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Environmental Risk and Oil Prices Uncertainty: A Threat to Firm Profitability?

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Abstract
In today's era of global challenges, profitability remains a key indicator of corporate success. However, environmental risk and volatile oil prices have become critical factors affecting business performance, particularly in resource-intensive sectors. This study examines the influence of environmental costs and oil prices on profitability. The study targets companies in the energy and basic materials sectors that were listed on the Indonesia Stock Exchange (IDX) between 2021 and 2023. The study uses panel data regression with a random effects model to examine the relationships among the variables. The results indicate that environmental costs and oil prices have a positive and significant impact on profitability. These outcomes reveal that environmental responsibility and external economic factors, such as oil prices, are crucial in shaping financial performance. The study provides firms with insights for managing sustainability strategies and offers policymakers perspectives to strengthen regulations that support sustainability and energy market stability.

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1. Introduction

Profitability is more than just a financial metric; it represents a company's ability to thrive amid economic and operational challenges. In today's dynamic business environment, profitability serves not only as a benchmark of performance but also as a signal for stakeholders in evaluating a company's sustainability and competitiveness (Ramlawati *et al*., 2022) [13]. Differences in profitability across firms can be attributed to varying levels of innovation, growth strategies (Bloch & Zhou, 2024) [4], and external conditions, such as market volatility and environmental pressures (Spitsin *et al*., 2020) [4].

Environmental risks have become a significant concern for businesses aiming to maintain or improve their profitability. Climate change, pollution, and resource depletion disrupt operations, damage supply chains, and lead to financial losses (Network for Greening the Financial System, 2020; Oyebanji *et al*., 2024) [11]. In Indonesia, industrial activities have contributed to environmental degradation due to the overuse of fossil fuels and inefficient resource management. According to the Ministry of Environment and Forestry and Greenpeace Indonesia, critical issues include poor waste management, water and air pollution, and rising industrial emissions, which collectively threaten long-term ecological and economic sustainability

To address these concerns, businesses are adopting sustainable practices, which is environmental cost, which reflects a company's commitment to sustainability. Spending on pollution control, environmental restoration, and green technologies is not only an ethical necessity but also a strategic investment (Widjaya & Nursiam, 2024) [17]. Proper environmental cost allocation enhances reputation, attracts investors, and can improve profitability. The Indonesian government reinforces this through regulations requiring environmental costs to be factored into production expenses, underlining their strategic importance.

Additionally, oil prices as a major global economic indicator directly affect operational costs in energy-intensive industries. Indonesia, as the largest oil consumer in Southeast Asia, is highly exposed to oil price fluctuations. These fluctuations can significantly impact companies' cost structures, pricing strategies, and ultimately their profitability (Amin & Rehman, 2022) [3]. Global events such as geopolitical conflicts and post-pandemic recovery have caused major swings in oil prices, making this variable critical for business planning and risk management (Kementerian Energi dan Sumber Daya Mineral, 2022; Troderman, 2022) [9, 15].

Given the complexity and relevance of these factors, this study investigates the influence of environmental costs, and oil prices on profitability in energy and basic materials companies listed on the Indonesia Stock Exchange. By analyzing these relationships, this research aims to offer strategic insights for businesses, policymakers, and investors in promoting financial performance.

2. Methods

The study's quantitative research design is for the examination of the influence of environmental costs and oil prices on firm profitability. The dependent variable is profitability. Environmental costs and oil prices are the independent variables, and firm size is the control variable.

1. Sample

The population of this study consists of companies in the energy and basic materials sector. These companies are listed on the Indonesia Stock Exchange (IDX). The period of the study is from 2021 to 2023. These sectors were chosen due to their significant environmental impact and high dependence on oil as an energy source or raw material. The sample was selected using purposive sampling with the following two criteria: First, companies must have published annual and sustainability reports consecutively for 2021–2023. Second, companies must have consistently disclosed environmental cost data during those years. This study used 243 samples from the existing population.

2. Variable and Model

Environmental Cost

Environmental costs refer to expenditures made by an entity or company in the context of managing environmental aspects and fulfilling responsibilities for environmental impacts arising from its operational activities. Environmental costs are measured from the total environmental costs disclosed by the company (Jo *et al*., 2016).

Oil Prices

Data of oil prices is obtained from the Energy Information Administration (EIA) for the period 2021-2023 (Wattanatorn & Kanchanapoom, 2012) [16]

Firm Size

The way the company runs its operations is affected by its size. Large companies are believed to have higher productivity and be more advanced in technology, labor, and capital accumulation, so they are considered more productive than small companies. The total assets and total employees of these companies will be used as control variables in the analysis (Hashmi *et al*., 2020) [6]

3. Results and Discussion

Statistic Descriptive

The following table presents the resulting statistics for the variables.

Table 1: Statistic Descriptive

	Profitability	*ln* (Environmental Cost)	Oil Prices	*ln* (Total Assets)	*ln* (Total Employee)
Mean	0,07	5,39	84,76	8,81	2,91
Maximum	0,60	7,91	100,93	12,97	4,48
Minimum	-0,20	2,40	70,86	2,04	0,46
Std. Dev	0,12	1,16	12,40	1,37	0,70
Observation	243	243	243	243	243

Based on the statistical results obtained by the company during the research period, there is evidence of financial losses and wide variations in return on assets (ROA) among different companies. These findings suggest that profitability levels differ significantly between firms, likely due to variations in operational efficiency, strategic decision-making, or industry-specific factors.

Environmental costs also vary considerably from one company to another. These discrepancies can be attributed to several factors, including the scale of each company's operations and the environmental strategies they implement. Companies with larger operations naturally incur higher environmental costs, while those with proactive sustainability strategies may have different cost structures.

Additionally, oil prices fluctuated significantly between 2021 and 2023. These price movements were largely driven by the lingering effects of the pandemic and ongoing geopolitical tensions. These external shocks disrupted global oil supply chains and altered demand patterns, causing instability in the oil markets. The observed market volatility reflects the dynamic interplay between supply and demand during this period.

Regression Result

Table 2: Regression Test

Variables	Coefficient	Std. Error	t-Statistic	Prob
C	-0,2149	0,0775	-2,7709	0,0062
ln(environmental cost)	0,0211	0,0103	2,0403	0,0424
Oil prices	0,0008	0,0003	2,2876	0,0230
ln(total assets)	0,0102	0,0068	1,4940	0,1365
ln(total employee)	0,0130	0,0156	0,8388	0,4024

The results of the regression can then be described as follows

1. Preliminary findings from the regression analysis suggest a positive relationship between environmental costs and profitability. From the perspective of signaling theory, the information disclosed by a company regarding environmental costs can serve as a signal of credibility concerning the company's commitment to

environmental management. Such disclosures may reflect the company as an entity capable of managing environmental issues effectively (Ramadhana & Setiawan, 2024) [12]. The quantitative data disclosed through the reporting of environmental costs is considered more credible, as it is measurable and comparable, providing a more objective basis for stakeholders to assess the company's commitment—compared to disclosures that are solely narrative in nature (Akhter *et al*., 2023) [2].

2. The results of the regression analysis show that oil prices positively affect profitability. This finding is supported by a study conducted by (Bugshan *et al*., 2023) [5], who also found that oil prices positively impact profitability. From the perspective of signaling theory, increased profitability driven by rising oil prices can send a positive signal to stakeholders (Hermawan, 2024) [7]. The signal regarding how oil price movements impact profitability is important to observe, as information about the company's condition amidst oil price fluctuations can influence decision-making aimed at maintaining the company's financial stability (Ahmed *et al*., 2023) [1].

4. Conclusion

The research findings indicate that environmental costs have a positive impact on profitability. This suggests that corporate expenditures aimed at environmental protection can improve a company's reputation and financial performance. Additionally, oil prices were found to positively affect profitability, suggesting that price fluctuations can yield financial benefits for companies in relevant sectors.

However, the sample size was limited due to inconsistent publication of environmental cost data by companies in the energy and basic materials sectors during the 2021–2023 period. Consequently, the findings cannot be generalized to all companies in these sectors.

These findings have several important implications. For academics, this research contributes to the literature linking environmental costs, oil price dynamics, and corporate financial performance. It also establishes a basis for further research on how companies can manage environmental and market risks to increase profitability.

For investors, the findings offer insights into a company's environmental management efficiency and ability to respond to oil price fluctuations. For policymakers, the results underscore the importance of strengthening environmental cost regulations without fear of harming businesses because such costs produce positive financial outcomes. Additionally, maintaining oil price stability is crucial for supporting long-term national economic resilience.

It is recommended that future research be expanded to include other industrial sectors and a longer period of time. This would allow for the attainment of more comprehensive and generalizable results. It is anticipated that subsequent research will incorporate additional variables, such as digital transformation and cybersecurity, which have the capacity to influence profitability. This is predicated on the finding that the variables utilized in the present study were only capable of explaining a modest portion of the dependent variable.

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