

Research Article

The Influence of Profitability, Leverage, and Company Size on Carbon Emission Disclosure

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Abstract: Carbon emission disclosure is increasingly important for companies in establishing legitimacy, enhancing stakeholder trust, and drawing public attention to sustainability issues. This study aims to examine how profitability, leverage, and company size affect carbon emission disclosure. The research is grounded in legitimacy theory and stakeholder theory, which provide the theoretical foundation for understanding corporate carbon disclosure behavior. The population of this study comprises energy companies listed on the Indonesia Stock Exchange (IDX) during the 2020–2023 period. The sample was selected using non-probability purposive sampling, resulting in 113 observations. Data were analyzed using SPSS with multiple linear regression techniques. The results indicate that profitability and company size have a positive influence on carbon emission disclosure, while leverage does not have a significant effect. Theoretically, the findings support the notion that profitability and company size drive carbon disclosure, in line with legitimacy and stakeholder theories.

Keywords: Carbon Emission Disclosure, Company Size, Leverage, Profitability

1. INTRODUCTION

Carbon emission disclosure has become an increasingly significant aspect of corporate responsibility in addressing environmental issues. Climate change, largely driven by global warming, is a critical environmental concern in recent years and is mainly caused by the release of greenhouse gases (GHGs), especially carbon emissions. Carbon emissions refer to the release of combustion-related gases containing carbon into the earth's atmosphere (Dewi et al., 2019). One major source of these emissions is industrial activity, particularly in the energy sector. According to the 2020 Greenhouse Gas Inventory Report for the Energy Sector, energy contributed the highest share of emissions in Indonesia—43.83%—compared to other sectors (Ministry of Energy and Mineral Resources, 2020).

This situation underscores the importance of carbon emission disclosure as a form of environmental accountability. Disclosure efforts reflect a company's commitment to reducing emissions (Rooschella & Sulfitri, 2023), help gain public legitimacy, and foster stakeholder trust. Ultimately, carbon emission disclosure enhances corporate reputation and responds to growing environmental awareness among stakeholders and the public.

Carbon disclosure gained significant attention following discussions of carbon neutrality and peak emissions at the 2020 UN General Assembly (Guo & Xu, 2022). In

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Indonesia, carbon disclosure was initially considered voluntary and a means to enhance corporate credibility (Florenca & Handoko, 2021). Over time, however, it became mandatory in public companies' sustainability reports, as regulated by OJK Regulation No. 51/POJK.03/2017 Article 10, which mandates public companies to submit sustainability reports beginning January 1, 2020 (Financial Services Authority, Republic of Indonesia, 2017). These reports must include environmental information, including carbon emissions, allowing companies to disclose the impact of their business operations on social and environmental aspects, particularly emissions.

Although such reporting has been mandatory since 2020, many public companies still fail to comply. A study by the Foundation For International Human Rights Reporting Standards (FIHRRST, 2024) found that only 121 public companies (16%) submitted sustainability reports. Of those, only 7% disclosed greenhouse gas emissions for scopes 1, 2, and 3; 27% for scopes 1 and 2; and 65% only disclosed scope 1. Scope 1 refers to direct GHG emissions, scope 2 to indirect emissions from energy use, and scope 3 to other indirect emissions. This reveals that carbon disclosure remains suboptimal. Disclosure intensity in the energy sector is also declining (Gisella & Permatasari, 2023). For example, PT Indo Tambangraya Megah Tbk. had the highest disclosure rate in 2020 based on GRI Standards, yet the level dropped from 53.40% in the previous year to 40.66% (Gisella & Permatasari, 2023). This indicates that energy companies are not disclosing carbon emissions fully according to GRI Standards.

Furthermore, according to Betahita (Wicaksono, 2023), some companies do not disclose all emission scopes, particularly scope 3, despite its importance. Scope 3 emissions often represent the largest proportion of a company's carbon footprint, including emissions from the supply chain and product use by consumers. These emissions are critical to stakeholder expectations and the legitimacy of corporate environmental performance.

According to Dowling & Pfeffer (1975), legitimacy theory explains the actions companies take to obtain, maintain, or regain societal acceptance. It highlights the dynamic relationship between corporations and the communities where they operate. Thus, legitimacy theory forms the basis for companies to report sustainability activities (Mahrani & Soewarno, 2018). Carbon emission disclosure aligns with this theory, as it allows the public to assess and ensure corporate activities align with social norms and values (Florenca & Handoko, 2021). This transparency helps stakeholders understand the environmental impact of corporate operations and monitor compliance.

Ambarwati (2022) found that companies with high levels of debt strive to maintain stakeholder trust and reputation. Accordingly, they tend to engage in activities beneficial to stakeholders, such as environmental responsibility initiatives. Investors and debtholders, like banks, increasingly demand carbon disclosure (Cohen et al., 2023). Banks now incorporate environmental considerations into their lending policies, encouraging companies to adopt sustainable practices, including carbon emission reporting (Hendratni et al., 2024).

Stakeholder theory (Freeman & McVea, 2001) emphasizes the importance of managing organizational processes to meet the needs of all stakeholders. Therefore, companies are expected to operate in alignment with stakeholder expectations.

Several factors influence the level of carbon emission disclosure, including profitability (Ferdinand et al., 2021). Profitability reflects a company's ability to generate earnings. Highly

profitable companies are more capable of investing in sustainability efforts, such as adopting eco-friendly technologies or funding emission reporting initiatives (Apriliana et al., 2019). For example, PT Adaro Energy Indonesia Tbk, one of Indonesia's most profitable energy companies (Putri & Sandria, 2022), achieved a Return on Assets (ROA) of 26.26% in 2022. This high ROA indicates that the company effectively utilized its assets, including allocating resources to carbon disclosure. The consistent publication of sustainability reports by PT Adaro Energy Indonesia Tbk from 2010 to 2023 illustrates how profitability can drive environmental transparency. High ROA often places companies in the public eye, prompting them to disclose carbon-related activities as part of their sustainability responsibility. This is especially critical in the energy sector, where operations typically involve large capital investments in fixed assets.

Company size can also affect carbon emission disclosure. Company size is the scale of large and small companies seen from the company's total assets. Large companies tend to get more pressure and attention from various parties, such as the public (Witri Astiti & Wirama, 2020). The greater the assets owned by a company, the higher the pressure to disclose company activities (transparency), including transparency in carbon emission disclosure. Companies with large assets tend to carry out more operational activities, which will result in greater carbon emissions. So the company will disclose sustainability reports as a form of responsibility. POJK Regulation 51/2017 Article 10 requires public companies to disclose sustainability reports which include carbon emission disclosures. The results of research by Desai (2022) and Andriadi et al. (2023) state that company size has a positive impact on carbon emission disclosure. Meanwhile, the results of research by Witri Astiti & Wirama (2020), which shows that company size has a negative impact on carbon emission disclosure.

Based on the description, it is stated that there is a research gap in previous studies which shows that there is inconsistency in research results. This study will examine the effect of profitability, leverage, and company size on carbon emission disclosure in energy companies in Indonesia. This study has differences with previous studies, namely, this study uses the energy sector and uses the 2020-2023 range in companies that disclose carbon emissions according to GRI Standards 305.

The determination of the energy sector in this study is because the energy sector is the sector with the largest carbon emissions in Indonesia and there was a decrease in the disclosure index according to GRI Standards 305 in 2020. The determination of 2020 as the starting year of this study is in accordance with the enactment of POJK 51/2017 Article 10 which requires public companies to disclose carbon emissions starting in 2020. The determination of the energy sector in this study is in line with the research suggestion by Florencia & Handoko (2021) which suggests using other sectors besides the mining sector. In addition, the research suggestion by Sandy & Ardiana (2023) which suggests using the mandatory reporting period after POJK 51/2017. This study also measures carbon emission disclosure with GRI Standards 305. GRI Standards are internationally recognized global best practices for reporting economic, environmental, and social impacts and are highly relevant to stakeholders (GRI, 2024). GRI Standards 305 is a standard that can provide disclosures related to the topic of carbon emissions. This is in line with the research suggestions by Apriliana et al. (2019) and Andriadi et al. (2023) which suggest using a measurement index other than CDP (Carbon, namely with GRI Standards 305. The use of GRI Standards 305 as an update for measuring

carbon emission disclosure because the disclosure indicators are more, namely 37 items compared to CDP, which is only 18 items.

2. RESEARCH METHODS

This study was conducted on energy sector companies listed on the Indonesia Stock Exchange (IDX) during the period 2020–2023. The selection of the energy sector is based on its contribution as the largest emitter of carbon emissions in Indonesia. Data were obtained from the official IDX website and the respective company websites, focusing on firms that disclosed carbon emissions in their sustainability reports using the Global Reporting Initiative (GRI) 305 (2016) standard. The object of this study is carbon emission disclosure, which is influenced by profitability, leverage, and firm size. The variables in this study consist of a dependent variable, namely carbon emission disclosure, and independent variables including profitability, leverage, and firm size.

Carbon emission disclosure was measured by assigning a score based on the GRI 305 indicators, where a score of 1 was given if the company disclosed a specific indicator and 0 if it did not. These scores were then used to calculate a disclosure index in percentage form. The population of this study includes all energy sector companies listed on the IDX during 2020–2023. The sample was determined using a non-probability sampling method with purposive sampling technique based on the following criteria: (1) the company remained listed until 2023, (2) disclosed carbon emissions in both sustainability and annual reports, and (3) applied the GRI 305 standard. The type of data used is quantitative in the form of numerical values and secondary data obtained from financial reports and sustainability reports. Data were collected using a documentation method by accessing the reports of the selected companies. Data analysis was carried out using SPSS software with the following stages: descriptive statistics, classical assumption tests (normality, autocorrelation, multicollinearity, and heteroscedasticity tests), and multiple linear regression analysis.

Descriptive statistics are used to describe data characteristics such as mean and standard deviation. The classical assumption test ensures that the regression model meets the validity requirements with normality tests (Kolmogorov-Smirnov), autocorrelation (Durbin-Watson), multicollinearity (VIF and tolerance), and heteroscedasticity (Glejser test). Furthermore, multiple linear regression analysis is used to test the effect of independent variables on carbon emission disclosure, with the regression equation: $CED = \alpha + \beta_1ROA + \beta_2DER + \beta_3UP + e$, where ROA is profitability, DER is leverage, and UP is company size. This analysis is complemented by the coefficient of determination (R^2) test, F test, and t test to measure the strength and significance of the relationship between variables.

3. RESULT AND DISCUSSION

Table 1. Descriptive Statistics Results of Research Variables

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation

Carbon Emission Disclosure	113	-0.31	0.50	0.1347	0.13537
Profitability	113	-0.46	0.57	0.358	0.13129
Leverage	113	-10.85	23.84	0.4825	2.63341
Company Size	113	2.12	12.96	10,1717	1.28886
Valid N (listwise)	113				

Source: Processed Data, 2025

Based on the results of the descriptive statistical test, the conclusions that can be drawn from Table above are summarized as follows.

1) Profitability (X1)

The profitability variable has a minimum value of -0.46 which is owned by PT Buana Lintas Lautan Tbk. and a maximum value of 0.57 which is owned by PT Bayan Resources Tbk. The profitability variable has an average value of 0.358, and a standard deviation value of 0.13129. A standard deviation value that is higher than the average value indicates that the distribution of profitability data in the companies studied is uneven or the difference between one data and another is relatively high.

2) Leverage(X2)

The leverage variable has a minimum value of -10.85 which is owned by PT Bumi Resources Tbk. and a maximum value of 23.84 which is also owned by PT Bumi Resources Tbk. The leverage variable has an average value of 0.4825, and a standard deviation value of 2.63341. A higher standard deviation value than the average value indicates that the distribution of leverage data in the companies studied is uneven or the difference between one data and another is relatively high.

3) Company Size (X3)

The company size variable has a minimum value of 2.12 owned by PT Petrosea Tbk. and a maximum value of 12.96 owned by PT Medco Energi Internasional Tbk. The company size variable has an average value of 10.1717 and a standard deviation value of 1.28886. The standard deviation value is lower than the average value indicating that the distribution of company size data in the companies studied is even or the difference between one data and another is not high.

4) Carbon Emission Disclosure (Y)

The carbon emission disclosure variable has a minimum value of -0.31 which is owned by PT Mitrabahtera Segara Sejati Tbk and a maximum value of 0.5 which is owned by PT Dian Swastatika Sentosa Tbk. The carbon emission disclosure variable has an average value of 0.1347 and a standard deviation value of 0.13537. The standard deviation value is higher than the average value indicating that the distribution of carbon emission disclosure data in the companies studied is uneven or the difference between one data and another is relatively high.

Classical Assumption Test Results

1) Autocorrelation Test

Table 2. Autocorrelation Test Results

Model Summaryb					
Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	Durbin-Watson
1	0.518 ^a	0.270	0.251	0.15677	0.693

- a. **Predictors: (Constant), Firm Size, Profitability, Leverage**
 b. **Dependent Variable: Carbon Emission Disclosure Source: Processed Data, 2025**

Based on Table 2, the results of the autocorrelation test obtained a dw value of 0.693. Based on the Durbin-Watson table with a significance level of 0.05 with the number of data (n) 114, and the number of independent variables (k) which is 3, the dU value is 1.7488 and the dL value is 1.6410. With the testing criteria being $dU < dw < (4-dU)$, the results of the autocorrelation test show that the dw value (0.693) is not between the dU value (1.7488) and the 4-dU value (2.2512). Based on these results, it can be interpreted that there are symptoms of autocorrelation.

Ghozali (2018: 125), stated that if a model experiences autocorrelation symptoms, then it can be treated through autocorrelation treatment. This treatment is carried out using the Cochrane-Orcutt method. After data transformation using the Cochrane-Orcutt method, there was one outlier data so that the number of samples used from 114 samples became 113 samples. The results of the autocorrelation test using the Cochrane-Orcutt method are presented in Table 4.3 as follows.

Table 3. Results of the Cochrane-Orcutt Method Autocorrelation Test
Model Summary^b

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	Durbin-Watson
1	0.490a	0.240	0.219	0.11964	2,019

a. Predictors: (Constant), Company Size, Leverage, Profitability

b. Dependent Variable: Carbon Emission Disclosure

Source: Processed Data, 2025

Based on Table 3, the results of the autocorrelation test obtained a dw value of 2.019. Based on the Durbin-Watson table with a significance level of 0.05 with the number of data (n) 113, and the number of independent variables (k) which is 3, the dU value was obtained as 1.7480 and the dL value was 1.6391. With the testing criteria being $dU < dw < (4-dU)$, the results of the autocorrelation test showed that the dw value (2.019) was between the value of two (1.7480) and the value of 4-dU (2.252). Based on the results after the Cochrane-Orcutt method was carried out, it can be interpreted that there are no symptoms of autocorrelation.

2) Normality Test

Table 4. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		113
Normal Parameters ^{a,b}	Mean	0.0000000
	Std. Deviation	0.11802346
Most Extreme Differences	Absolute	0.069
	Positive	0.041
	Negative	-0.069
Test Statistics		0.069
Asymp. Sig. (2-tailed)		0.200c,d

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.
- d. This is a lower bound of the true significance. Source: Processed Data, 2025

Based on Table 4, it is known that the Asymp. Sig. (2-tailed) value is 0.200. This figure shows that the significance value is 0.200.

> alpha (0.05) so it can be interpreted that the data is normally distributed.

3) Multicollinearity Test

Table 5. Multicollinearity Test Results

Model	Coefficients ^a	
	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
Profitability	0.893	1,119
Leverage	0.907	1,103
Company Size	0.929	1,076

a. Dependent Variable: Carbon Emission Disclosure Source: Processed Data, 2025

Based on Table 5, it can be seen that all variables have The tolerance value is greater than 10% and the VIF value is less than 10. It can be concluded that the regression model is free from multicollinearity.

4) Heteroscedasticity Test

Table 6. Heteroscedasticity Test Results

		Coefficients ^a				
Model		Unstandardized Coefficients		Standardize d Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.148	0.061		2,426	0.017
	Profitability	0.025	0.060	0.042	0.416	0.678
	Leverage	0.001	0.003	0.024	0.238	0.812
	Size	-0.006	0.006	-0.099	-0.998	0.320

pany

a. Dependent Variable: ABS_RES

Source: Processed Data, 2025

Based on Table 6, it can be seen that the Profitability variable has a significance value of 0.678, then the leverage variable has a significance value of 0.812, and the Company Size variable has a significance value of 0.320. These values indicate that all variables have values greater than 0.05, which indicates that there is no influence between the independent variables on the Absolute Residual. Thus, there are no symptoms of heteroscedasticity.

Multiple Linear Regression Test

Table 7. Multiple Linear Regression Test Results

		Coefficients ^a			t	Sig.
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta		
1	(Constant)	-0.274	0.92		-3,009	0.003
	Profitability	0.231	0.091	0.224	2,535	0.013
	Leverage	0.007	0.451	0.135	1,541	0.123
	Size	0.039	0.910	0.375	4,326	0,000
	Company					

a. Dependent Variable: Carbon Emission Disclosure

Source: Processed data, 2025

Based on Table 7, the unstratardized coefficients values from the results of the multiple linear regression test can be seen, which form the following equation.

$$CED = \alpha + \beta_1 \text{PROF} + \beta_2 \text{LEV} + \beta_3 \text{UP} + e \dots \dots \dots (6)$$

$$CED = -0.274 + 0.002 \text{PROF} + 0.007 \text{LEV} + 0.039 \text{UP} + e (7)$$

Information:

CED = Carbon Emission Disclosure **α** = Constant value

β_1 = Regression coefficient of profitability **β_2** = Regression coefficient of leverage

β_3 = Regression coefficient of company size **PROF** = Profitability

LEV = Leverage

UP = Company Size

e = Standard error.

Based on the results of multiple linear analysis, it can be seen that the constant (α) is -0.274 and the regression coefficients $\beta_1 = 0.0231$, $\beta_2 = 0.007$, $\beta_3 = 0.039$. Based on the regression model, it can be interpreted as follows.

- 1) The value of the constant (α) of -0.274 indicates that profitability (X1), leverage (X2), and company size (X3) are zero, then the value of carbon emission disclosure (Y) is -0.274. This means that if all independent variables are zero, there is a decrease in carbon emission disclosure of 0.274 units.
- 2) The profitability regression coefficient has a positive value of 0.231, meaning that if profitability increases by one unit, assuming other variables are constant, carbon emission disclosure will increase by 0.231.
- 3) The leverage regression coefficient has a positive value of 0.007, meaning that if leverage increases by one unit, assuming other variables are constant, carbon emission disclosure will increase by 0.007.
- 4) The regression coefficient of company size has a positive value of 0.039 units, meaning that if the company size increases by one unit, assuming other variables are constant, then carbon emission disclosure will increase by 0.039.

Coefficient of Determination Test

Table 8. Results of the Determination Coefficient Test

Model Summary

Model	R	R Square	Adjusted Square	R	Std. Error of the Estimate
1	0.490a	0.240	0.219		0.11964

a. Predictors: (Constant), Company Size, Leverage, Profitability Source: Processed data, 2025

Based on Table 8, it is known that the coefficient of determination is 0.240. This means that the ability of the independent variables in this study, namely profitability (X1), leverage (X2), and company size (X3) affects the dependent variable, namely carbon emission disclosure (Y) by 24%, while the remaining 76% is explained by other variables outside the research model.

Model Feasibility Test (F Test)

Table 9. Model Feasibility Test Results

ANOVA						
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.492	3	0.161	11,466	0.000b
	Residual	1,560	109	0.014		
	Total	2,052	112			

a. Dependent Variable: Carbon Emission Disclosure

b. Predictors: (Constant), Company Size, Leverage, Profitability Source: Processed data, 2025

Based on Table 9, the calculated F value is 11.466 with a significance level of 0.000. The significance level of 0.000 is smaller than the significance level of 0.05. This means that the profitability variables (X1), leverage (X2), and company size (X3) are suitable for predicting the carbon emission disclosure variable (Y).

Hypothesis Test (t-Test)

Table 10. Hypothesis Test Results

Coefficients ^a					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-0.274	0.92		-3,009	0.003
Profitability	0.231	0.091	0.224	2,535	0.013
Leverage	0.007	0.451	0.135	1,541	0.123
Size	0.039	0.910	0.375	4,326	0,000
Company					

a. Dependent Variable: Carbon Emission Disclosure

Source: Processed data, 2025

a) The Effect of Profitability on Carbon Emission Disclosure (H1)

The first hypothesis states that the higher the profitability, the higher the level of carbon emission disclosure. The significance value of profitability is 0.013 with a positive coefficient of 0.231. Since the significance value of 0.013 is less than 0.05, this indicates that H0 is rejected and H1 is accepted. This result means that the profitability variable has a positive and significant effect on carbon emission disclosure.

b) **The Effect of Leverage on Carbon Emission Disclosure (H2)**

The second hypothesis states that the higher the leverage, the higher the level of carbon emission disclosure. The significance value is 0.123 with a positive coefficient of 0.007. Since the significance value of 0.123 is greater than 0.05, this indicates that H0 is accepted and H1 is rejected. This result means that the leverage variable does not have a significant effect on carbon emission disclosure.

c) **The Effect of Firm Size on Carbon Emission Disclosure (H3)**

The third hypothesis states that the larger the firm size, the higher the level of carbon emission disclosure. The significance value is 0.000 with a positive coefficient of 0.039. Since the significance value of 0.000 is less than 0.05, this indicates that H0 is rejected and H1 is accepted. This result means that the firm size variable has a positive and significant effect on carbon emission disclosure.

4. CONCLUSION

- a) Profitability has a positive effect on carbon emission disclosure. This indicates that the higher the profitability ratio of a company, the more extensive its carbon emission disclosure.
- b) Leverage has no effect on carbon emission disclosure. In other words, the proportion of debt held by a company does not influence its decision to disclose carbon emissions.
- c) Firm size has a positive effect on carbon emission disclosure. This means that the larger the company, as measured by total assets, the more extensive the disclosure related to carbon emissions.

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