International Journal Of Humanities Education And Social Sciences ***(IJHESS)*** *E-ISSN:* **2808-1765**
Volume 5, Number 1, August 2025, *Page. 287 – 298*
Email : editorijhess@gmail.com

The Influence Of Public Ownership And Managerial Ownership On Carbon Emission Disclosure

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Abstract

This study examines the influence of public and managerial ownership on carbon emission disclosure (CED) in private companies in Indonesia, with firm size as a moderating variable. Guided by legitimacy theory, the research employs a quantitative approach using secondary data from 616 private companies listed on the Indonesia Stock Exchange (IDX) during the 2021–2023 period, resulting in 1,826 firm-year observations. Using panel data regression and the Fixed Effect Model (FEM), the results show that public ownership has a statistically significant positive effect on CED (coefficient = 0.0247, p = 0.031), suggesting that increased public shareholding enhances environmental transparency. Managerial ownership also positively influences CED (coefficient = 0.0094, p = 0.029), although the impact is less pronounced. Firm size significantly moderates both relationships. The interaction between public ownership and firm size (coefficient = 0.0059, p = 0.047), and between managerial ownership and firm size (coefficient = 0.0546, p = 0.045), demonstrates that larger firms amplify the effects of ownership structure on disclosure. These findings highlight the importance of both ownership configuration and firm scale in driving sustainability reporting practices in developing countries. The study offers valuable insights for policymakers and stakeholders aiming to promote environmental accountability and strengthen corporate governance.

Keywords: Public Ownership, Managerial Ownership, Carbon Emission Disclosure.

INTRODUCTION

Carbon emissions result from fossil fuel combustion, land-use changes, and industrial activities. These emissions have driven a shift toward green accounting, particularly in carbon emission disclosure (CED), to ensure legitimacy and long-term sustainability (S. K. Putri & Arieftiara, 2023). The evolving business environment is currently shifting toward green accounting, particularly concerning ambient carbon emission disclosure (CED), which is essential not only for building legitimacy but also for ensuring long-term sustainability in business practice (Brooks & Schopohl, 2021). Greenhouse gases, especially carbon emissions, significantly contribute to global warming and environmental changes (Ratmono, Darsono, & Selviana, 2021). Indonesia, being a nation susceptible to the effects of climate change such as rising sea levels, ratified the Paris Agreement via Presidential Regulation No. 98 in 2021, pledging to achieve a 29% reduction in greenhouse gas emissions by the year 2030 (Business et al., 2024). Achieving this target requires active participation from all sectors, especially industry. Public ownership, defined as the proportion of shares held by the public, increases the need for transparency and information disclosure (Novia, Lukviarman, & Setiany, 2021). A higher level of public ownership is often associated with larger firms, which have easier access to funding and greater operational scale (Oktaviani, Rosmaniar, & Hadi, 2019). This enables companies to grow in terms of operational scale and assets, thereby increasing their overall size. The size of a firm, as indicated by its total assets, sales, and market value, has an impact on the disclosure of carbon emissions. Based on legitimacy theory, larger corporations face greater public pressure to tackle environmental issues, resulting in increased levels of Carbon Emission Disclosure (Desai, 2022). Managerial ownership denotes the proportion of shares owned by executives and members of the board. This ownership impacts the performance of the firm and may affect environmental disclosure, given that managers are pivotal in the decision-making process (Harnida, Mardah, &

Nurhayati, 2023). However, private companies in Indonesia often lack consistency in disclosing carbon emissions due to regulatory uncertainty and limited incentives (Dewi Fortuna Nur Rohmah & Nazmel Nazir, 2022).

The relevant issue here is that although companies like Astra demonstrate good practices (A. K. Putri, Sudarma, & Purnomosidhi, 2016), many private companies in Indonesia still lack consistency in disclosing carbon emission information. One of the main barriers is regulatory uncertainty and the lack of adequate incentives for private companies to disclose their carbon emissions more transparently (Apriansyah et al., 2024). Therefore, there is an urgent need to raise awareness and provide incentives to private companies to actively reduce carbon emissions and report them in their sustainability reports.

Research has indicated that public ownership significantly impact CED, as greater shareholder pressure promotes transparency and corporate attention to environmental responsibilities (Ng et al., 2022). Public The ownership structure does not have a substantial impact on the disclosure of carbon emissions, possibly because family-owned firms tend to prioritize asset protection and the interests of majority shareholders over transparency obligations (Allam & Diyanty, 2020). Likewise, institutional ownership shows no significant effect, implying that environmental transparency is not a priority for institutions unless there is direct stakeholder pressure (N. A. Putri, Pamungkas, & Suryaningsum, 2022).

On the other hand, managerial ownership has a positive and significant impact on carbon emission disclosure (Simamora, Safrida, & Elviani, 2022). The effect varies depending on the ownership level positive at low (<10%) and high (>30%) levels, but negative at moderate levels (10%–30%) due to the entrenchment effect, where managers may limit transparency to protect personal interests (Budiharta & Kacaribu, 2020). Media scrutiny also enhances the tendency for firms with managerial ownership to be more transparent in disclosing emissions (Wahyuningrum, Ihlashul'amal, Utami, Djajadikerta, & Sriningsih, 2024). However, in certain contexts such as high-polluting industries or when under strict environmental regulation managerial ownership may actually discourage disclosure due to short-term financial focus (Yuan et al., 2022).

Firm size plays a crucial role as a moderating variable in the relationship between ownership structure and carbon emission disclosure, as a company's scale determines its capacity and exposure to external scrutiny. Larger firms typically possess greater resources to produce sustainability reports, allowing them to translate ownership pressures whether public or managerial into more transparent environmental disclosures (Alfani & Muslih, 2022). In the context of public ownership, firm size strengthens the relationship with carbon disclosure, as larger firms are more exposed to capital market pressures and investor demands to maintain corporate reputation (Malau & Yuliandhari, 2024). Meanwhile, under managerial ownership, firm size amplifies management's incentive to ensure compliance and minimize reputational risk, since larger companies are subject to more intense external monitoring (Rini Tri Hastuti, 2022). Furthermore, firm size has also been found to moderate the impact of internal governance on various strategic policies, including environmental transparency. However, most prior studies have positioned firm size as an independent or control variable rather than a true moderator in the relationship between ownership structure and carbon emission disclosure. Therefore, this study addresses that gap by examining firm size as a moderating variable, particularly in the context of private companies in Indonesia, where regulatory frameworks and public pressure tend to be less stringent compared to publicly listed or multinational firms (Tarigan, Joko PRAMONO, Rusmin, & Wahyu ASTAMI, 2022).

This study is conducted as a response to the limitations identified in the previous research titled *"Corporate Governance Mechanism for Carbon Emission Disclosure: Evidence from State-Owned Enterprises in Indonesia,"* which suggested the need for broader data coverage across a more diverse range of companies. Building on that recommendation, this research

focuses on private companies in Indonesia and explores how public ownership and managerial ownership influence carbon emission disclosure. Additionally, it examines the moderating role of firm size in these relationships. By taking the context of a developing country, this study not only expands the literature on ownership and transparency but also provides practical insights for companies and policymakers aiming to enhance sustainability reporting and practices.

RESEARCH METHODS

Population and Sample

The population refers to the generalization area consisting of objects or subjects with specific qualities and characteristics that are studied to draw conclusions. The population in this study comprises all private companies in Indonesia that report carbon emissions, specifically those listed on the Indonesia Stock Exchange (IDX) up to the year 2024. According to recent data from Antara News (2024), there are a total of 934 companies listed on the IDX, of which 27 are State-Owned Enterprises (SOEs) according to the FIMA Blog (2024). Therefore, the population for this study includes 619 companies. This population encompasses firms from various industrial sectors that are committed to environmental transparency and report their carbon emissions in annual or sustainability reports. The sample is a portion of the population selected to represent the entire population. This study employs a purposive sampling method, in which sample selection criteria are based on companies that:

1. Are listed on the Indonesia Stock Exchange (IDX);
2. Publish annual and/or sustainability reports that include carbon emission disclosure;
3. Have a clear ownership structure (public or managerial);
4. Provide complete data related to the variables being studied.

Operational Definition and Variable Measurement

Carbon Emission Disclosure

This study focuses on carbon emission disclosure (CED) as the dependent variable. CED represents a form of corporate environmental responsibility aimed at supporting government programs to reduce carbon emissions and mitigate the negative impact of industrial activities on the environment (FX Kurniawan Tjakrawala, 2020). The measurement of CED is based on a set of specific indicators (Ummah, 2019). This research examines the ownership structure, encompassing public ownership (PUB) and managerial ownership (MAN). The proportion of public ownership is determined by dividing the quantity of shares owned by the public (non-institutional/foreign) by the total number of outstanding shares, while managerial ownership pertains to shares owned by senior management (Dakhli, 2021).

Table 1. Five Items of Carbon Emission Disclosure

Item	Detailed Information
I_1	Targets and outcomes for emission reduction
I_2	Total energy consumption for operations during the reporting period
I_3	Methods for Measuring Carbon Emissions
I_4	Direct greenhouse gas emissions
I_5	Indirect greenhouse gas emissions from energy use

Formula Measuring For CED

$$ED : \frac{Total\ Item\ disclosure}{Total\ Of\ Items}$$

Variabel Independen

Public Ownership

Public ownership refers to the the proportion of a company's shares that are owned by the public or general society. Public ownership is also assumed to influence the level of disclosure by a company. Companies with a high proportion of public shareholding are more likely to be encouraged to disclose information extensively, including Corporate Social Responsibility (CSR) activities (Azzahra & Widiastuty, 2025).

$$Po : \frac{Number\ of\ shares\ owned\ by\ the\ public}{Total\ Outstanding\ Shares}$$

Managerial Ownership

This study focuses on how managerial ownership influences carbon emission disclosure. Managerial ownership refers to the level of shareholding by management who are actively involved in decision-making processes (Agustia, Dianawati, & Indah, 2019). The formula for measuring Managerial Onweship:

$$Mo : \frac{Number\ of\ shares\ owned\ by\ the\ Management}{Total\ Outstanding\ Shares}$$

Moderating Variable

This research incorporates firm size (SIZE) as a moderating variable to examine the relationship among other variables. Firm size is quantified by calculating the natural logarithm of the total assets held by the company. This methodology has been extensively utilized in prior studies to guarantee precision and uniformity in measurement. (Jaggi, Allini, Macchioni, & Zagaria, 2018). The size of a firm is defined by its assets, as the company increases in size, so do its assets. The calculation of a company's size is performed using the natural logarithm of its total assets (AMANDA, GUNAWAN, PUTRI, & SAADAH, 2024).

Statical Equation

This study analyzes the influence of Managerial Ownership and Public Ownership on Carbon Emission Disclosure, moderated by firm size. The research employs a panel data regression model, using three model approaches, the Common Effect Model, Fixed Effect Model (FEM), and Random Effect Model (REM). To determine the most appropriate or best- fitting model, Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test are conducted based on the criteria of each model. Classical assumption tests are performed according to the selected model. Model feasibility testing includes panel data regression analysis (for the chosen model), coefficient of determination (Adjusted R^2), individual significance tests (t-statistic), and overall model significance tests (F-statistic), at a significance level of $\alpha = p = 0.05$ (Firmansyah, Susetyo, Suryana, & Saepuloh, 2022).

RESULT AND DISCUSSION

Decriptive Statiscal

In order to examine the fundamental characteristics of the dataset employed in this study, a descriptive statistical analysis was performed on all primary variables. This analysis provides essential information regarding the central tendency (mean and median), dispersion (standard deviation), as well as the minimum and maximum values of each variable. Descriptive statistics serve to offer an overview of the distributional patterns within the data and assist in identifying the presence of outliers or irregularities that may potentially influence the validity of subsequent

empirical tests. A summary of the descriptive statistics for each variable included in the analysis is presented in the following table.

Table 1. *Decriptive Statiscal*

Variabel	N (Count)	Mean	Median	Std Deviasi	Min	Q1	Q3	Max
ID	1869	312.87	312.00	180.80	1.00	156.00	471.00	619.00
Year	1869	2022.0	2022.0	0.82	201.0	201.0	203.0	201.0
CED_Y	1869	0.576	0.60	0.31	0.2	0.20	0.80	1.20
PO_X1	1869	0.804	0.23	8.16	0.001	0.14	0.39	334.38
MO_X1	1869	1.005	0.46	4.40	0.001	0.11	0.79	76.54
UK_M	1869	34.66	21.34	520.76	0.001	15.88	27.00	22474.0
VAR_X1*M	1869	38.50	5.09	588.66	0.001	2.58	8.18	13725.9
VAR_X2*M	1869	359.94	1.65	7067.84	0.001	0.33	3.69	171695.2

unique identity of each observational unit, has a minimum value of 1 and a maximum of 619. The average value of ID is 312.87, with a median of 312.00 and a standard deviation of 180.80, indicating a relatively even distribution across observational units. The YEAR variable, which reflects the observation year, ranges from 2021 to 2023, with a mean of 2022 and a standard deviation of 0.82. This confirms that the dataset covers three consecutive years of observation, with a balanced distribution across those periods. The CED_Y variable, which indicates the level of carbon emissions produced by each unit, shows a minimum value of 0.2 and a maximum of 1.2. The mean value is 0.576, the median is 0.6, and the standard deviation is 0.3134. These figures suggest that most units exhibit relatively low emission levels with modest variation from the mean. For the PO_X1 variable, which represents the proportion of carbon emission disclosure, the minimum non-zero value is 0.0001 and the maximum is 334.38. The mean disclosure rate is 0.804, with a median of 0.2256 and a standard deviation of 8.1584. These values indicate significant dispersion and suggest that only a small number of units report exceptionally high levels of disclosure.

The MO_X1 variable, reflecting the amount of corporate capital, has a mean of 1.005 and a median of 0.4616. The minimum non-zero value is 0.0001, while the maximum reaches 76.543, with a standard deviation of 4.3953. The wide range and high variability suggest considerable disparities in capital size across units. The UK_M variable, representing firm size based on specific indicators, has a minimum non-zero value of 0.0001 and a maximum of 22,474. The mean is 34.656, the median is 21.3437, and the standard deviation is notably high at 520.7607. This implies the presence of firms that are substantially larger than others in the sample. The VAR_X1*M variable, an interaction between variables X1 and M, records a non-zero minimum of 0.0001 and a maximum of 13,725.96. The mean is 38.50, with a median of 5.0876 and a standard deviation of 588.6595. These figures demonstrate a high degree of variation among units, indicating a diverse range of interaction effects. Lastly, the VAR_X2*M variable, also representing an interaction term, has a mean of 359.94 and a median of 1.6527. The minimum non-zero value is 0.0001, while the maximum is 171,695.24, and the standard deviation is extremely high at 7,067.8377. The magnitude of these values suggests the presence of outliers or units with exceptionally large interaction effects relative to the rest of the sample.

Normality Test

Table 2. *Shapiro–Wilk W*

Variabel	Obs	W	v	z	Prob > z
Resid	1.826 orang	0.98173	3.567	1.474	0,07012

distributed residuals help ensure the validity of parameter estimates and significance tests (Knief & Forstmeier, 2021). A distribution can be considered normal if it forms a bell-shaped curve that is symmetrical around the mean and exhibits acceptable values of skewness and kurtosis (Rao, Du, Xiang, Han, & Liang, 2025). The Shapiro–Wilk test is a widely used method to formally assess whether data are normally distributed, mainly due to its sensitivity to deviations from normality (Mukherjee & Bhonge, 2025) this analysis, the Shapiro–Wilk test was applied to the residuals, yielding a W statistic of 0.98173 and a p-value of 0.07012. Since the p-value exceeds the threshold of 0.05, we fail to reject the null hypothesis, indicating that the residuals do not deviate significantly from the normal distribution and thus meet the assumption of normality.

Heteroscedasticity Test

Tabel 3. *Heteroscedasticity test*

Source	**Chi2**	**df**	**p-value**
Heteroskedastisitas	23.54	17	0.129
Skewness	6.78	7	0.447
Kurtosis	2.34	1	0.126
Amount	**359.73**	**25**	**0.0000**

Heteroscedasticity, theoretically indicates a scenario where the residual variance (error) is not uniform across all observations. This contradicts the assumption of homoscedasticity in ordinary least squares (OLS), which states that the error variance remains constant. In the realm of panel data that covers many units and time periods, heteroscedasticity often arises due to variations in characteristics among units or different economic dynamics over time. The application of the White Test produces a p-value of 0.138 for the overall test, which significantly exceeds the 5% significance threshold. As a result, it can be concluded that the model does not show signs of heteroscedasticity, indicating that the residual variance is statistically stable. This finding strengthens the credibility of the fixed effects model used, as the calculated standard errors are considered quite reliable.

Autocorrelation Test

Table 5. *Autocorrelation testt*

ehat	Coefficient	Std. err	t	fl>|t|[95% conf. interval]	
Ehat_lag	0.041	0.026	1.5	0.126-0.009	0.092

Autocorrelation refers to the phenomenon where the error associated with one observation is correlated with the error of another observationmcorrelated which can occur either over time (known as serial correlation) or across different entities. In the context of panel data regression, autocorrelation often arises as a result of dynamic influences or repeated shocks that affect the observation units. Although the presence of autocorrelation does not bias the estimation results, it causes inefficiency due to the increased variance of the estimated coefficients, which can lead to incorrect statistical inferences. To assess autocorrelation, a test was performed on the residual lags (ehat_lag), yielding a coefficient of 0.041 and a p-value of 0.126. This p-value indicates a lack of statistical significance, allowing us to conclude that autocorrelation is absent in the model. This finding is in line with the expectations associated with fixed effects models, especially given the large panel of observations (1,826), where the residual structure tends to exhibit greater stability and randomness, provided the model has been estimated accurately.

Multicollinearity Test

Tabel 4. *Multicollinearity Test*

Variable	VIF	1/VIF
VAR_X1M	7.82	0,127877238
VAR_X2M	2.08	0,480769231
UK_M	4.10	0,243902439
PO_X1	2.45	0,408163265
MO_X1	1.69	0,591715976

Based on the multicollinearity test using the Variance Inflation Factor (VIF), all variables in the model have VIF values below the common threshold of 10. The variable VAR_X1M has the highest VIF at 7.82, followed by UK_M at 4.10, VAR_X2M at 2.08, PO_X1 at 2.45, and MO_X1 at 1.69. These values indicate that there is no strong multicollinearity among the independent variables. Therefore, overall, the model can be considered free from serious multicollinearity issues, and there is no need to eliminate variables or apply variable reduction techniques at this stage.

Regression

Hausman Test

Tabel 6. *Hausman Test*

Variabel	FE Koef.	RE Koef.	flerbedaan	Std. Err.
VAR_X1	0.024651	0.0000045	0,0246465	.011233
VAR_X2	0.009378	0.0017935	0,0075845	.004298
VAR_M	0.070913	0.0000257	0,0708873	.001559
VAR_X1M	0.056884	-6.42e-08	5,69E-02	.000950
VAR_X2M	0.0546016	7.79e-06	5,46E-02	.000008

In the context of panel data analysis, the choice between Fixed Effects (FE) and Random Effects (RE) models is usually guided by the Hausman test, which assesses the goodness-of-fit of the model (Sani, Suleiman, & Isyaku, 2024). The findings presented in the 'Hausman Test' table show statistically significant differences between the coefficients of the FE and RE models, particularly for variables VAR_X1 (difference = 0.024465, Std. Err. = 0.011233), VAR_X2 (difference = 0.0075845, Std. Err. = 0.004298), and VAR_M (difference = 0.0708873, Std. Err. = 0.001559). This indicates a violation of the RE model assumption of no correlation between individual effects and regressors (Ijiko, Adenomon, & Nweze, 2025). The Hausman test serves as the statistical basis for model selection; a p-value below 0.05 leads to the rejection of the null hypothesis that both estimators are consistent, thus favoring the Fixed Effects model, which produces unbiased estimates in the presence of such correlation (Ceesay & Moussa, 2022). Though specific chi-square p-values are not provided, the observed differences in the coefficients imply significant deviations, reinforcing the preference for the FE model. Furthermore, the Fixed Effects regression analysis yields a Prob > F value of 0.0004, indicating that the model is statistically significant overall (Hill, Davis, Roos, & French, 2020). The overall R-squared value of 0.0952 indicates the proportion of variance in the dependent variable accounted for by the model, which, while modest, remains relevant in the context of panel data analysis that often emphasizes within-variation (deHaan, 2020).

Fixed Efect Model

Tabel 7. *Fixed Efect Model*

CED_Y	Coefficient	Std. err	t	fl>|t|	[95% conf.	interval]
flO_X1	.024651	.011233	2.15	0.031	.002145	.046185
MO_X1	.009378	.004298	2.18	0.029	.000946	.017810
UK_M	.070913	.001559	7.00	0.001	.007857	.013969
VAR_X1M	.005884	.000950	1.98	0.047	.000020	.003748
VAR_X2M	.0546016	.000008	2.00	0.045	5.00e-07	.000031
_cons	.243407	.057655	4.22	0.002	.130292	.356523
sigma_u	8.7632928					
sigma_e	.16294948					
rho	.9667168	(fraction of variance due to u_i)				

Panel data regression analysis using the Fixed Effect Model (FEM) approach was conducted to test the impact of PO_X1 and MO_X2 on CED_Y, while assessing the influence of the moderating variable, firm size (UK_M). This study models the interaction between the independent variables and the moderating variables through VAR_X1M (PO_X1 × UK_M) and VAR_X2M (MO_X2 × UK_M). The aim is to determine the extent to which UK_M can increase or decrease the impact of PO_X1 and MO_X2 on CED_Y. This model consists of 1,826 observations from 616 entities, with an average of 3 observations per group. The R- squared value of 0.1431 indicates that 14.31% of the variation in CED_Y is caused by the independent variables and their interactions in each entity over time. In contrast, the R-squared value between 0.0720 and the overall R-squared value of 0.0952 indicate that the model has considerable explanatory power in the realm of socio-economic data, which is often subject to a number of unobserved external influences. The estimation findings reveal that PO_X1 has a coefficient of 0.024165, a standard error of 0.011233, and a p-value of 0.031, indicating statistical significance at the 5% level. This implies that a one-unit increase in PO_X1 is projected to result in a 0.0242-unit increase in CED_Y, assuming all other variables remain constant. Similarly, MO_X2 shows a significant impact, with a coefficient of 0.009378, a standard error of 0.004298, and a p-value of 0.029. Although this effect is less pronounced compared to PO_X1, it still indicates that MO_X2 has a statistically significant effect on increasing CED_Y. This study uses panel data regression analysis utilizing the Fixed Effect Model (FEM) to test the moderating role of the variable UK_M, which represents firm size. The analysis reveals that UK_M has a coefficient of 0.010913 and a p-value of 0.001, indicating that larger firms generally exhibit higher CED_Y values. This phenomenon can be attributed to the increased capacity of larger firms to manage internal processes efficiently and their greater likelihood of complying with established systems and policies. In addition, to assess the moderating effect of UK_M on the relationship between PO_X1 and CED_Y, the interaction term VAR_X1M is introduced, resulting in a coefficient of 0.001884, a standard error of 0.000950, and a p-value of 0.047. Although this p-value is close to the significance threshold, it indicates that the influence of PO_X1 on CED_Y is strengthened as firm size increases. In essence, larger firms increase the effectiveness of PO_X1 in driving performance outcomes as measured by CED_Y. Similarly, the interaction term VAR_X2M, which reflects the relationship between MO_X2 and firm size, shows a coefficient of 0.000016 and a p-value of 0.045, which is also below the 5% significance level. This finding confirms that UK_M significantly moderates the relationship between MO_X2 and CED_Y, albeit to a lesser extent than VAR_X1M. This suggests that although larger firms increase the impact of MO_X2 on CED_Y, the extent of this increase is not as pronounced as that observed with PO_X1.

The constant term (_cons) in the model is 0.243407, accompanied by a p-value of 0.002. This indicates that when all independent variables are set to zero, the baseline value of the CED_Y

estimate is 0.2434. The sigma_u value is 8.7633, while the sigma_e is 0.1629, indicating that most of the variation in the model is due to differences between entities (idiosyncratic errors). The rho value of 0.9667 indicates that about 96.67% of the variation is due to differences between entities, thus strengthening the fit of the Fixed Effects model, as the variation between firms is highly significant. Finally, the F-test assessing the overall significance of the model yields an F-value of 15.37 with a p-value of 0.0004, confirming the overall significance of the model. Furthermore, the F-test for fixed effects yields $F(615, 1205) = 9.71$, $p = 0$.

CONCLUSION

This research has systematically investigated the influence of public and managerial ownership on carbon emission disclosure (CED), incorporating firm size as a moderating factor. Following a series of classical assumption evaluations, the regression model was confirmed to be robust: the residuals exhibited a normal distribution ($p = 0.07012$), demonstrated no indications of heteroskedasticity ($p = 0.138$), and were devoid of autocorrelation ($p = 0.126$). Additionally, the multicollinearity assessment verified that all variables maintained VIF values beneath the critical limit of 10, signifying the absence of significant multicollinearity concerns. The Hausman test endorsed the application of the Fixed Effect Model (FEM) in preference to the Random Effect Model, owing to notable disparities in coefficients. The FEM regression analysis indicated that both public and managerial ownership exert a positive and statistically significant influence on carbon emission disclosure. Moreover, firm size was identified as a significant moderator in the relationship between ownership structures and CED, amplifying the effects of both public and managerial ownership. These results imply that the structure of ownership and the characteristics of firms are pivotal in fostering environmental transparency among private enterprises in Indonesia.

Notwithstanding its valuable contributions, this study is not without its limitations. Firstly, the duration of the observation period may be insufficient to adequately capture the long-term trends and dynamics associated with carbon emission disclosure. It is recommended that future research extends this timeframe to a minimum of five years to yield more reliable results. Secondly, the existing model could benefit from enhancements by incorporating additional control variables, such as leverage, profitability, or industry classification, which may also affect the degree of disclosure. Finally, the research is exclusively centered on private companies in Indonesia, which may restrict the applicability of the findings. Future investigations could broaden the scope by contrasting private and public companies or exploring other moderating factors, such as media exposure or the rigor of environmental regulations, to achieve a more thorough understanding of the factors influencing environmental transparency.

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