian ini bertujuan untuk menguji pengaruh struktur kepemilikan institusional dan kepemilikan manajerial terhadap pengungkapan emisi karbon perusahaan di ASEAN-5 dengan ukuran dewan komisaris sebagai pemoderasi. Sampel penelitian adalah perusahaan berkapitalisasi besar yang terdaftar di bursa efek masing-masing negara ASEAN-5 yang telah mempublikasikan laporan keberlanjutan dan laporan tahunan yang terintegrasi yang mengungkapkan pengungkapan emisi karbon periode 2018 s.d.2022 (175 observasi). Dengan menggunakan analisis regresi linier berganda, hasil penelitian menunjukkan bahwa kepemilikan institusional dan kepemilikan manajerial berpengaruh negatif terhadap pengungkapan emisi karbon. Penelitian ini juga mengkonfirmasi peran ukuran dewan komisaris dapat memperlemah hubungan negatif antara kepemilikan institusional dan kepemilikan manajerial terhadap pengungkapan emisi karbon.

1. Introduction

The issue of global warming has become the focus of attention worldwide, and awareness of other environmental issues needs to be increased. This encourages the urgency of company transparency in providing information on carbon emissions. Companies in ASEAN-5 countries, namely Indonesia, Malaysia, Singapore, Thailand, and the Philippines, face pressure to disclose information regarding their carbon emission performance, including the energy they consume (ASEAN Secretariat, 2021). The urgent need to overcome the various challenges faced by global warming has encouraged joint efforts from stakeholders across sectors to reduce its impact. One key aspect of this effort is the importance of entities' understanding and communication of information regarding their contribution to global warming (Hapsoro & Ambarwati, 2018).

ASEAN has voluntarily taken steps to increase climate resilience and reduce carbon emissions (Pramudianto, 2016). Voluntary disclosure is necessary to maintain a company's reputation and increase the trust of investors and other stakeholders. Voluntary disclosure in the form of disclosure of company carbon emissions allows principals, including investors, the government, and society, to take better steps in managing climate risks and promoting sustainable business practices. Therefore, a company's ownership structure is an important factor in determining how transparent it is in disclosing information related to its carbon emissions (Fan et al., 2024). Company ownership structures, such as institutional ownership (Fan et al., 2024, Wei et al., 2024, Bedi & Singh, 2024, Ghachem et al., 2022, Acar et al., 2021) and managerial ownership (Wei et al., 2024, Elsayih et al., 2018), have the potential to influence company decisions regarding environmental issue disclosures and carbon emission disclosures. Large institutions have a long-term interest in companies' environmental and social performance and encourage companies to increase their transparency regarding carbon emissions. On the other hand, greater managerial ownership can create incentives for companies to safeguard sensitive information, including keeping carbon emission information confidential (Shan et al., 2021).

Furthermore, board size can influence the transparency and disclosure of carbon emissions in sustainability reports (Chakraborty & Dey, 2023). A strong and diverse board may have more resources and knowledge for monitoring and assessing a company's disclosure practices. In addition, the presence of board members with a background in the environment or sustainability can help companies manage risks, improve environmental performance, and strengthen their reputation.

Several previous studies have examined the influence of company ownership structure on carbon emission disclosure. Ghachem et al. (2022) prove that institutional ownership has a negative influence on the disclosure of carbon emissions by small and medium-sized enterprises (SMEs) in countries that are members of the Organization for Economic Co-operation and Development (OECD). The results of this study are consistent with those of Fan et al. (2024), who used a sample of companies in Japan. In addition, research by Shan et al. (2021), in the context of carbon emissions disclosure in Australia, proves that managerial ownership causes a refusal to adopt environmental strategies related to carbon emissions.

Based on the existing description, this study aims to empirically prove (1) the influence of institutional ownership on carbon emissions disclosure, (2) the influence of managerial ownership on carbon emissions disclosure, (3) the moderating role of the size of the board of commissioners on the influence of institutional ownership on carbon emissions disclosure, and (4) the moderating role of board of commissioner size on the influence of managerial ownership on carbon emissions disclosure.

This study is expected to make the following contributions: A number of literatures have examined the influence of ownership structure on environmental disclosure (Wei et al., 2024, Acar et al., 2021, Diantimala & Amril, 2018) and carbon disclosure (Fan et al., 2024, Ghachem et al., 2022, Shan et al., 2021) in the context of developed countries. This research enriches the climate change literature by providing new knowledge regarding the influence of ownership structure on corporate carbon emissions disclosure in the ASEAN-5 context. To the best of our knowledge, this study is the first to examine the influence of ownership structure on carbon emissions disclosure in the ASEAN-5 context. ASEAN has identified climate change as a regional priority. Furthermore, several previous studies have predominantly focused on placing the size of the board of commissioners as a determining factor in carbon emissions disclosure (Chakraborty & Dey, 2023; Karim et al., 2021; Cordova et al., 2020). Using agency theory, this study empirically proves the moderating role of the board of commissioners' size in the relationship between

ownership structure and carbon emissions disclosure.

The remainder of this paper is organized as follows. The theoretical framework and hypothesis development are presented in the second part. The third section describes the research methodology used in this study. Section 4 describes the test results and discussion. Conclusions, limitations, and recommendations for future research are presented in the fifth section.

2. Theoretical Framework and hypotheses development

Theoretical framework

Stakeholder theory

Stakeholder theory states that an entity seeks to pay attention to its activities to meet stakeholder expectations (Freeman, 1984). Management is forced to provide more information disclosure due to pressure exerted by stakeholders (Naser et al., 2006). Thus, the urgency of the role of stakeholders in conveying the company's environmental and social performance is to pressure managers to disclose it in sustainability reports. To respond to this pressure, company managers have begun to engage in environmental accountability practices and increase disclosure of sustainability reports that are tailored to stakeholder demands.

Agency theory

Agency theory is used to understand how directors often act in their interests rather than shareholders (Jensen & Meckling, 1976). In the context of efforts to reduce greenhouse gas emissions, companies seek to turn audit risks and opportunities from their carbon footprint into market opportunities for investors (Khlif & Hussainey, 2016, Harmes, 2011, Kolk et al., 2008). However, directors can use superficial information disclosure to create imbalanced information among the shareholders. In the context of sustainability reports, agency theory highlights the role of information in minimizing discrepancies between agents and principals. Publishing sustainability reports transparently and in detail means that the company is trying to reduce uncertainty and allows the principals to make informed and rational decisions.

Carbon emission disclosure

In dealing with the issue of climate change, the disclosure of carbon emissions is closely related to the transparency and accountability of company disclosures as a form of responsibility for the impact of business operations on the environment and society. Disclosure of carbon emissions is still voluntary (Ummah & Setiawan, 2021). Disclosure of carbon emissions as an obligation for entities can be found through annual and sustainability reports to disclose information about environmental performance. Disclosure of carbon emissions and energy produced from business activities provides stakeholders with information about the company's environmental impact. To achieve legitimacy, companies strive to gain recognition from society and stakeholders. These efforts are made by disclosing information regarding environmental performance to improve the company's reputation so that its existence can be accepted and recognized (Simamora et al., 2022).

Ownership structure

Institutional ownership refers to the proportion of company shares held by institutional investors (Bedi & Singh, 2024). Examples include pension funds, investment companies, and financial institutions. This study examines how institutional ownership influences carbon emission disclosure. Shareholder theory argues that it is important for companies to consider all stakeholder interests, including shareholders, employees, customers, and the public, in their decision-making processes. Institutional owners, as significant shareholders, are in a position to influence companies to prioritize initiatives that benefit stakeholders and ultimately enhance long-term value creation.

Managerial ownership refers to the percentage of common shares owned by company management, such as executive directors (Wei et al., 2024).

Managers who hold ownership have the point of view that information disclosure made by companies, such as carbon emissions disclosure, can function as a means of building and fostering better relationships between the company and its stakeholders. Managerial ownership is an incentive for managers in a company to improve company performance to minimize agency costs, which will ultimately increase the welfare of all shareholders (Diantimala & Amril, 2018). A high level of managerial ownership reduces information disclosure because it relies on the currently available information to take personal advantage.

Board size

From an agency theory perspective, corporate governance can be interpreted as a process that aligns the interests of management with those of shareholders (Rezaee & Fogarty, 2019). One function that can support companies in achieving optimal performance is supervision by the board of directors and commissioners. The board of commissioners must be accountable for designing sustainable business strategies because of its role as the highest management body and its function as a supervisor of the use of company assets (Jizi et al., 2014). In addition, the board of commissioners must provide assurance that material environmental risks can be monitored and disclosed in full (Ben-Amar et al., 2017). A larger board of commissioners indicates that a company may have a stronger tendency to handle carbon emission disclosure issues, which ultimately increases its disclosure (Akhtaruddin et al., 2009).

Hypotheses development

Institutional ownership and carbon emission disclosures

Institutional shareholders place greater emphasis on short-term financial profits, resulting in lower responsiveness to the needs of other stakeholders (Wei et al., 2024). This is in line with voluntary disclosure theory, which states that a short-term focus results in minimal transparency of shared environmental information (Li et al., 2017). Institutional shareholders are also less likely to feel the need to legitimize their actions through environmental disclosures to enhance a positive image. Additionally, potential free-rider problems may occur between institutional investors and other shareholders (Li et al. 2023). This problem arises when only a small number of shareholders bear the costs of the company's active involvement, but all parties, including those who do not, feel the benefits. When institutional ownership is greater, it can create more free-riders. This increasingly encourages them to focus on the short term, so they do not care about environmental disclosure activities, for example, the long-term oriented disclosure of carbon emissions. This is in line with stakeholder theory, which states that to meet the expectations of institutional investors as stakeholders, companies are not required to disclose information, especially environmental information, such as carbon emissions. Several empirical studies prove that institutional ownership negatively influences environmental disclosure (Wei et al., 2024; Acar et al., 2021; Diantimala & Amril, 2018) and carbon emissions disclosure (Fan et al., 2024; Ghachem et al., 2022). Based on the above description, the following hypothesis is proposed.

H1: Institutional ownership has a negative influence on carbon emissions disclosures.

Managerial ownership and carbon emission disclosures

According to agency theory, managers who own a high percentage of company shares will try to align the manager's interests with the interests of the owner (Jensen and Meckling, 1976). However, on the other hand, managers who own large amounts of shares have the potential to feel so powerful that they do not feel the need to consider the interests of other stakeholders (Morck et al., 1988). Managerial ownership can create a transactional relationship between executives and shareholders (Davis et al., 2018). Managerial ownership can reduce voluntary information disclosure because managers may be

more inclined to retain information on themselves (Sartawi et al., 2014). Shan et al. (2021), in the context of carbon emissions disclosure in Australia, prove that the ownership of managers who control significant shares has the potential to give priority to their profits over the long-term interests of the company, thereby causing a refusal to adopt environmental strategies. Managerial ownership, which is no longer entrenched in a company's ownership structure, tends to choose not to provide clear information to protect their interests, thereby hampering carbon transparency. These results are consistent with those reported by Diantimala & Amril (2018). During increasing stakeholder pressure on disclosing information related to climate change, the interests of managers who tend not to disclose carbon emissions raise concerns. The hypothesis proposed is as follows.

H2: Managerial ownership has a negative influence on carbon emissions disclosure.

Institutional ownership, board size, and carbon emission disclosures

Agency theory reveals that conflicts of interest between principals and agents can influence the level of carbon emission disclosure. The size of the board of commissioners is one of the most important corporate governance mechanisms for resolving this conflict. The larger the size of the board of commissioners, the more control and supervision there is over management, so that it can minimize the possibility of poor environmental performance policies, including carbon emissions (Chakraborty & Dey, 2023). The stakeholder theory perspective emphasizes the importance of various parties involved in the company in influencing company policies related to environmental responsibility, including the disclosure of carbon emissions. Based on the existing description, the size of the board of commissioners is thought to weaken the influence of stakeholders, in this case, institutional investors, regarding carbon emissions disclosure. The hypothesis proposed is as follows.

H3: The board size weakens the negative influence of institutional ownership on carbon emissions disclosure.

Managerial ownership, board size, and carbon emission disclosures

Agency theory suggests that strategic managers who own shares in a firm have greater incentives to pay attention to disclosure practices related to carbon emissions. However, managerial ownership that is no longer rooted in the company's ownership structure tends to choose not to provide clear information to protect their interests, thus hampering the transparency of carbon emission information. A larger board size can weaken the influence of managerial ownership on carbon emissions disclosure because companies that have a larger board size will tend to disclose information related to carbon emissions more transparently (Chakraborty & Dey, 2023). Based on the above description, the following hypothesis was tested:

H4: The board size weakens the negative influence of managerial ownership on carbon emissions disclosure.

3. Research method

Research sample and data

The sample in this study was selected using a purposive sampling technique. The criteria set are as follows. First, large capitalization companies that are included in the ASEAN-5 category, namely Indonesia, Malaysia, Singapore, Philippines, and Thailand, also the data is available on the S&P Capital IQ database. Companies included in the large capitalization category are companies that have a market value of between USD10 billion and USD200 billion. The selection of companies included in the large capitalization category is based on the reason that these companies have very high market value and are already well-established in operation so stakeholders will demand more of these companies to be more transparent.

Therefore, the sample of large capitalization companies is relevant in the context of carbon emission disclosure research. Second, the companies in the ASEAN-5 region are listed on each country's stock exchange. Third, companies that publish sustainability reports and integrated annual reports for 2018-2022.

Research empirical model

Hypothesis testing in this research uses multiple regression tests. The two regression models used are described below. The first research model was used to test the two hypotheses developed, namely H1 and H2. This second research model was carried out to test the next two hypotheses which included moderating variables, namely H4 and H5.

First empirical model:

$$CED_{i,t} = \alpha - \beta 1INS_{i,t} - \beta 2MAN_{i,t} + \beta 3SIZE_{i,t} + \beta 4COV_{i,t} + \beta 5PROF_{i,t} + \beta 6LEV_{i,t} + \varepsilon$$

Second empirical model:

$$CEDi,t = \alpha - \beta_1 INS_{i,t} - \beta_2 MAN_{i,t} + \beta_3 BSIZE_{i,t} - \beta_4 INS*BSIZE_{i,t} + \beta_5 MAN*BSIZE_{i,t} + \beta 6SIZE_{i,t} + \beta 7COV_{i,t} + \beta 8PROF_{i,t} + \beta 9LEV_{i,t} + \varepsilon$$

Description:

CED	: Carbon Emission Disclosures
i	: Company
t	: Period
INS	: Institusional Ownership
MAN	: Managerial Ownership
BSIZE	: *Board Size*
SIZE	: Firm Size
COV	: Covid-19
PROF	: Profitability
LEV	: Leverage
α	: Constant
β	: Coefficient
Ɛ	: Error

Operational definition and measurement of variables

Measurement of all variables in this study uses measures adopted from some previous studies. This is because the measures have been validated in previous studies; therefore, the measures used are expected to measure the variables intended in this study.

Dependent variable — carbon emission disclosure

The measurement of carbon emissions disclosure in this study adopts the measure developed by Choi et al. (2013). This measure is the most comprehensive and relevant in carbon emission disclosure research because it covers 5 aspects that are directly related to climate change and carbon emissions, consisting of climate change risks and opportunities, greenhouse gas emission calculations, energy consumption calculations, greenhouse gas reductions, and carbon cost and emission accountability. This measure is a checklist of statements developed based on the information request sheets provided by the carbon disclosure project and has been modified (Choi et al., 2013). Therefore, this checklist is not limited to the analysis of carbon emission disclosure in countries that are members of the carbon disclosure project.

In the context of this research, Carbon Emission disclosure (CED) is the main focus because carbon emission disclosures not only reflect transparency regarding environmental impacts but also provide valuable information for stakeholders in evaluating companies' performance and commitment to global environmental issues. Thus, the analysis of CED is expected to provide a better understanding of companies' levels of environmental awareness and responsibility as well as their contribution to overall climate change mitigation efforts.

With increasing awareness of the impacts of climate change, ASEAN-5 countries are increasingly under pressure to reduce their carbon emissions. Disclosure of carbon emissions by

companies is an illustration of how well the private sector participates in climate change mitigation efforts. Companies that actively disclose their carbon emissions tend to be more open to the risks and opportunities associated with the transition to a low-carbon economy. Stakeholders such as the government, investors, and society can also measure the company's contribution to achieving the net zero emission target by 2050. Transparent and accurate information about companies' carbon emissions can help in designing policies, allocating sustainable investments, and encouraging companies to adopt environmentally friendly business practices.

The distribution of carbon emissions disclosures is categorized into 5 sections: risk and opportunities, calculation of Green House Gas (GHG) emissions, energy consumption, GHG costs and reductions, and accountability for carbon emissions with a total of 18 disclosure items (Choi et al., 2013, Simamora et al., 2022). The measurement is carried out by giving a value of 1 if the information is disclosed in the sustainability report and/or in the annual report and a value of 0 if it is not disclosed (Choi et al., 2013). The scores are added up and will be generated using the following formulation:

$$CED = \frac{Total\ Item\ Disclosed}{Total\ Item\ Disclosure\ Checklist}\ x\ 100\%$$

Independent variables

Institutional ownership

Institutional ownership refers to the proportion of shares of a company that are owned by large financial institutions, pension funds, insurance companies, and other institutional entities. Institutional ownership is one factor that can influence a company's behavior and stock performance. This variable reflects the interests and strategies of large investors towards a company. These institutions often have long-term goals in their investments and can influence company policy through shareholder meetings, voting at general shareholder meetings, and direct communication with company management. Institutional owners focus more on short-term financial gains (Acar et al., 2021). This makes them less sensitive to other stakeholders' needs. They were less willing to transparently disclose company information.

Asset managers who come from institutional investors demand disclosure of matters related to climate information because performance regarding climate change, in this case, carbon emissions, can influence prices (Friedman & Heinle, 2016). They believe that improving environmental performance can attract or retain clients who are sensitive to climate change risks (Barzuza et al., 2019). As a result, based on the reasons above, companies tend to feel compelled to disclose their carbon emissions to attract institutional investors who care about the company's environmental performance.

$$INS = \frac{Number\ of\ Shares\ Owned\ by\ Institutions}{Number\ of\ shares\ outstanding}$$

Managerial ownership

Managerial ownership can help reduce conflict by balancing the interests of both parties because every action taken by managers has the potential to provide direct benefits to them, but also forces them to bear risks if something goes wrong. Thus, managerial ownership reflects corporate leaders' direct interest in the company's success and can provide insight into the dynamics of the relationship between management, shareholders, and business sustainability practices.

Managerial ownership harms a company's voluntary disclosure of information (Diantimala and Amril, 2018). High levels of managerial ownership encourage information retention because managers can rely on internal sources to obtain all the information they need, including environmental information. Managerial owners assume that disclosing various types of information will increase the various costs and political risks that are detrimental to them.

$$MAN = \frac{Number\ of\ Shares\ Owned\ by\ Manager}{Number\ of\ shares\ outstanding}$$

Moderating variable

According to Sugiyono (2020), a moderating variable is a variable that has an influence, namely strengthening or weakening the link between the dependent variable and the independent variable. Board size was the moderating variable in this study. Board size was measured using the total number of members of the board of commissioners.

$$BSize = Total\ Number\ of\ Members\ of\ the\ Board\ of\ Commissioners$$

Control variables

Firm size

According to Rudyanto & Siregar (2018), company size is a variable that is often used in research because it has a positive influence on the disclosure of sustainability reports. The formula used to measure company size is the natural logarithm of the total number of company assets.

$$SIZE = Log\ natural\ (Ln)\ of\ total\ assets$$

COVID-19

According to Bidari et al. (2020), the government implemented a semi-lockdown policy that encourages social distancing practices, which has an impact on industrial sectors that cannot operate remotely, such as street vendors and online transportation services. COVID-19 as a control variable can be used to isolate the effects of the pandemic on other variables considered in this research. In this context, this study attempts to understand how ownership structures, such as institutional or managerial ownership, influence carbon emission disclosure by companies in ASEAN-5 countries while controlling for or considering the effects of the COVID-19 pandemic.

COVID-19 was used as a control variable to adjust or consider the impact of the pandemic on the other variables studied. For example, the effect of the pandemic on company operational activities, government policies regarding lockdowns, changes in environmental policies caused by the pandemic situation, and the behavior of institutional or individual investors during the pandemic. By including COVID-19 as a control variable, research can more precisely evaluate the influence of ownership structure on carbon emissions disclosure in ASEAN-5 countries, as well as understand how changes in the external context, such as a pandemic, affect this relationship. This helps to provide deeper insights into corporate carbon emission disclosure practices amidst the challenges and changes faced in the context of the global pandemic. Therefore, measurement indicators with numbers 1 and 0 were used as control variables. Number 1 indicates the year affected by the COVID-19 pandemic, while number 0 indicates the fiscal year that was not affected by the COVID-19 pandemic. The years 2020—2022 are considered to have 1 and the years 2018—2019 are given number 0.

Profitability

Profitability is generally used in research related to the disclosure of corporate social responsibility which is part of the disclosure of sustainability reports (Rudyanto & Siregar, 2018). The research results show a positive influence of profitability on company disclosure. Profitability is measured using the following return on assets ratio.

$$ROA = \frac{Net\ income}{Total\ assets}$$

Leverage

Leverage is used by companies to assess how much of the company's capital is covered by debt. Leverage is used as a control variable because many previous studies have shown that this variable has a positive effect on disclosure of corporate social responsibility (Rudyanto & Siregar, 2018). Leverage measurement in this research uses the Debt to Total Capital Asset Ratio (DAR) ratio with the following formula.

$$DAR = \frac{Total\ Liabilitas}{Total\ Aset}$$

4. Results and discussion

A purposive sampling method was used to select samples. The following table shows the sample size and number of observations used in this research. The limited number of companies selected as samples was due to the following factors:

Table 1. Sample description

No.	Criteria	Total
1	Total companies in the large-cap category operating in ASEAN-5 whose data is available on the S&P Capital IQ database.	41
2	The company is not listed on the Stock Exchange of each country in the 2018-2022 period.	(5)
3	The company did not publish a sustainability report or integrated annual report for the period of 2018-2022.	(1)
	Total research samples	35
	Observation period	5
	Total observation	**175**

First, the authors' universities only subscribe to the S&P Capital IQ database; therefore, the authors only have access to the S&P Capital IQ database. Therefore, this study focuses only on companies whose data are available and can be accessed from the S&P Capital IQ database. Second, sustainability reports, especially those related to the carbon emission information of companies whose data are disclosed in the S&P Capital IQ database, are still very limited.

Descriptive Statistics Results

The following table presents descriptive statistics of all variables used in this research.

Table 2. Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CED	175	0.000	1.000	0.78762	0.266419
INS_OWN	175	0.000	45.529	17.73751	11.024855
MAN_OWN	175	0.000	73.781	8.93084	17.885123
SIZE	175	12.767	20.133	17.09064	1.646339
COV	175	0	1	0.60	0.491
ROA	175	-5.829	57.652	4.92956	7.666793
DAR	175	0.000	66.596	21.96731	17.307119

According to Table 2, a low CED score means that the sustainability report has not disclosed any information related to carbon emissions based on the author's analysis. The number of companies from each ASEAN-5 country is Indonesia with 10 companies, Malaysia with 7 companies, the Philippines with 6 companies, Singapore with 9 companies, and Thailand with 9 companies. The total number of companies in the 5 countries is 41 as shown in Table 1.

Normality test

The normality test results obtained with a total research sample of 175 showed a significant value of 0.778. This value indicates no normality problem because the significant value is greater than 0.05.

Multicollinearity test

The multicollinearity test is carried out to identify whether the regression model used has a multicollinearity problem. The value of the variance inflation factor (VIF) and tolerance value need to be considered to determine this problem. Multicollinearity problems can be identified if the VIF value is more than 10 and the tolerance value is less than 0.10. Table 3 presented below shows the results of the multicollinearity test in the first regression model. Meanwhile, Table 4 describes the results of the second regression model.

Table 3. Multicollinearity test of the first model

	Tolerance	VIF
INS_OWN	0.675	1.482
MAN_OWN	0.756	1.323
SIZE	0.505	1.979
COV	0.976	1.025
ROA	0.679	1.474
DAR	0.787	1.270

The multicollinearity test produced in table 3 for the first regression model shows that the first regression model test results do not show multicollinearity problems in this research, which means the first model is free from interpolation problems on independent variables. This can be seen in the tolerance values for all operational variables with values within reasonable limits (VIF less than 10 and tolerance more than 0.1).

Table 4. Multicollinearity test of the second model

	Tolerance	VIF
(Constant)		
INS_OWN	0.046	21.690
MAN_OWN	0.026	38.026
BSIZE	0.236	4.230
INS_OWNxBSIZE	0.044	22.646
MAN_OWNxBSIZE	0.027	37.711
SIZE	0.460	2.173
COV	0.976	1.025
ROA	0.652	1.534
DAR	0.718	1.393

Table 4 presents the results of the multicollinearity test for the second regression model. The second regression model is used for the interaction variables between INS_OWN and BSIZE and MAN_OWN and BSIZE. The results of the multicollinearity test in the second regression model show that there is a multicollinearity problem because the values of tolerance and VIF in the interaction variable have values of .044 and 22.646 for the interaction between INS_OWN and BSIZE, and .027 and 37.711 for the interaction between MAN_OWN and BSIZE. Both results have a VIF value of more than 10, where these results exceed the specified regulatory limits. However, multicollinearity occurs because of interacting variables; therefore, this problem can be ignored.

Heteroscedasticity Test

The heteroscedasticity test refers to a test is useful for showing the existence of variability in the regression residuals. One method used to examine heteroscedasticity is the Glejser test. The heteroscedasticity test results of the first regression model are presented in Table 5 and the second regression model in Table 6.

Table 5. First model heteroscedasticity test results

	Coefficient	Sig.
(Constant)	0.780	0.000
INS_OWN	0.004	0.450
MAN_OWN	0.002	0.231
SIZE	-0.035	0.000
COV	-0.059	0.003
ROA	-0.001	0.377
DAR	-0.004	0.000

The heteroscedasticity test focuses on significance values with values greater than 5% or (p-value > 5%). The test results show there is no heteroscedasticity problem for the main variables.

Table 6. Second model heteroscedasticity test results

	Coefficient	Sig.
(Constant)	14.045	0.000
INS_OWN	0.024	0.726
MAN_OWN	0.023	0.675
BSIZE	0.093	0.438
INS_OWNxBSIZE	0.004	0.507
MAN_OWNxBSIZE	0.000	0.955
SIZE	-0.708	0.000
COV	-0.978	0.004
ROA	0.003	0.911
DAR	-0.055	0.000

Referring to Table 6, it can be seen that all variables have a significance value of >5%. From these results, it can be said that for the second regression model, there were no heteroscedasticity problems.

Autocorrelation test

The autocorrelation test is a useful method for determining errors in time series data variables correlated with the method used, namely Durbin-Watson. The results of the correlation test in the first regression model and the second model did not show any autocorrelation problems.

Hypothesis test results

The results of hypothesis testing can be seen in Table 7 below.

Table 7. Result of hypotheses test

	First model		Second model	
	Coefficient	Significance Level	Coefficient	Significance Level
Ins_Own	-0.004	0.016**	0.009	0.191
Man_Own	-0.006	0.000***	0.006	0.248
BSize			0.015	0.190
Ins_Own*BSize			-0.001	0.045**
Man_Own*BSize			-0.001	0.020**
Size	0.063	0.000***	0.055	0.000***
Cov	0.178	0.000***	0.180	0.000***
ROA	0.008	0.004***	0.006	0.014**

DAR	0.005	0.000***	0.004	0.001**
R-squared		0.340		0.383
F test	15.956	0.000***	12.983	0.000

*** Significance level at 0.00

** Significance level at 0.05

The test results of the first model in the table above show support for H1 which states that institutional ownership has a negative influence on carbon emissions disclosure. This is indicated by the coefficient and significance value of -0.004 and 0.016, respectively. High levels of institutional ownership tend to result in less transparent disclosure of carbon emissions. The results of this study are consistent with those of Fan et al. (2024) and Ghachem et al. (2022). Institutional shareholders emphasize a short-term focus so they tend not to pay attention to company activities that have a long-term impact, such as carbon emissions disclosure. This result is in line with stakeholder theory which states that to meet the expectations of institutional investors as stakeholders, companies are not required to disclose information, especially environmental information such as carbon emissions, transparently.

The research results also proved H2, namely that managerial ownership has a negative influence on carbon emissions disclosure. The coefficient and significance values were -0.006 and 0.000, respectively. The level of ownership held by managerial investors within the company indicates that managers' behavior in disclosing carbon emissions tends to be seen as an opportunistic action by taking advantage of the asymmetry of information they have. This reduces the number of carbon emission disclosures. The results of this research provide evidence that the tendency of managers to act as agents in disclosing sustainability reports has a large risk in seeking to increase disclosure of environmental performance. This action follows agency theory which says that agents act to fulfill personal interests. The results of this research are in line with research conducted by Shan et al. (2021) and Diantimala & Amril (2018).

The results of testing the second model show that institutional ownership, managerial ownership, and board size do not influence carbon emission disclosure. The significance values are 0.191; 0.248; and 0.190 respectively. Meanwhile, the results of the interaction of the moderating variables, namely board size with both independent variables (institutional ownership and managerial ownership) show significant values, 0.045 and 0.020. These results indicate that board size is a pure moderator. This result is consistent with the findings of Sharma et al. (1981). A variable can be said to be a pure moderator when it does not have a direct influence on the dependent variable, while the interaction of the moderator variable with the independent variable shows significant results.

The results of testing the second model show that the size of the board of commissioners can weaken the negative influence of institutional ownership on carbon emission disclosure. These results support H3. The supervisory function of the board of commissioners focuses on the strategic management decisions related to climate change. This oversight can reduce the likelihood of negative social and environmental policies. The test results also supported H4. More members of the board of commissioners tend to increase their ability to monitor sustainability practices, including environmental ones. With more diverse members, the board of commissioners can form a special committee that focuses on environmental issues, including the wider and more transparent disclosure of carbon emission information. The larger the board size, the more diverse is the experience and knowledge. This can reduce the knowledge gap between managerial investors and the board of commissioners thereby minimizing the potential for conflict.

5. Conclusions

This research aims to provide empirical evidence by investigating the impact of institutional ownership and managerial ownership on carbon emissions disclosure. Apart from that, the aim of this research is also to empirically prove the moderating role of the size of the board of commissioners in the influence of institutional ownership and managerial ownership on carbon emissions disclosure. The following conclusions are drawn based on the results of the analysis and testing carried out. This research finds that high levels of institutional ownership make companies tend to disclose their emissions in smaller amounts or be less transparent. Apart from that, the findings also show that the level of ownership held by managerial investors from within the company negatively influences carbon emissions disclosure. This shows that managers' behavior in disclosing carbon emissions tends to be seen as opportunistic, which results in a decrease in the quality of disclosure.

This research succeeded in proving that the addition of more commissioners contributed to increasing carbon emissions disclosure. The negative influence of institutional ownership on carbon emission disclosure can be weakened by the size of the board of commissioners. The same results are also shown for the negative influence of managerial ownership on carbon emission disclosure, which can be weakened by the size of the board of commissioners.

The practical implications of the results are described below. The corporate governance mechanism, in this case, the size of the board of commissioners, plays an important role in increasing carbon emission disclosure. The monitoring function carried out by the board of commissioners has proven effective in encouraging carbon emission disclosure in ASEAN-5 countries. In this case, the greater the number of boards of commissioners, the greater the span of control over institutional ownership and managerial ownership. Institutional ownership which tends to be non-transparent because they focus on the short term can be more controlled so that they will be more open in disclosing information including carbon information. Furthermore, monitoring by the board of commissioners can suppress the interests of managerial ownership, which tends to hinder carbon transparency. Based on these results, policymakers and companies in the ASEAN-5 region need to pay attention to the existence and size of the board of commissioners.

This study has some limitations and provides avenues for future research. The research currently being conducted only focuses on 2 ownership structures, namely, institutional ownership and managerial ownership as well as 1 moderating variable, namely the size of the board of commissioners. Future research is expected to expand the ownership structure used and use other moderating variables. Until now, assessments related to the disclosure of carbon emissions have used content analysis, which has the potential to provide a subjective view of the results of the interpretation made by each person. Future research could develop measures related to the disclosure of carbon emissions to minimize the occurrence of subjectivity.

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