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THE EFFECT OF PROFITABILITY, LEVERAGE, SOLVABILITY ON CARBON EMISSION DISCLOSURE WITH COMPANY SIZE AS A MODERATING VARIABLE

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Abstract

Disclosure emission carbon become element important in accountability companies , especially in the sector contributing energy big to emission national research This analyze influence profitability , leverage, and solvency to disclosure emission carbon with consider size company as variables moderation and performance environment as variables Control . The results of the 2021–2024 data analysis show that profitability has a significant negative effect, while leverage and solvency have no effect. Company size weakens the effects of profitability and solvency, and strengthens the effect of leverage, although not as hypothesized. These findings suggest that carbon emission disclosure is driven more by external pressure and the need for legitimacy than by a company's financial characteristics.

Keywords: ***Leverage, Disclosure emotion carbon , Profitability , Solvency , Size company***

INTRODUCTION

Indonesia has source Power natural abundant , including forest covering an area of 94.1 million hectares or 50.1% of land in 2019 (Ministry of Environment and Forestry , 2020), however FAO (2019) noted lost around 50 hectares forest per day since 2007 which triggered damage ecosystem , loss diversity life , as well as increasing emissions and risks fire , so that confirm importance disclosure emission carbon as part from reporting environment (Solikhah et al., 2018). Although PSAK 1 (revised 2019) provides room for report environment , disclosure emission carbon Still nature voluntary (Sari et al., 2023), so that level openness companies vary greatly . Research previously show a number of factor like profitability , leverage, size , type industry , performance environment , governance , and structure ownership influence level disclosure (Dewi & Yasa, 2017 in Witri Astiti & Wirama , 2020), however difference findings push the need testing repeat . This study focus on the sector energy as contributor around 35% of emissions carbon national (LCDI, 2022) and using Agency Theory (Jensen & Meckling, 2012) to explain potential conflict between principal and agent consequence difference interests and asymmetry information asymmetry information , where the manager can act opportunistic for profit term short , so that bring up conflict agency (Dhea Kania Paramitha , 2020).

For minimize conflict agency , required monitoring and bonding mechanisms , one of which through disclosure relevant and transparent information . In practice , managers often act opportunistic through management profit , namely manipulation information finance with method accountancy certain factors . Factors such as profitability , leverage, solvency , and size company influence level disclosure emission carbon Because related with condition financial , pressure external , and demands accountability . In perspective theory agency , disclosure emission carbon become governance mechanisms the important one For reduce asymmetry information , pressing behavior opportunistic manager , and ultimately minimize conflict between agent and principal . For minimize conflict agency , required monitoring and bonding mechanisms , one of which through disclosure transparent information Because manager potential do action opportunistic like management profit . Financial factors like profitability , leverage, solvency , and size company participate influence level disclosure emission carbon Because related with pressure external and demands accountability . Solvency reflect ability fulfil obligation term long (Putri et al., 2024), and although high debt burden can hinder disclosure (Luo et al., 2012 in Putri et al., 2024), the company with solvency tall precisely the more pushed increase transparency so that assumed influential positive to disclosure emission carbon (H3).

Size companies also influence level transparency , where the company big more pushed do reporting sustainability (Abdul Rahman & Alsayegh, 2021; Sekarini & Setiadi, 2021), so that assumed weaken influence profitability , leverage, and solvency to disclosure emission carbon (H4–H6). In addition , the performance environment controlled Because reflect implementation principle sustainability and can influence its area disclosure emission carbon .

LITERATURE REVIEW

Indonesia has forest covering an area of 94.1 million hectares (Menlhk , 2020), however deforestation reaching 50 hectares per day (FAO, 2019) increases emission carbon and confirms urgency transparency environment . Disclosure emission carbon as part from environmental disclosure (Solikhah et al., 2018) still nature voluntary in Indonesia (Sari et al., 2023), so that level the reporting diverse and influenced awareness management as well as stakeholder pressure . Research previously show various factor like profitability , leverage, size company , type industry and governance influence disclosure environment (Dewi & Yasa, 2017 in Witri Astiti & Wirama , 2020), however findings regarding Carbon Emission Disclosure (CED) is still No consistent .

Energy sector chosen Because contributes 35% of emissions national (LCDI, 2022). In Agency Theory (Jensen & Meckling, 1976), conflict agency and asymmetry information can trigger behavior opportunistic like management profit (Paramitha , 2020), so that disclosure emission carbon become governance instruments For increase accountability . Findings related factor the determinant Still diverse : profitability can expand disclosure through availability source power (Pratiwi, 2018; Suhardi & Purwanto, 2015), however a number of studies show results on the contrary ; leverage can increase transparency Because pressure creditors (Cormier & Magnan, 2005) but can also limit reporting consequence debt burden (Brigham & Houston, 2019); solvency tall can inhibit (Luo et al., 2012 in Putri et al., 2024) or push disclosure ; size company tend increase transparency (Abdul Rahman & Alsayegh, 2021; Sekarini & Setiadi, 2021) however No always consistent between industry ; temporary performance environment participate influence its area disclosure (Maulidiavitasari & Yanthi , 2021; Wahyuningrum et al., 2024). In a way overall , literature show existence inconsistency findings related factors CED determinants and minimum research that focuses on the sector energy . Research This fill the gap with test return influence profitability , leverage, solvency , and role moderation size company against CED, with performance environment as variables control .

METHOD

Study This use approach quantitative with numerical data from report finance and sustainability company . The sample consists of from company sector energy listed on the Indonesia Stock Exchange (IDX) with data for the period 2021–2024, collected through the official BEI and company websites . Objects study is level disclosure emission carbon , whereas the subject companies that meet criteria data availability , using secondary data from the IDX. This study used purposive sampling, a method of selecting samples based on specific considerations or criteria established by the researcher. This sampling method is expected to produce a sample that is truly appropriate and representative of the research objectives.

Table 1. Sample

No	Sample Criteria	Does Not Meet the Criteria	Accumulation
1	Companies operating in the energy sector listed on the Indonesia Stock Exchange (IDX) during the 2021-2024 period.	-	72
2	Companies in the energy sector that consistently publish annual reports or sustainability reports for the 2021-2024 period, either through the official IDX website or the company's official website.	(38)	34
3	Companies in the energy sector that provide carbon emissions disclosure, either explicitly or implicitly, in their annual reports or sustainability reports at least once during the study period.	(13)	21
4	Companies in the energy sector that have participated in the Company Performance Rating Assessment Program (PROPER) issued by the Ministry of Environment and Forestry for the 2021-2024 period.	-	21
5	BEI delisted companies	-	21
	Research period (2021-2024)	-	4
	Total Sample	-	84

Source : Research Data , 2025

Study This use disclosure emission carbon as variables dependent , measured with the Carbon Emission Disclosure Index (CEDI) based on GRI 305, CDP, and Bae Choi et al. (2013), with score ratio of 18 disclosure item Variables its independence covering profitability (ROA), leverage (DER), and solvency (DAR). Size company made into variables moderation (Ln Total Assets), whereas performance environment as variables control measured through converted KLHK PROPER rating to ordinal score 5–1.

Table 2. Definition Variables Operational

Variables	**Type**	**Proxy**	**Indicator**	**Scale**
Carbon Emission Disclosure	Y	Carbon Emission Disclosure Index (CEDI)	Checklist based on *GRI (305) standards* , *CDP* , or research by Choi et al. (2013). CEDI = Number of items disclosed ÷ Total items (18 items)	Ratio
Profitability	X1	ROA (*Return on Assets*)	ROA = Net Profit ÷ Total Assets	Ratio
Leverage	X2	DER (*Debt to Equity*)	DER = Total liabilities ÷ Total equity	Ratio
Solvency	X3	DAR (*Debt to Asset Ratio*)	DAR = Total debt ÷ Total assets	Ratio
Company Size	M	Ln (Total Assets)	Size = Ln (Total Assets)	Nominal
Environmental Performance	K	PROPER KLHK	PROPER Rating (Gold, Green, Blue, Red, Black → changed to score 5–1)	Ordinal

Source: Research Data, 2025

The analysis process was carried out through multiple linear regression and Moderated Regression Analysis (MRA), so that the relationship between variables could be tested comprehensively.

CE_Disc : α + β 1 ROA + β 2 LEV + β 3 SOLV + β 4 (ROA x SIZE) + β 5 (LEV x SIZE) + β 6 (SOL x SIZE) + β 5 PROPER + e

Where :

α = Constant
β 1- β 6 = Regression Coefficient
CE_Disc = Carbon Emission Disclosure
ROA = Profitability
LEV = Leverage
SOLV = Solvency
ROA x SIZE = Interaction of profitability and company size
LEV x SIZE = Interaction of leverage and company size
SOLV x SIZE = Interaction of solvency and company size
PROPER = Environmental performance
e = Error

RESULTS AND DISCUSSION

Analysis Statistics Descriptive

Variables	Observation Data	Mean	Std. Dev	Min	Max
CED	84	0.628	0.181	0.666	0.888
ROA	84	2172	2840	1189	9972
LEV	84	0.372	0.171	0.352	0.790
SOLV	84	0.672	0.133	0.650	0.986
SIZE	84	2006	7577	2121	2962
PROPER	84	2,896	0.619	3,000	4,000

Source : Research Data , 2025

Descriptive results show level disclosure emission carbon (Y) average 0.62 (min 0.11; max 0.88), indicating part big company Enough active revealed . Profitability (X1) averaged 217.23 with variation high (–98.39 to 997.24), while leverage (X2) averaged 0.37 (0.13–0.79) and solvency (X3) averaged 0.67 (0.43–0.98) indicating more variations small between company . Size company (Z) average 200.62 (1.94–296.23), indicating variation significant and dominant company big , while performance relative environment (K) stable (average 2.89; 2–4). In general overall , the company energy own characteristics finance diverse However disclosure emission carbon relatively high , so that important For research influence profitability , leverage, and solvency with size company as moderation .

Assumption Test Classic

Normality Test

Jarque-Bera	Probability
1,518	0.468

Source : Research Data 2025

The Jarque-Bera Prob. value of 0.468, which is greater than 0.05, indicates that the data is normally distributed.

Multicollinearity Test

X1	X2	X3
1,000	-0.191	-0.191
-0.036	1,000	0.453
-0.191	0.453	1,000

Source: Research Data, 2025

The correlation value between X1 and X2 is –0.036, between X1 and X3 is –0.191886, and between X2 and X3 is 0.453. All of these values are well below the 0.80 limit, so it can be concluded that there is no multicollinearity problem among the independent variables in the model.

Heteroscedasticity Test

Variables	Coefficient	t-Statistic	Prob.
X1	7.91E	0.524	0.729
X2	0.069	0.347	0.629
X3	-0.208	-0.430	0.668

Source: Research Data, 2025

The probability values for variables X1, X2, and X3 each show numbers greater than 0.05. Because these values exceed the significance limit used, it can be concluded that the three independent variables do not experience heteroscedasticity. Therefore, the regression model is considered to meet the homoscedasticity assumption, making these variables suitable for use in further analysis.

Autocorrelation Test

Durbin-Watson	R-squared	Adjusted R-squared	Prob(F-statistic)
1,714	0.724	0.901	0.000

Source: Research Data, 2025

Test results show Durbin-Watson value of 1.916, which is close to number 2 and signifies that No happen autocorrelation . The R-squared value is 0.929, with an Adjusted R-squared of 0.901, indicating improvement model quality . The F-statistic value of 33.001 with Prob(F) = 0.000 confirms that the model is significant . Thus, the data is declared free of autocorrelation and meets the classical assumptions of multiple linear regression.

Hypothesis Testing
Coefficient of Determination Test (R2)

R-squared	Adjusted R-squared
0.963	0.947

Source: Research Data, 2025

The R^2 value of 0.963 indicates that 96.35% of the variation disclosure emission carbon explained by profitability , leverage, solvency , size company , and performance environment , while Adjusted R^2 0.948 confirms ability predictive fixed model high . This is shows the regression model own level very strong explanation .

F Test (Simultaneous)

F-statistic	Prob (F-statistic)
33,001	0,000

Source: Research Data, 2025

The F-statistic value of 33.00195, which is much higher than the F-table of 2.718785, and the Prob (F-statistic) value of 0.000000, which is less than 0.05, indicate that the overall regression model is significant. Thus, the independent variables are proven to have a simultaneous effect on the dependent variable.

Partial Test (t-Test)

Variables	Coefficient	t-Statistic	Prob.
X1	-8.45E	-2,540	0.016
X2	-0.333	-1,405	0.165
X3	-0.813	-1,257	0.221
X1Z	3.91E	2,327	0.025
X2Z	-0.008	-2,605	0.012
X3Z	0.004	2,630	0.010
K	0.101	0.017	0,000

Source: Research Data, 2025

Variable X1 shows t count –2.540 > t table 1.984 with significance 0.0162 < 0.05, so H1 is accepted and profitability influential significant to disclosure emission carbon . Although its influence No too strong , company still pushed disclose information environment For reduce potential conflict interests , in line with findings Adillah et al. (2025) and Suhardi & Purwanto (2015) that company profitable have more funds adequate For disclosure emission carbon . X2 variable shows a calculated t of –1.405 < t table of 1.984 with significance 0.1658 > 0.05, so H2 is not accepted and leverage is not influential significant to disclosure emission carbon . This is show disclosure more affected by pressure external like regulation , market, and reputation industry , in line with Adillah et al. (2025) and Ekonomi & Brawijaya (2025), although different with Claudia (2023) and Afrizal et al. (2023) who found influence positive leverage. Variable X3 has a calculated t of –1.257 < t table of 1.984 with significance 0.2202 >

0.05, so H3 is not acceptance and solvency No influential significant to disclosure emission carbon . This is show that even though ability fulfil obligation term long varies , company energy still consider issue environment . Findings This in line with Putri et al. (2024), however different with Wiratno & Muaziz (2020) who found influence positive . Variables The X1Z interaction has a calculated t of 2.327 > t table of 1.984 with significance 0.0253 < 0.05, so H4 is accepted . This result show size company moderate influence profitability to disclosure emission carbon , where company big more influenced pressure public and regulation than profitability high . Supervision from investors, creditors , government and society push management guard image and transparency , so that improvement profitability No always increase disclosure in a way proportional . Variables X2Z interaction has a calculated t of -2.605 > t table 1.984 with significance 0.0119 < 0.05, so significant , but hypothesis H5 is rejected Because direction coefficient strengthen , not weaken . This means that the size company precisely strengthen the effect of leverage on disclosure emission carbon , but influence This No Enough dominant . Although company big with high leverage get supervision strict from creditors (Dey et al., 2018), other factors such as regulations , demands industry , and reputation strategy more determine level transparency compared to that leverage Alone . Variables X3Z interaction has a calculated t of 2.630 > t table 1.984 with significance 0.0100 < 0.05, so H6 is accepted . The results show size company moderate with weaken influence solvency to disclosure emission carbon ; company with solvency tall tend increase disclosure more A little Because risk finance low and supervision decreased , while company with solvency low pushed For more transparent to reduce concern capital owners (Albertin Yunita Nawangsari, 2025).

CONCLUSION

Study This conclude that objective study has achieved with show that profitability influential negative significant to disclosure emission carbon , while leverage and solvency No own influence significant . In addition , the size company proven moderate connection between variables finance and disclosure emission carbon , with weaken influence profitability and solvency as well as strengthen leverage effect even though No in accordance with direction hypothesis . In overall , results This indicates that disclosure emission carbon in the company sector energy more Lots influenced by factors external and needs legitimacy compared to characteristics internal company finances

Study This own a number of limitations , including coverage samples that only limited to companies sector energy so that results study Not yet can generalized For all over industry . Variables research is still ongoing focus on indicators finance so that Not yet covers other potential non- financial factors influential strong to disclosure emission carbon . In addition , the assessment disclosure depending on the content the report presented company , so that No can fully describe practice true sustainability . Based on limitations said , research furthermore recommended For expand sample to cross sector so that the results become more comprehensive , adding non-financial variables such as governance , pressure regulation , or orientation sustainability company , as well as use method analysis more content comprehensive so that the measurement disclosure become more accurate and in-depth .

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