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Is Profitability Affected By Carbon Emission Disclosure?

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Abstract

So far, in testing the effect of carbon emission disclosure on financial performance, only using financial performance based on net income, there have not been many studies that specifically examine the effect of carbon emission disclosure on financial performance based on operating profit, comprehensive profit and attributable profit, even though these three profits are presented in the income statement. The purpose of this study is to test the effect of carbon emission disclosure on profitability based on operating profit, comprehensive profit, and attributable profit. The data for this study are secondary data from the annual reports and sustainability reports of companies listed on the IDX for the period 2019 - 2024, with a total of 2,960 observation data. Hypothesis testing uses multiple linear regression analysis. The results of the study indicate that carbon emission disclosure has a positive effect on profitability, as measured by ROA, operating profit, comprehensive profit, and attributable profit. The results of this study are consistent with the stakeholder theory that carbon emission disclosure is not only in the interests of the government and the environmentally conscious community, but also shareholders and creditors, because it has been proven to have an impact on profitability. The originality of this study lies in testing the effect of CED on three types of modified ROA formula profits, namely operating profit, comprehensive profit, and attributable profit.

Keywords: Carbon Emission Disclosure; Profitability; Operating Profit; Comprehensive Profit; Attributable Profit.

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Introduction

Indonesia is the lungs of the world, but on the other hand also contributes to environmental damage and global warming because it is the tenth country in the world and the first in Southeast Asia as a contributor of carbon emissions, with a carbon dioxide production volume in 2020 of 590 million tons (Ladista et al., 2023). Based on the Safutri et al., (2023) study it shows that the average disclosure of carbon emissions by companies in Indonesia is still relatively low, which is only 24%. Companies in Indonesia that contribute the most to the increase in carbon emissions are the industrial, transportation and electricity, and heat generation sectors.

The research of carbon emissions disclosure (CED) is important to study, because carbon emissions cause temperature increases and global warming, which will threaten environmental damage, the lives of living things, climate change, and ultimately also give rise to economic problems such as scarcity of biological raw materials, reduced purchasing power of the community. After all, livelihoods in the agricultural sector are affected by global warming, and the number of unemployed increases. One form of effort to reduce carbon emissions is energy efficiency through the use of renewable energy. Bose's 2024 in study proved that renewable energy consumption strengthens the positive influence of CED on the market value of the company. Disclosure of carbon emissions as a form of transparency of information to stakeholders and the implementation of good governance, which is represented in responsibility for the environment (Maryanti et al., 2025).

The challenges ahead for companies are getting bigger, and competition is inevitable. Future business competition requires companies to meet stakeholder expectations, including building a positive image to win the hearts of potential investors and product customers. Disclosure of carbon emissions is one of the ways to win business competition through positive public image and reputation, in addition to full awareness and a sincere form of responsibility for efforts to protect the future environment (Lee et al., 2023). The demand for carbon emission information by investors and customers is currently increasing, along with the increasing issues of sustainable economics (Cohen et al., 2023). Disclosure of carbon emissions in Indonesia is still limited to voluntary disclosure; however, companies that make this disclosure will have a positive reputation in the eyes of investors and customers, which will have an impact on the sustainability and welfare of the company (Maryanti et al., 2025).

A cross-country study with a sample of 6,600 companies by Borsuk et al. (2024) concluded that family companies are more committed to implementing the Paris Agreement related to CED. Family companies emit less carbon in their activities than non-family companies. This study also proves that the determinants of CED are the level of family control, governance structure, research and development burden, and ownership of green patents. Top management is female in banking sector companies in ASEAN (Saadah et al., 2024). Desai (2022), in his study in India, concluded that CED is influenced by profitability, leverage, company size, and market value. A study of top multinational companies in 32 countries showed that CED is driven by the country's political stability and the

effectiveness of the government's role through supportive regulatory policies (Oyewo et al., 2024).

Board leadership that shapes business strategy and environmental responsibility affects the level of carbon emission disclosure. Companies with a homogeneous board structure and CEOs who are overconfident in making risky decisions harm CED (Guo et al., 2024). Carbon emission disclosure has a positive effect on carbon emission performance as a form of sustainable economic development (Jiang et al., 2024). Carbon emission disclosure has a positive effect on profitability in China (Han et al., 2023), in Nigeria (Inegbedion, 2024). Carbon emission disclosure harms bond credit risk (Si & Zhang, 2025) and can reduce the cost of equity and business risk (Barg et al., 2024).

The results of research on the effect of carbon emission disclosure on financial performance have so far been inconsistent. Yasean & Ghassan (2021) in their study of 116 FTSE-indexed companies in the UK showed evidence that CED had a positive effect on ROA and ROE. Still in the UK FTSE, but with a larger sample of 977 companies and a longer period, Alsaifi et al., (2020) provides the same evidence, CED has a positive impact on ROA and ROE, and even has a positive impact on EPS and company value. Contrary to these findings, a study in the UK by Liu 2023 found evidence that ECD harms organizational performance. This negative impact is because decarbonization activities require large investments; the benefits are more felt in the long term, so in the short term, it causes profitability to decline. Meanwhile, according to research by Mazaya & Barokah (2022) and Safutri et al., (2023)Carbon emission disclosure does not affect financial performance. The Trumpp & Guenther (2017) study with 2,361 international firm-year observation data shows that CED does not affect profitability, company size, growth, and cash flow. A literature study by Sitompul et al., (2023) 22 articles that tested the effect of CED on the profitability of Scopus-indexed journal publications for the period 2016-2022 showed that 50% of articles concluded a positive effect, 27% a negative effect, 14% changed direction of effect in the long term, and 9% had no effect.

So far, research in testing the effect of carbon emission disclosure on financial performance has only used financial performance based on net income, there have not been many studies that specifically examine the effect of carbon emission disclosure on financial performance based on operating income, comprehensive income and attributable income, even though these three profits are presented in the income statement as items that are no less important than net income. The originality of this study is to test the effect of carbon emission disclosure on financial performance based on operating income, comprehensive income, and attributable income, not only on the measurement of ROA based on net income alone. Measuring financial performance by involving these three profit components is in addition to being in line with the development of accounting standards related to the presentation of income statements with three types of income, and also to identify the cost-benefit of carbon emissions, the cost of the company's carbon emission management activities is linked to the benefits received by the company. In addition, measuring financial performance is related to the company's ability to

survive in the future by optimizing the ability to manage assets in generating profits, in order to meet the expectations of all stakeholders' interests in the longer future period, and the existence of the company's going concern in the future.

The urgency of testing the effect of carbon disclosure on profitability based on operating profit is that environmental burdens, which include the burden of carbon emission management activities, are part of operating expenses, so knowing their relationship to operating profit (without involving non-operating expenses) is more in line with the matching concept. In line with IFRS 18, regarding changes in the contents of the income statement that tend to be more towards the presentation of operating profit items. Testing the effect of carbon disclosure on profitability based on comprehensive profit, the positive image of stakeholders on carbon emission management activities has an impact on the availability of cash, both from sales (customers who care about environmentally friendly products) and investors and creditors providing funding, who use environmental awareness information as one of the bases for investment decisions. This cash availability can be spent on productive assets by the company, whose measurement is based on fair value, which then affects comprehensive profit. Testing the effect of carbon disclosure on profitability based on attributable profit is that not all company investors are large investors with motivation as controlling shareholders, long-term investors with dividend motivation and control rights, but many potential investors are small investors in subsidiaries with short-term motivation in the form of returns on capital gains. ROA based on profit attributed to small investors in subsidiaries is in line with performance measurements that are more relevant to their interests. Especially if carbon emission management activities also occur in subsidiary entities, where their shares are in the subsidiary entity.

Academic benefits fill the gap in the literature on the influence of carbon emission disclosure on profitability based on ROA and ROE ratios using operating profit performance, comprehensive profit, and attributable profit, where the literature so far has mostly provided evidence of profitability using only net profit after tax. Benefits for management as input for developing a business strategy that balances more comprehensive financial performance and decarbonization performance that is integrated into business operations. Benefits for investors as a reference for the relationship between CED disclosure and performance measurement by considering the size of various types of profit.

Stakeholder theory (Freeman, 1984) underlies this study, that management carries out carbon emission management activities and discloses them transparently to other stakeholders as a form of responsibility and fairness to all stakeholder interests as a whole. Company management is not limited to optimizing business profits to meet its interests and shareholders, but also the interests of the wider community of the inhabitants of the universe by carrying out operational activities without damaging the environment, being responsible for carbon emission management, and disclosing it to the public with full awareness. Management provides a special budget for environmental burdens, including carbon emission management burdens. With the burden of managing carbon emissions, companies

can save production costs and ultimately have a positive impact on financial performance.

The legitimacy theory (Dowling & Pfeffer, 1975) is also the basis of this study, that management carries out carbon emission management activities and discloses them transparently to the public to gain legitimacy in the eyes of the public, especially product customers, fund providers, environmental NGOs, and the government. Management builds legitimacy in the eyes of the public, as management complies with the rules related to carbon emission management, complies with norms about environmental love, and, of course, meets the expectations of product customers who decide to buy products only from environmentally friendly products. The company also builds legitimacy in the eyes of fund providers who decide to invest their funds only in companies that care about the environment, especially awareness of disclosing carbon emission management. By gaining legitimacy in the eyes of customers and fund providers, it has a positive impact on financial performance.

Carbon emission accounting is the activity of recognizing, measuring, recording, assessing, presenting, and disclosing the carbon emissions management of an entity (Ladista et al., 2023). The term carbon emission accounting was first coined in the international agreement "Kyoto Protocol" in 1997 as a form of concern and responsibility for future environmental sustainability. The Kyoto Protocol was later clarified again as a form of international commitment to global damage in the "Paris Agreement" in 2015 by UN member countries, with the main target of zero emissions by 2050. The Indonesian government responded positively to this international agreement by issuing regulations in the form of Law No. 17 of 2004, Law No. 40 of 2007, Presidential Regulation No. 61 of 2011, and updated again in Law No. 16 of 2016 and technically stated in OJK Circular Letter No. 30/SEOJK.04/2016 and Presidential Regulation Number 18 of 2020 to optimize companies in Indonesia in reducing the impact of the greenhouse effect including the impact of carbon emissions. Although so far, the disclosure of carbon emissions in Indonesia is still voluntary (Madyan et al., 2024) or has not become a mandatory disclosure as in Japan, Australia, and several member countries of the European Union.

Company performance related to carbon emissions is the company's ability to manage activities that have an impact on carbon emission outputs, namely the efficiency of energy input and carbon-solid materials, which leads to minimizing the output of carbon emission expenditures, or how the company's ability to reduce carbon emission outputs from operational activities carried out by the company. Carbon emission disclosure (Choi et al., 2013) consists of 18 items grouped into five disclosure categories, namely: (1) Climate change category, consisting of two items explaining the company's risk of climate change, what steps have been taken by management regarding climate change, and the opportunities, challenges, and financial and non-financial impacts of climate change. (2) Carbon emission category, consisting of seven items describing the assessment and presentation of greenhouse gases. The assessment explains the calculation method, external verification of the calculation method, and the quantity of GHG emissions

produced. The presentation presents the scope, emission sources, facilities, and comparability between periods. (3) Energy consumption category, consisting of three items describing the company's consumption of energy, renewable energy, and energy consumption classification. (4) Greenhouse gas (GHG) disclosure category, consisting of three items describing the activity plan and emission reduction targets and the costs of emission reduction activities, and (5) Carbon emission accountability category, consisting of two items describing the responsibilities and monitoring mechanisms of top management related to mitigating the risk of climate change.

Profitability is one of the items measuring the company's financial performance. Profitability generally consists of three ratios, namely Return on Asset (ROA), Return on Equity (ROE), and Net Profit Margin (NPM) (Murdiyanto Ekonika). ROA reflects the ability of management to utilize its assets in order to generate profit. The formula is net profit after tax divided by total assets. Along with the development of accounting standards that affect the contents of the presentation of the income statement, namely the application of fair value accounting in assessing assets, the concept of profit has developed. Profit is not only net profit, but in the income statement, total comprehensive profit is also presented, or often simply called comprehensive profit (Ratih et al., 2025). This profit is the sum of net profit after tax with Other Comprehensive Income (OCI). OCI is unrealized earnings that arise because assets and liabilities are adjusted to the fair value of the recorded value (Kusuma, 2023). Some OCI items that are still unrealized earnings in the current period, in the next period change to part of net income because assets and liabilities have been realized by management, so even though in the current period the recognition, measurement and presentation are not related to net income and cash flow, when realized in the future, the OCI items in this group will affect net income and cash flow (Andriana et al., 2025). Therefore, ROA based on comprehensive income can predict future accounting information, such as cash flow (Kusuma, 2020), comprehensive income, net income (Kusuma, Zuhroh, et al., 2021), dividends (Kusuma & Agustin, 2023) and bankruptcy (Kusuma, 2024), which ultimately, comprehensive income has value relevance for users, because it can be used to measure performance, market response, profit quality (Buton), and affect company value (Kusuma, 2021b), the basis for investment decision-making (Kusuma, 2021a) and a reflection of accountability to all users (Kusuma, 2017). Conceptually, ROA comprehensive income is more in line with the theory of fair value accounting, because it brings together assets measured at fair value, with income that has been adjusted for the impact of fair value (Kusuma et al., 2025).

ROA operating profit is a ratio that measures the ability of assets to generate operating profit. Operating profit is profit that is more in line with the company's core business. Operating profit is profit that has excluded items outside the company's operational activities, such as other income and expenses, profits and losses outside of business, and income tax expenses (Athori & Kusuma, 2023). ROA operating profit is more appropriate for measuring the company's operational performance, because it only links income and expenses that are linear with the

company's main activities, such as net sales, cost of goods manufactured, and periodic operating expenses, both cash and accrual, and have been realized (Kusuma, 2016). Operating profit is more in line with changes in the income statement based on IFRS 18, which will be implemented in Indonesia in 2027. ROA operating profit is more in line with the cash flow of operational activities, and the combination of the two can be the right decision-making material if the focus of the assessment is only based on operations. Wahyudi et al., (2025) study shows that performance measurement based on operating profit has predictive power and information quality.

ROE attributable profit is a ratio that measures the ability of attributable equity to generate attributable profit (Kusuma, Assih, et al., 2021). This ROE measurement is more appropriate than conventional ROE because it only brings together aggregate profit and equity. Conceptually, ROE of attributable profit is more in line with entity theory, because it brings together equity attributed to the owners of the parent entity as controlling shareholders and owners of non-controlling entities as minority shareholders in the subsidiary, with profits that have been attributed to both owners (Kusuma & Agustin, 2024). A study conducted by Saymeh et al., (2019) showed that ROE based on attributable profit can be used for financial performance evaluation, has value relevance and predictive power, and minimizes type 1 agency problems between agents and principals and type 2 between controllers and non-controllers (Kusuma & Athori, 2023).

Profitability is affected by intellectual capital (Fristiani et al., 2020) and the profitability effect on company value (Fristiani, 2021; Harnovinsah et al., 2023). Profitability measurement based on ROA operating profit, ROA comprehensive profit, and ROE based on attributable profit can be used as an alternative to conventional profitability measurement that has been used so far on the basis of net profit after tax. Users can combine the four for decision-making materials, with the characteristics of each type of profit that are different, and all four have their advantages. The presence of comprehensive profit and attributable profit in the income statement adds to the work of independent auditors in measuring the fairness of presentation and minimizing audit risk due to the characteristics of comprehensive profit that is reactive to macroeconomic changes (Kusuma & Saputra, 2022), thus affecting external audit rates (Kusuma & Luayyi, 2024) and the time to complete the audit report (Agustin & Kusuma, 2024). The presence of comprehensive profit and attributable profit in the income statement also has the potential to be an arena for fraud (Kusumaningarti et al., 2025; Wahyudi et al., 2024), earnings management (Kusuma et al., 2022), tax avoidance (Kusuma & Rahayu, 2022) and income smoothing (Kusuma, 2021b).

Carbon emission disclosure improves the company's reputation in the eyes of the market, both customers and investors, and indicates that the company cares about the environment and complies with government regulations (stakeholder theory). Carbon emission management activities will have an impact on increasing operational costs, especially environmental costs, and its disclosure is a signal that the company cares about the environment and does not merely pursue economic profit, thus providing a guarantee of investment security in the future, especially

the minimal risk of the company receiving sanctions and public demands in the future in environmental management, especially carbon emissions. Carbon emission management activities and their disclosure to the public are also to gain support and increase the company's legitimacy in the eyes of the public, that the company cares about and participates in activities to maintain environmental sustainability and the form of implementation of public norms and agreements related to reducing carbon emissions in the company's production activities (legitimacy theory). By gaining legitimacy in front of stakeholders because of the fairness of interests to all stakeholders, it has a positive impact on financial performance, especially profitability, which is not only conventionally based on net profit, but also profitability based on comprehensive profit and attributable profit, so that the conceptual framework of this study is as follows:

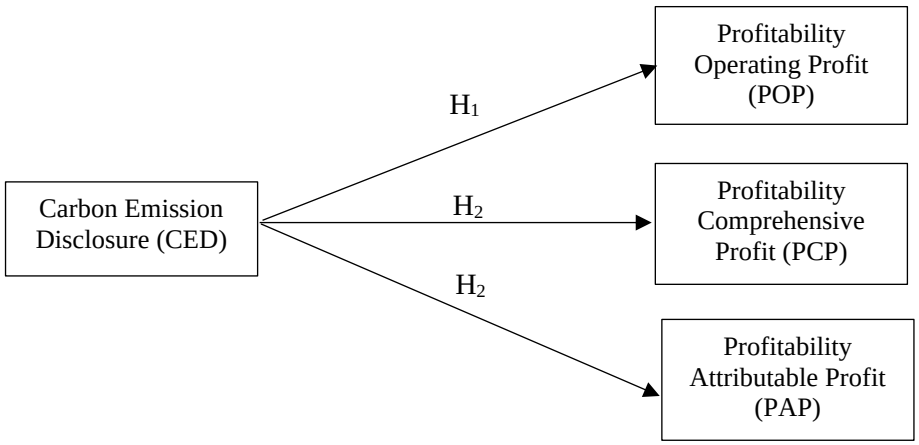

Figure 1. Conceptual Framework of Research

Carbon emission management activities are part of the environmental burden, and the environmental burden is part of the operational burden, so knowing the relationship between carbon emission management burden and operational profit without involving non-operational burden is considered more in line with the matching concept. In addition, this is also in line with IFRS 18 regarding changes to the contents of the income statement, which tends to prioritize and revise the classification of operational profit items. The study by Madyan et al., (2024) in Indonesia, it showed that carbon emission disclosure has a positive effect on market performance, ROA, and ROE. Senna & de Araujo Moxotó (2025) in their study of 73 companies in the Brazilian market for the 2021 period showed evidence that DEC has a positive effect on financial performance, which, in its measurement, uses RA, ROE, and earnings per share (EPS).

$H_{1.}$ Disclosure of carbon emissions has a positive effect on the profitability of operating profit.

Disclosure of carbon emission management activities by companies to the public, although voluntary and not required by accounting standards or other regulations, represents the seriousness of management towards environmental sustainability, natural ecosystems, and the sustainability of living things in the

future through handling carbon emissions and greenhouse gases. Customers and investors perceive companies as being environmentally conscious and responsible, not merely prioritizing profits at the expense of other important dimensions. A positive customer image leads to increased sales and profitability. A positive investor image leads to an increase in the company's value and has an impact on the company's financing performance, and reduces capital costs. Homroy (2023) in his study of 309 companies listed in the UK for the period 2007–2017 with 3,188 observation data concluded that the more complete and consistent the disclosure of carbon emissions by the company to the public, the higher its profitability performance, because the company is protected from negative information flows that influence investment decisions of market players which will have an impact on capital costs. This study also concluded that the efficiency of production costs due to decreased energy consumption contributed to the achievement of profitability performance. Athori et al. (2025) in their study in Indonesia proved that corporate sustainability performance, which includes environmental performance and carbon emission management activities, has a positive effect on corporate comprehensive performance as measured by ROA based on comprehensive income. Profitability and market performance have an impact on net profit performance and cash availability, and cash can be reinvested in productive assets. Productive assets are valued based on fair value, which has an impact on the achievement of comprehensive income. Thus, the hypothesis built in this study:

H_2. Disclosure of carbon emissions has a positive effect on the profitability of comprehensive income.

Not all corporate investors are large investors motivated by being controlling shareholders, long-term investors motivated by dividends and control rights, but many potential investors are small investors in subsidiaries with short-term motivations in the form of returns on capital gains. Profit-based ROA attributed to small investors in subsidiaries is in line with performance measurements that are more relevant to their interests. Especially if carbon emission management activities also occur in subsidiaries, where their shares are in the subsidiary. CED is a form of information transparency and strict supervision as an indicator of good governance implementation, especially at high carbon risks. Strict supervision as a representation of the effectiveness of supervision, concern for information rights and interests of all company owners, which ultimately leads to the quality of information provided by the company to the public, both annual financial reports and sustainability reports, and ultimately also minimizes the aggressiveness of audit reporting (Long et al., 2023). A study by Ibishova et al., (2024) with study of 2,768 companies in 36 countries showed that companies with carbon emission reduction policies have proven to be more capable of improving their financial performance, as both by ROE, whose formulated using equity attributed to the owners of the parent entity and owners of non-controlling entities. Ibishova et al., (2024) added that this positive influence is stronger, especially in companies with industrial sectors that have higher carbon intensity.

H_3. Disclosure of carbon emissions has a positive effect on the profitability of attributable profit.

Methodology

The data for this study are secondary data derived from annual reports and sustainability reports of companies listed on the IDX for the period 2019 – 2024, with a total of 2,960 observation data.

Table 1. Research Data

Description	2019	2020	2021	2022	2023	2024	Amount
Public companies that report financial statements and sustainability reports	94	158	615	661	712	757	2.997
Minus:							
Companies that do not disclose	(2)	(6)	(10)	(2)	(12)	(5)	(37)
					Observation data		2.960

The dependent variable of this study is profitability, which consists of three types of profit in the measurement of Return on Asset (ROA), namely operating profit as Y1.1, comprehensive profit as Y1.2, and attribution profit as Y1.3. The independent variable is carbon emission disclosure, with company size and leverage level as control variables. Measurement of research variables is as follows:

Table 2. Research Variables

Notation	Description	Measurement
$CED_{i,t}$	Carbon Emissions Disclosure (CED)	The number of carbon emission disclosure items divided by the total disclosure that should be 18 items in company i period t (Choi et al., 2013).
$POP_{i,t}$	Profitability based on Operating Profit (POP)	Return on Assets (ROA) operating profit, which is operating profit divided by the total assets of the company i period t.
$PCP_{i,t}$	Profitability based on Comprehensive Profit (PCP)	Return on Asset (ROA) comprehensive profit, which is net profit plus other comprehensive income, divided by the total assets of the company i period t.
$PAP_{i,t}$	Profitability based on Atrributable Profit (PAP)	Return on Equity (ROE) is attributable profit, which is profit attributed to owners of the controlling parent entity divided by total equity attributed to owners of the controlling parent entity of the company i period t.
$SIZE_{i,t}$	Company size	Natural logarithm of total assets of company i period t.
$LEV_{i,t}$	Leverage level	Debt to Equity Ratio (DER), which is the ratio of total liabilities divided by total equity of the company i period t.

The research model is as follows:

Model 1 : $POP_{i,t} = \alpha + \beta\ CED_{i,t} + \gamma\ SIZE_{i,t} + \theta\ LEV_{i,t} + \varepsilon_{i,t}$
Model 2 : $PCP_{i,t} = \alpha + \beta\ CED_{i,t} + \gamma\ SIZE_{i,t} + \theta\ LEV_{i,t} + \varepsilon_{i,t}$
Model 3 : $PAP_{i,t} = \alpha + \beta\ CED_{i,t} + \gamma\ SIZE_{i,t} + \theta\ LEV_{i,t} + \varepsilon_{i,t}$

The decision to accept or reject the hypothesis with the following criteria, H1

carbon emission disclosure has a positive effect on operating profit, is accepted if the coefficient β CED i,t in model 1 is positive with a significance below 5%. H2 carbon emission disclosure has a positive effect on comprehensive profit profitability, if the coefficient β CED i,t in model 2 is positive with a significance below 5%. H3 carbon emission disclosure has a positive effect on attributable profit, if the coefficient β CED i,t in model 3 is positive with a significance below 5%.

Model Robustness Test. This test is conducted to prove the robustness of the model by: 1) changing the measurement of the Profitability based on Operating Profit (POP) variable from the original ROA operating profit replaced by ROE (operating profit divided by total equity), 2) changing the measurement of the Profitability based on Comprehensive Profit (PCP) variable from the original ROA comprehensive profit replaced by ROE comprehensive profit, and 3) changing the measurement of the Profitability based on Attributable Profit (PAP) variable from the original ROE with profit and equity attributed to the owners of the controlling parent entity replaced by ROE with profit and equity attributed to owners with non-controlling interests (NCI). Additional testing was conducted by dividing the data into two classifications, namely 1) the period before the COVID-19 pandemic, 2) during and after the pandemic.

Result and Discussion

The following table presents the results of descriptive statistics and Pearson correlation analysis. The average value of ROA based on operating profit or POP is 0.034. The average value of ROA based on comprehensive profit or PCP is 0.026. The average value of ROA based on attribution profit or PAP is 0.018. The average value of the carbon emission disclosure ratio scoring is CED 0.444, or an average of disclosing 8 items out of 18 items. The average value of company size or SIZE is 6.617. The average value of the leverage ratio or LEV is 0.023.

Table 3. Results of Descriptive Statistics and Pearson Correlation Analysis

Variable	**Mean**		**Min**		**Max**	**SD**
Panel A. Descriptive Statistics Results						
POP	0.034		–0.016		0.038	11.161
PCP	0.026		–0.034		0.042	0.272
PAP	0.018		–0.023		0.027	3.383
CED	0.444		0.055		0.944	3.552
SIZE	6.617		3.587		12.018	2.494
LEV	0.023		0.011		0.043	6.505
Panel B. Pearson Correlation Analysis Results						
Variable	POP	PCP	PAP	CED	SIZE	LEV
POP	1	0.635***	0.518***	0.418**	0.614***	–0.016
PCP		1	0.418**	0.318**	0.512**	–0.025
PAP			1	0.307**	0.375**	–0.301*
CED				1	0.668***	0.001
SIZE					1	0.147*
LEV						1

***, **, * significant correlation coefficient at 1%, 5%, 10% level.

Source: Processed data.

The coefficient β CED i,t in model 1 is positive 0.416 (7.728)** with significance below 5%, thus H1 is accepted, carbon emission disclosure has a positive effect on operating profit. The coefficient β CED i,t in model 2 is positive 0.342 (7.208)** with significance below 5%, thus H2 is accepted, carbon emission disclosure has a positive effect on comprehensive profit. The coefficient β CED i,t in model 3 is positive 0.466 (7.036)** with significance below 5%, thus H2 is accepted, carbon emission disclosure has a positive effect on attributable profit.

Table 4. Result of Hypothesis Test

Variable	Coefficient, t count & p value		
	Model 1 $\mathbf{Y = POP_{i,t}}$	**Model 2** $\mathbf{Y = PCP_{i,t}}$	**Model 3** $\mathbf{Y = PAP_{i,t}}$
Constant	0.314	0.213	0.255
	(5.118)**	(5.791)**	(5.935)**
CED	0.416	0.342	0.466
	(7.728)**	(7.208)**	(7.036)**
SIZE	0.608	0.535	0.487
	(11.321)***	(11.913)***	(11.147)***
LEV	0.116	0.164	0.178
	(3.257)	(3.024)	(3.382)
F – Statistics	11.654***	9.124***	10.3587***
Adjusted R^2	0.6145	0.4081	0.3884

***, **, * significant regression coefficients at 1%, 5%, 10% levels.

Source: Processed data.

Model Robustness Test

The results of the model robustness test prove that the model still meets the eligibility to explain variations even though the measurement of the profitability variable is changed. This can be seen from the adjusted R2 value of model 1 of 67.1%, model 2 of 43.7%, and model 3 of 31.3% with the F-statistic of the three models significant at the 1% level.

Table 5. Result of Model Robustness Test

Variable	Coefficient, t count & p value		
	Model 1 $\mathbf{Y = ROE\ OP_{i,t}}$	**Model 2** $\mathbf{Y = ROE\ CP_{i,t}}$	**Model 3** $\mathbf{Y = ROE\ NCI_{i,t}}$
Constant	0.362	0.229	0.276
	(5.948)**	(5.848)**	(5.579)**
CED	0.537	0.314	0.458
	(7.159)**	(7.359)**	(7.804)**
SIZE	0.784	0.525	0.464
	(12.260)***	(11.460)***	(11.913)***
LEV	0.159	0.163	0.134
	(3.317)	(3.517)	(3.125)
F – Statistics	11.068***	9.620***	10.322***
Adjusted R^2	0.671	0.437	0.313

***, **, * significant regression coefficients at 1%, 5%, 10% levels.

Source: Processed data.

Additional Test

The results of additional tests show that in conditions before and during and after the pandemic, carbon emission disclosure still has a significant positive effect on three types of profitability, measuring profits, where in model 1 for Y = POPi,t the CED coefficient before Covid is 0.434 (7.453)** and after 0.473 (6.460)**. Model 2 for Y = PCPi,t the CED coefficient before Covid is 0.386 (7.790)** and after 0.309 (7.983)**. Model 3 for Y = PAPi,t the CED coefficient before Covid is 0.324 (7.431)** and after 0.488 (7.945)**.

Table 6. Result of Additional Test

Variable	Coefficient, t count & p value					
	Model 1 $Y = POP_{i,t}$		**Model 2** $Y = PCP_{i,t}$		**Model 3** $Y = PAP_{i,t}$	
	Before Covid	**Covid**	**Before Covid**	**Covid**	**Before Covid**	**Covid**
Constant	0.312 (5.232)**	0.371 (5.289)**	0.246 (5.57)**	0.212 (5.102)**	0.201 (5.219)**	0.256 (5.737)**
CED	0.434 (7.453)**	0.473 (6.460)**	0.386 (7.790)**	0.309 (7.983)**	0.324 (7.431)**	0.488 (7.945)**
SIZE	0.666 (11.647)***	0.655 (11.651)***	0.518 (11.923)***	0.587 (11.746)***	0.445 (11.652)***	0.491 (11.206)***
LEV	0.187 (3.958)	0.174 (3.832)	0.104 (3.156)	0.165 (3.54)	0.167 (3.873)	0.113 (3.42)
F – Statistics	11.906***	10.923***	9.237***	9.453***	10.839***	10.356***
Adjusted R^2	0.611	0.501	0.481	0.403	0.384	0.301

***, **, * significant regression coefficients at 1%, 5%, 10% levels.

Source: Processed data.

The Effect of Carbon Emission Disclosure on Profitability Based on Operating Profit.

ROA operating profit reflects the ability of assets to generate operating profit, where operating profit is profit that is more in line with the company's main operational activities without involving other activities outside the company's main operations. Measurement of profitability based on operating profit is free from bias elements that may arise from non-operating income and expenses that are not related to the company's core business. ROA operating profit is more appropriate in theory as a measure of income in the concept of matching income with expenses, because in companies related to energy and carbon, and greenhouse gas emission activities, everything related to it is included in the operational activity category. So it is more appropriate to consider carbon emission activities as operational activities, which are associated with ROA based on operating profit. Integration of decarbonization business strategies with zero carbon emission targets with production activities produces a series of more efficient production processes, product differentiation, and environmentally friendly product outputs, thereby increasing income, ROA, operating profit, and the company's competitive advantage in uniform business competition. The results of this study support the findings of Madyan et al., (2024) and Senna & de Araujo Moxotó (2025).

The Effect of Carbon Emission Disclosure on Comprehensive Profitability Based

on Income

CED has a positive effect on ROA and comprehensive income, because by disclosing carbon emissions, the company is protected from the risk of a negative image that affects the investment decisions of market players. CED also causes lower capital costs and increases the efficiency of operational costs as a result of reduced energy consumption and environmentally friendly production process operations. Investment decisions of market players due to positive perceptions, reduced capital costs, and operational cost efficiency will increase the availability of cash to be invested in productive assets that are profitable, both financially and have an impact on increasing production capacity. Productive assets based on the fair value theory that underlies the presentation of financial statements will be adjusted to fair value so that they have an impact on comprehensive income. The use of ROA comprehensive income as an alternative measurement of financial performance, in addition to being by the application of fair value accounting that underlies financial accounting standards, is also in line with the concept of ROA measurement, namely if assets are adjusted and valued at fair value, then the appropriate profit to be included in the ROA formula is comprehensive income, namely net income that has been added to the profit from adjusting the valuation of assets from historical costs, acquisition costs, and recorded costs to fair value. The positive influence of CED on profitability is in line with the findings of Homroy (2023) in his study on the UK market. It is also in line with the evidence provided by Athori Proaksi that sustainability performance, which includes environmental performance, has a positive effect on comprehensive profit.

The Effect of Carbon Emission Disclosure on Profitability Based on Attributed Profit

Attributed ROE reflects the ability of attributable equity to generate attributable profit, where this measurement is more appropriate than the ROE-based measurement of aggregate profit and equity. ROA based on profit attributed to small investors in subsidiaries is in line with performance measurements that are more relevant to their interests. Especially if carbon emission management activities also occur in subsidiaries, where their shares are in the subsidiary. The results of this study are in line with stakeholder theory, that CED reflects concern for all stakeholders' interests, including small investors in subsidiaries without control rights. Not all company investors are large investors motivated as controlling shareholders, long-term investors motivated by dividends and control rights, but many potential investors are small investors in subsidiaries with short-term motivations in the form of returns on capital gains. CED is a form of information transparency and strict supervision as an indicator of the implementation of good governance, especially at high carbon risks. Strict supervision as a representation of the effectiveness of supervision, concern for information rights and interests of all company owners, which ultimately leads to the quality of information provided by the company to the public. Companies with carbon emission reduction policies are more capable of improving their financial performance, as both by ROE, the formulation of which uses equity attributed to owners of the parent entity and owners of non-controlling entities. This positive effect is stronger, especially in companies with industrial sectors that have higher carbon intensity. The results of this study are in line with the evidence provided by

Athori et al., (2025) and Ibishova et al., (2024).

Conclusion

The purpose of this study is to test the effect of carbon emission disclosure on profitability based on operating profit, comprehensive profit, and attributable profit. The results of the study indicate that carbon emission disclosure has a positive effect on profitability, as measured by ROA, operating profit, comprehensive profit, and attributable profit. The results of this study are in line with the stakeholder theory that carbon emission disclosure is not only in the interests of the government and the environmentally conscious community, but also shareholders and creditors, because it has been proven to have an impact on profitability. The novelty of this study lies in testing the effect of CED on three types of modified ROA formula profits, if in the previous study ROA was only measured by net profit, in this study it was measured by operating profit, comprehensive profit, and attributable profit.

This study does not specifically test the relationship between CED and ROA and ROE based on industry type, so it is not yet known how much influence the two have on the industries that contribute the largest and lowest carbon emissions. Further research is suggested to test the effect of CED on comprehensive and attributable profitability by classifying industry types based on the highest and lowest carbon emission contributions. Management is advised to implement a business strategy that includes a carbon emission policy, because more empirical studies provide evidence that a business strategy with a carbon emission disclosure policy drives increased financial performance, both based on operational profit and alternative measurements with comprehensive profit and attributable profit. Investors are advised to use alternative financial performance measurements by involving not only conventional net profit, but also the ability of assets to generate operating profit, comprehensive profit, and attributable profit, to produce more appropriate investment decisions, especially regarding the company's concern for environmental issues, especially carbon emission disclosure.

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