

Carbon Tax, Environmental Costs, and Green Investment on the Profitability of Mineral and Coal Companies

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ABSTRACT

This study aims to determine the influence of carbon taxes, environmental costs, and green investments on the Profitability of Mineral and Coal companies listed on the Indonesia Stock Exchange (IDX) during the period 2021 to 2024. Applying a descriptive quantitative approach through purposive sampling techniques, this study processed 40 observational data using multiple linear regression analysis. The research findings show varied results and provide strategic insights. First, the Carbon Tax has proven to have no significant influence on profitability, considering that its implementation in Indonesia is still in the form of regulatory discourse (price shadow) so that it has not burdened the company's cash flow in real terms. Second, Environmental Costs have a significant positive effect on profitability, which confirms the validity of the Legitimacy Theory where environmental spending is able to strengthen public trust and operational stability.

INTRODUCTION

The mining sector on the Indonesia Stock Exchange has great potential in its contribution to economic development in Indonesia. The development and development of this sector has significant significance, both at the national and regional levels, due to the important role of mining companies as the main contributor to the country's foreign exchange (Aji & Kartika, 2023). However, the existence of this extractive industry is often faced with a dilemma between economic contribution and the impact it has (E. Asriana, R. Kumalawati, 2023). From a financial management perspective, profitability is a fundamental indicator that reflects a company's ability to generate profits from its assets. Return on Assets (ROA) as a proxy shows management efficiency in utilizing company assets to generate profits (Zahra, 2025).

However, the latest phenomenon in companies in the mineral and mineral sector in Indonesia shows that there is volatility in financial performance that is in the spotlight. Based on the 2023 audited financial statement data, a number of large issuers recorded a significant decrease in ROA after the commodity boom period. As valid empirical evidence, PT Bukit Asam Tbk (PTBA) experienced a sharp ROA correction from 28.17% in 2022 to 16.23% in 2023. This decline in profit-making capacity occurred in line with a decrease in net profit which reached 51% (year on year) even though coal sales volume actually increased by 13% to 37.0 million tons (PTBA Annual Report, 2023). Anomalies occur where sales volume increases but profitability decreases drastically, which indicates that the decline in profitability is not solely driven by the revenue side, but due to an escalation of operational cost burdens and structurally increasing compliance costs.

The decline in profitability in this sector is inseparable from massive external pressures related to the energy transition and climate change regulations. Global demands through the Paris Agreement and national commitments in the form of Net Zero Emission 2060 targets force mining companies to operate with much stricter environmental standards. Within the framework of Legitimacy Theory, companies will seek to align their operations with social norms in order to maintain the operating license (license to operate) from the community (Suchman, 1995). However, efforts to provide this legitimacy often require the sacrifice of large financial resources.

One of the external policies that affects the profitability of companies is the implementation of a carbon tax. The government imposes a carbon tax to reduce greenhouse gas emissions and encourage companies to switch to more environmentally friendly production processes. The imposition of this tax is regulated in Law Number 7 of 2021 concerning the Harmonization of Tax Regulations, with a rate of IDR 30,000 per ton of CO₂. The policy is intended to reduce carbon emission reductions, expand the use of clean energy, and support the achievement of national emission reduction goals (Indah Ayu Sastro, 2025).

In research by (Park et al., 2024), it is shown that carbon pricing policies in Korea are able to improve energy efficiency so that it has a positive impact on the energy profitability of companies. However, in the study (Oestreich & Tsiakas, 2024), it was found that the opposite is true, namely an increase in the cost of carbon emissions that can reduce the profitability of the mining sector. However, according to (Hakim & Sudibyo, 2025), it actually shows that a high carbon emission tax can reduce the ROA of mining companies.

In addition to carbon taxes, factors that can affect a company's profitability are environmental costs. Environmental costs are a sacrifice to maintain the sustainability of a company. Environmental costs will improve the reputation and can be a long-term investment of a company. This allocation of environmental costs can affect consumer perception of the company's quality and environmentally friendly products, thereby increasing consumer interest in buying. This will have an impact on increasing the company's sales turnover continuously, so that the company's profitability in the next period will increase (Fahira & Yusrawati, 2023).

In the study (Hapsari et al., 2021) and (Fahira & Yusrawati, 2023), it was found that environmental costs have a positive influence that can increase profitability because a good image in the eye community can make it easier for companies to carry out their operations. However, there is a difference from the research conducted by (Nur Azizah, n.d.), by finding that environmental costs have no effect on profitability in basic industrial entities and chemicals.

Another factor that can affect a company's profitability is green investment. Green investment is an investment strategy that considers environmental impact and environmental sustainability as a form of natural resource conservation, the use of renewable energy and other environmentally friendly activities of the company's operational activities. Companies that allocate a certain amount of costs to implement environmental preservation and management and achieve good environmental performance by implementing prevention of environmental pollution, will have an impact on increasing the company's value. The three (3) main components of green investment include low-emission energy supply, energy efficiency, and carbon sequestration. Companies that implement green investment strategies will gain legitimacy from stakeholders because the investments used are not only to prosper the community but also to protect the environment (Intan Novia Astuti, AAinul Rudha, 2025).

Green investment is a factor that can affect profitability because it is in line with the results of research conducted by (Khalid et al., 2023), which found that green investment has a positive impact on the profitability of Chinese companies listed on the Stock Exchange. On the contrary, research by (Farrash & Smolo, 2025), found that green investment has a negative effect on the profitability of oil and gas industry companies. However, the results of research from (Loissa, 2025), actually found that green investment has no influence on profitability in banks in Indonesia. Thus, green investments that are done properly and appropriately can provide competitive advantages if managed strategically. Based on the problems that have been described and there are differences in the results from

previous research, this study was conducted to re-examine the influence of carbon taxes, environmental costs, and green investment on profitability

LITERATURE REVIEW

Legitimacy Theory

This research is based on the Legitimacy Theory initiated by (Suchman, 1995). This theory assumes that the survival of a business entity is highly dependent on the "social contract" between the company and the society in which it operates. General legitimacy is defined as the perception that an entity's actions are desirable, appropriate, or appropriate within a socially constructed system of norms, values, and beliefs. Therefore, companies must maintain harmony with applicable social norms and regulations. If the company is considered not in line with the expectations of the public, then its legitimacy can be revoked at any time. Therefore, companies are obliged to comply with regulations and norms so that operational activities can run sustainably (Puspita & Indriyani, 2021).

Profitability

Profitability is a fundamental indicator for a company of the company's ability to generate a profit or profit (Janah et al., 2023). In this study, profitability is proxied by Return on Assets (ROA). The Ratio on Assets (ROA) shows a company's ability to make a profit from the assets it owns. If the level of profitability reported by the company is higher, then the expectations of interested parties such as investors, the government, and others will be higher than the expected level of return and compensation from the profits made (Susilo & Ina Nikmatul Chasanah, 2025). The calculation of the return on asset calculation is as follows:

$$\text{Return on asset (ROA)} = \frac{\text{Net Income After Tax}}{\text{Total Assets}} \times 100\%$$

Carbon Tax

The carbon tax in this study is a levy imposed on goods or services that produce carbon emissions. This instrument is a market-based policy tool to reduce greenhouse gas emissions through a carbon pricing mechanism (Judijanto, 2025). In the context of legitimacy theory, carbon taxes and the dissemination of information related to carbon emissions by companies are seen as a way to obtain, maintain, or restore legitimacy (recognition and consent) from the Society.

The Carbon Tax is one of the instruments of the Carbon Economic Value (NEK), the purpose of NEK is to change the behavior of economic actors to switch to low-carbon green economic activities. The government supports the target of reducing greenhouse gas emissions in the medium and long term, and encourages the development of the carbon market, technological innovation, more efficient, low-carbon and environmentally friendly investments, the concepts outlined in Presidential Regulation 98/2021, including the implementation of Carbon Economic Value (NEK) and Nationally Deterred Contributions (NDC) at the Ministry of Environment (MoEF) and the Steering

Committee for Carbon Values including the Coordinator of the field maritime and investment (Manri & Machdar, 2025).

From a corporate finance perspective, the carbon tax has two enablements. On the one hand, this policy can increase the company's operational costs in the short term. Rising production costs can reduce profitability and potentially depress company value, especially for high-emitting companies such as the energy, heavy manufacturing, and transportation sectors. However, on the other hand, if companies are able to adapt through technological innovation, energy efficiency, and the implementation of good environmental management, carbon taxes can actually be an opportunity to improve the company's reputation. Companies that are responsive to environmental issues usually receive positive assessments from markets and investors (Pariska, 2025).

H1: *Carbon tax has a positive effect on profitability.*

Environmental Costs

Environmental costs are expenses that arise as a consequence of declining environmental quality due to the company's operational activities. Allocating costs to anticipate potential environmental impacts is a challenge for companies. Environmental costs are still considered an element that reduces a company's profits. But on the contrary, companies that constantly allocate resources to environmental costs demonstrate their dedication to addressing environmental impacts. This step is able to increase public trust while supporting the creation of company legitimacy (CA Wicaksono, RI Adyaksana, 2025)

Environmental Costs Refers to the company's expenditures to prevent, improve, or overcome environmental impacts arising from operational activities (Annas Lalo & Muhammad Irwan Nur Hamiddin, 2021). This variable is based on the Theory of Legitimacy, since the company needs to demonstrate an ecological commitment to gain public support, through the costs incurred to align its operations with social norms and societal expectations. According to (Budiono & Handoko, 2025), environmental costs are a form of corporate investment to ensure long-term desires.

Legitimacy Theory explains that companies that demonstrate environmental compliance can increase public trust while reducing legal risks. Therefore, environmental costs are positioned as a form of the company's commitment strategy in maintaining operational extinction, where such expenditures can become an investment reputation that ultimately impacts stability and increased profitability.

H2: *Environmental costs have a positive effect on profitability.*

Green Investments

Such as heavy electrification equipment or the use of renewable energy. Green investment is an investment aimed at reducing emissions and pollution without disrupting the company's business activities. Such as heavy electrification equipment or the use of renewable energy. Although this investment lies in the cash flow of the investment in the current year, the long-term is very positive for the operating cost structure (Retnowati & Putri, 2024). Based on the Legitimacy Theory, companies need to make green investments (investments in environmentally friendly projects or technologies) to gain and maintain support from stakeholders.

Green investments that are done well and appropriately can provide competitive advantages if managed strategically. This shows that green investment not only serves as a compliance effort, but also as a long-term strategy that is able to drive innovation, energy cost efficiency, and increased corporate competitiveness amid the demands of the transition to a low-carbon economy.

The measurement of green investment variables refers to providing a ranking score from 1 to 5 according to the color rating obtained by the company in the PROPER (Corporate Performance Rating Assessment Program in Environmental Management) award. PROPER is a program created by the Ministry of Environment and Forestry of the Republic of Indonesia to encourage companies to improve their environmental performance through awards and recognition for companies that meet environmental standards.

H3: *Green investment has a positive effect on profitability*

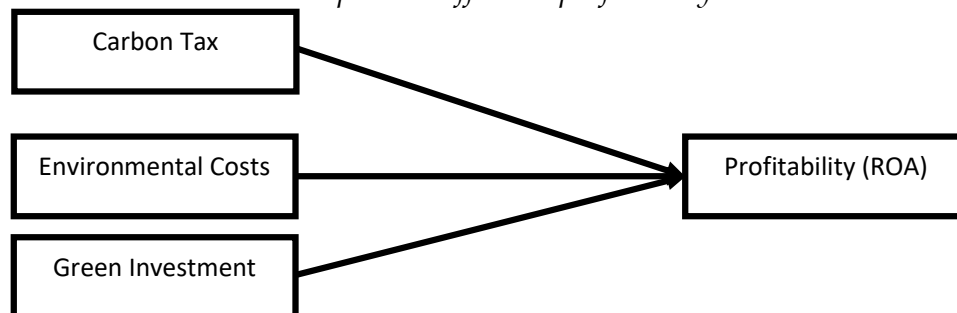


Figure 1. Conceptual Framework

METHODOLOGY

The data used in this study is in the form of numerical data and the analysis uses statistical analysis to test the causal relationship between the measured variables, so this study is included in quantitative research. The type of data is documentary data with secondary data sources obtained from the annual report and sustainability report published on the Indonesia Stock Exchange (IDX) website and also the company's website.

The population of this study is mineral and coal companies listed on the IDX in 2021-2024 which totals 85 companies. The research sample determined through the purposive sampling technique is manufacturing companies listed on the IDX and publish annual reports or sustainability reports in 2021-2024, a total of 10 companies. The companies are PT Alamtri Resources Indonesia, Tbk., PT Aneka Tambang, Tbk., PT Bayan Resources, Tbk., PT Harum Energy, Tbk., PT Vale Indonesia, Tbk., PT Indika Energy, Tbk., PT Indo Tambangraya Megah, Tbk., PT Resource Alam Indonesia, Tbk., PT Bukit Asam, Tbk., and PT Timah Tbk. These companies are engaged in mineral and coal mining. With a total observation period of 4 years, the total number of samples is $10 \times 4 = 40$.

The data analysis techniques used were descriptive statistical analysis and multiple linear regression analysis which were complemented by classical assumption tests, determination coefficient calculation (R^2), t test (partial hypothesis test), and F test (simultaneous hypothesis test).

RESEARCH RESULT

Descriptive Analysis

Table 1. Descriptive Statistics
Descriptive Statistics

	N	Minimum	Maximum	Red	Std. Deviation
Carbon Tax	39	-3.14	4.72	.8749	1.28213
Environmental Costs	39	-4.77	3.34	.9524	1.29355
Green Investments	39	-1.80	2.12	.1733	.71155
Profitability	39	-.20	.43	.0056	.12876
Valid N (listwise)	39				

Source: SPSS Secondary Data Process 3.1.0.2.0

Table 1 explains that the number of observations is 39. The average profitability value (ROA) is 0.0056, carbon tax is 0.8749, environmental costs are 0.9524, and green investment is 0.1733. The maximum value of profitability is 0.43, carbon tax is 4.72, environmental costs are worth 3.34, and green investment is worth 2.12. The minimum value of profitability is -0.20, carbon tax is -3.14, environmental costs are -4.77, and green investment is -1.80. The standard deviation value of profitability is 0.12876, carbon tax is 1.28213, environmental costs are 1.29355, and green investment is 0.71155.

Normality Test**Table 2. Kolmogorov-Smirnov Test One-Sample Test Results
One-Sample Kolmogorov-Smirnov Test**

			Unstandardize d Residual
N			39
Normal Parameters ^{a,b}	Mean		.0000000
	Std. Deviation		.11240367
Most Extreme Differences	Absolute		.104
	Positive		.104
	Negative		-.063
Test Statistic			.104
Asymp. Sig. (2-tailed) ^c			.200 ^d
Monte Carlo Sig. (2- tailed) ^d	Sig.		.343
	99% Confidence Interval	Lower Bound	.331
		Upper Bound	.355

Source ; SPSS Secondary Data Process 3.1.0.2.0

Based on the results of the normality test using the Kolmogorov-Smirnov test in table 2, it is declared to be normally distributed, indicated by the Asymp value. The 2-tailed sig. obtained is 0.200 which exceeds the significance limit of 0.05

Multicollinearity Test**Table 3. Multicollinearity Test Results****Coefficients^a**

Models		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Carbon Tax	.692	1.445
	Environmental Costs	.553	1.808
	Green Investments	.670	1.492

Source ; SPSS Secondary Data Process 3.1.0.2.0

The results of the multicollinearity test indicated that all independent variables did not experience multicollinearity problems with dependent variables indicated by a VIF value of less than 10 and a tolerance value of more than 0.10.

Autocorrelation Test

Table 4. Autocorrelation Test Results

Model Summary^b

Models	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.488 ^A	.238	.173	.11712	2.186

a. Predictors: (Constant), Green Investment, Carbon Tax, Environmental Costs

b. Dependent Variable: Profitability

Source ; SPSS Secondary Data Process 3.1.0.2.0

The results of the autocorrelation test showed that this study did not experience autocorrelation problems, with a Durbin-Watson (DW) value of 2.186. Based on the DW table for $k = 3$ and $n = 40$, the lower bound value (dL) is 1.3384 and the upper bound (dU) is 1.6589. Since the value of $DUA < DW < 4 - DU$ ($1.6589 < 2.186 < 2.3411$), it can be concluded that the regression model is free of autocorrelation. This condition indicates that the residual data is random and does not show a specific pattern, so the model used has better validity for hypothesis testing.

Heteroscedasticity Test

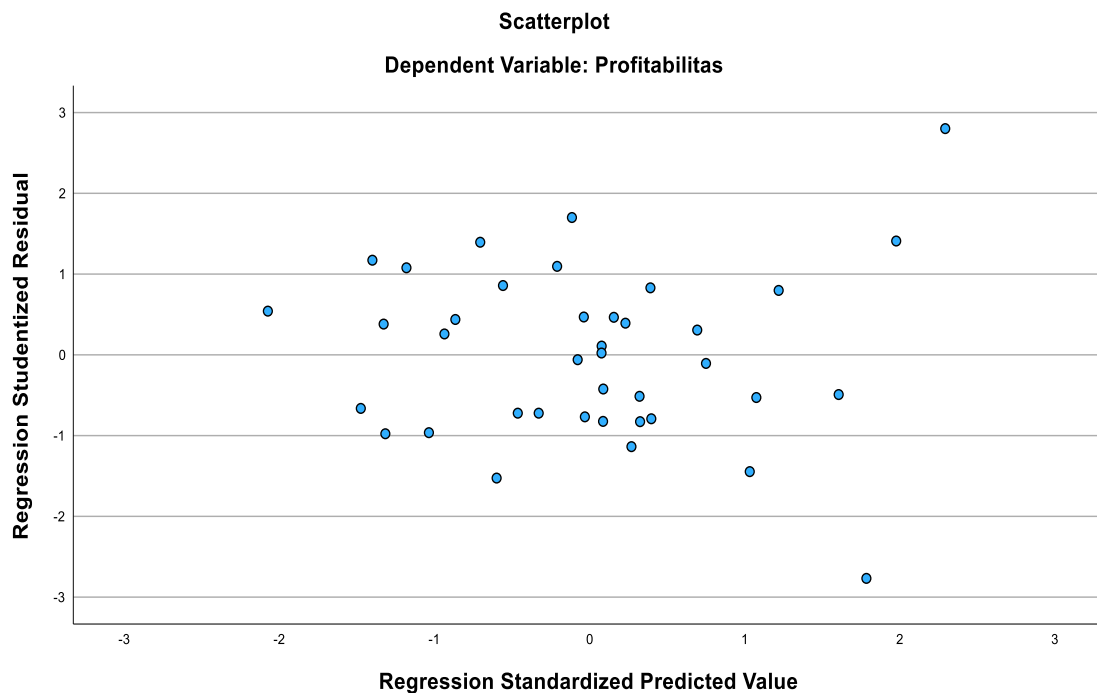


Figure 2. Heteroscedasticity Test Results

Source ; SPSS Secondary Data Process 3.1.0.2.0

The heteroscedasticity test based on the scatterplot graph above, shows that the dots on the graph are spread above and below the 0 line on the Y axis, so there are no symptoms of heteroscedasticity in this study.

Multiple Linear Regression Analysis**Table 5. Multiple Linear Regression Test Results****Coefficients^a**

Models		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.013	.025		-.507	.616
	Carbon Tax	-.021	.018	-.211	-1.187	.243
	Environmental Costs	.055	.020	.550	2.772	.009
	Green Investments	-.090	.033	-.496	-2.751	.009

Source ; SPSS Secondary Data Process 3.1.0.2.0

$$Y = -0.013 + -0.021 X1 + 0.055 X2 + -0.090 X3$$

Based on table 5, it can be explained as follows:

1. The Constant value obtained is -0.013. Therefore, it can be interpreted that if the independent variable is valued at 0 (constant), then the dependent variable is valued at -0.013.
2. The value of the Regression Coefficient of the Carbon Tax variable (X1) has a negative value (-) of 0.021. Therefore, it can be interpreted that if the variable of Carbon Tax (X1) increases, the variable (Y) will decrease, and vice versa.
3. The value of the Regression Coefficient of the Environmental Cost variable (X2) has a positive value (+) of 0.055. Therefore, it can be interpreted that if the Environmental Cost variable (X2) increases, then the variable (Y) will also increase, and vice versa.
4. The value of the Regression Coefficient of the Green Investment variable (X3) is negative (-) of 0.090. Therefore, it can be interpreted that if the Green Investment variable (X3) increases, the Y variable will decrease, and vice versa.

Partial Regression Coefficient Test (T Test)

Based on the results of table 2, several findings can be concluded as follows: First, the significant value t for the Carbon Tax variable of 0.243 is greater than 0.05 so that the first hypothesis (H1) is rejected. Carbon Tax has no effect on Profitability.

Second, the significant value t for the Environmental Cost variable of 0.009 is less than 0.05, indicating that the second hypothesis (H2) is accepted. This means that Environmental Costs have a positive and significant effect on Profitability. Third, the significant value of t for the Green Investment variable of 0.009 is greater than 0.05, indicating that the third hypothesis (H3) is accepted. Green Investment has a negative effect on Profitability.

Simultaneous Regression Coefficient Test (F Test)

Table 6. F Test Results

CHANGE^{TO}

Models		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.150	3	.050	3.642	.022 ^b
	Residual	.480	35	.014		
	Total	.630	38			

a. Dependent Variable: Profitability.

b. Predictors: (Constant), Green Investment, Carbon Tax, Environmental Cost.

Source ; SPSS Secondary Data Process 3.1.0.2.0

It is known that the Sig. value is 0.022 (<0.05). Therefore, it can be concluded that independent variables have a significant effect simultaneously (together) on dependent variables.

Coefficient of Determination Test (R²)

Table 7. Test Results (R2)

Model Summary^b

Model s	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.488 ^A	.238	.173	.11712	2.186

a. Predictors: (Constant), Green Investment, Carbon Tax, Environmental Costs

b. Dependent Variable: Profitability

Source ; SPSS Secondary Data Process 3.1.0.2.0

As a result of the R2 test, the R-square value was 0.173 or 17.3%. This indicates that independent variables can explain 17.3% of the dependent variables, while the remaining 83.7% are explained by other variables that are not included in this study.

DISCUSSION

Based on the results of the partial test (t-test), for the Carbon Tax variable (X1), a significance value of 0.243 (greater than 0.05) was obtained with a regression coefficient of -0.021. This shows that H1 is rejected, which means that the Carbon Tax does not have a significant influence on the Profitability (ROA) of companies in the mineral and mineral sector. These findings indicate that the simulation of carbon tax burden (Shadow Carbon Pricing) calculated based on actual emissions is not material enough to affect the current cost structure and net profit of mining companies. The results of this study are strengthened by the findings of (Hakim & Sudibyo, 2025) who found that the carbon tax has no effect on the profitability of the manufacturing industry because this policy has not been fully effectively implemented.

Based on the results of the partial test (t-test), for the Environmental Cost variable (X2) showed a significance value of 0.009 (less than 0.05) with a positive regression coefficient of 0.055. Thus, H2 is accepted, which states that Environmental Costs have a positive and significant effect on Profitability (ROA). These findings prove that the greater the costs allocated by mining companies for environmental management (such as land reclamation and waste management), the higher the company's ability to generate profits. This supports the Theory of Legitimacy, where companies that are responsible for the environment will gain acceptance (legitimacy) from the public and investors. This trust creates a positive image that supports smooth operations and minimizes social resistance, which ultimately improves financial performance. These results are consistent with research (Hapsari et al., 2021) and (Fahira & Yusrawati, 2023) which confirms that environmental costs have a positive effect on profitability.

Based on the t-test, the Green Investment variable (X3) has a significance value of 0.009 (less than 0.05) with a negative regression coefficient of -0.090. This shows that H3 is accepted, but with a negative direction of influence. This means that Green Investment has a significant negative effect on Profitability (ROA). These results indicate the presence of Trade-offs short-term. Green investment in low-emission or energy efficient technologies requires a very large amount of capital expenditure. In the short term, this expense will increase total assets or depreciation expense without being directly followed by an equivalent surge in revenue, thus depressing the ROA (Net Profit divided by Total Assets) ratio. Mineral and mineral companies are in a dilemma between maintaining short-term profitability or investing for long-term competitiveness. These findings are in line with research (Farrash & Smolo, 2025) In the oil and gas sector, which found that green investment had a negative effect on profitability due to the high initial cost of implementing green technology.

CONCLUSIONS AND RECOMMENDATIONS

The Carbon Tax has no significant effect on Profitability. This is because the carbon tax regulation in Indonesia is still in the socialization stage and technical implementation is delayed, so it has not provided a real financial burden that can correct the profits of mineral and mineral companies during the research period. Environmental Costs have a positive and significant effect on Profitability. These findings show that the allocation of costs for environmental responsibility is not an adverse burden, but rather a social investment that increases legitimacy and good name in the eyes of the public, which ultimately has a good impact on the company's financial performance.

Green Investment has a significant negative influence on Profitability. This can be interpreted as the transfer of capital to low-carbon technologies requires a very large initial investment cost (capital expenditure). In the short term, the magnitude of this depreciation and capital costs depress the value of the ROA before long-term efficiency is achieved.

Simultaneously, Carbon Taxes, Environmental Costs, and Green Investments have a significant influence on Profitability. So, it can be interpreted that sustainability and climate policy aspects collectively are crucial factors in determining the financial performance of mineral and mineral companies in the era of energy transition.

ADVANCED RESEARCH

Future research is recommended to expand the scope of variables by including environmental performance, corporate governance, renewable energy adoption, and sustainability disclosure to obtain a more comprehensive understanding of factors affecting company profitability. Further studies are also encouraged to involve broader industrial sectors and longer observation periods in order to examine the long-term impact of carbon taxes and green investments on corporate financial performance. In addition, the use of alternative analytical methods such as panel data regression or moderating variable analysis may provide deeper insights into the relationship between environmental policies and business sustainability.

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