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The Influence of Liquidity, Profitability, Leverage, and Firm Size on Stock Returns with Environmental Performance as a Moderating Variable in Energy Sector Companies

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ABSTRACT (10pt)

Volatility in global energy markets and the acceleration of the energy transition have increased investor focus on both financial fundamentals and sustainability signals. In Indonesia, the capital-intensive energy sector faces significant exposure to commodity cycles and environmental risks, with ESG considerations increasingly integrated into investment decisions. The government's PROPER program provides a standardized benchmark for corporate environmental performance, which can be combined with financial indicators to assess stock behaviour. This study analyzes the influence of liquidity, profitability, leverage, and firm size on stock returns, with environmental performance as a moderating variable in energy sector companies listed on the Indonesia Stock Exchange from 2019 to 2024. Using a quantitative panel data regression approach, secondary data were drawn from annual financial reports and PROPER scores issued by the Ministry of Environment and Forestry. Results show that only leverage has a significant negative effect on stock returns, while liquidity, profitability, and firm size do not significantly influence returns. The environmental performance variable alone also shows no significant effect. However, the interaction between leverage and environmental performance has a significant positive impact, indicating that strong environmental practices can moderate the adverse effects of leverage on stock returns. These findings highlight the importance of integrating sustainability into financial strategies to enhance investor confidence, particularly in the environmentally sensitive energy sector.

Keywords: Stock Returns, Liquidity, Profitability, Leverage, Firm Size, Environmental Performance

INTRODUCTION

The capital market is one of the vital sources of funding for companies, besides credit, and plays a critical role in supporting long-term economic growth (Mishra & Sharma, 2019; Wang et al., 2021). Its importance lies in mobilizing funds for corporate development and maintaining business continuity (Sari & Putra, 2020; Kim & Park, 2018). The capital market acts as a meeting place for parties with surplus funds and those in need of financing through the buying and selling of securities (Hasan et al., 2022; Liu et al., 2019). Furthermore, it serves as a platform for trading securities with maturities typically exceeding one year, such as stocks, bonds, and mutual funds, facilitating liquidity and investment diversification (Rahman et al., 2021).

The development of the capital market in Indonesia is evident from the significant year-on-year increase in the number of investors, with a remarkable 92.99% growth in 2021, bringing the total to 7,489,377 investors (Wijayanti et al., 2022; Nugroho & Sari, 2021). Among capital market instruments, stocks are the most widely recognized by the public, representing ownership in a company (Setiawan & Prasetyo, 2020; Hidayat et al., 2018). For instance, owning 1 million shares of a company with a total of 100 million shares means owning 1% of the company's equity (Rohman & Utami, 2019; Santoso & Wicaksono, 2021). Modern

technology has facilitated easy access to stock information through platforms such as the official website of the Indonesia Stock Exchange (IDX) (Lestari et al., 2020; Putra et al., 2022).

Investors who invest in capital certainly want profits, known as *stock returns*. *Stock return* is the level of profit earned from an investment made by a company or an individual, and its value is determined by the value of the stock (Nalurita, 2017). *Stock returns* can be in the form of realized returns that have already occurred and expected returns that are anticipated in the future. *Stock return* is one of the main factors that motivate investors to invest because *stock returns* are a reward for the investor's courage in bearing the investment risks made (Tandelilin, 2017). The higher the return on the stock, the higher the investor attention. Potential investors can analyze the company's financial statements to ensure that the investments made will bring profits.

On the Indonesia Stock Exchange (IDX), there are many stock sector classifications, one of which is the energy sector. The energy sector is a very strategic sector in the central and regional economies. This sector is the main driver of development and provides significant multiplier effect benefits. According to Aldo Fernando (2021), the world is experiencing an energy crisis caused by a surge in gas prices, which has also boosted coal prices. Coal issuers reap profits until their share prices set a record high. The high price of coal began in mid-2020, in line with the normalization of public activities after Covid-19, which caused energy demand to increase. This situation was exacerbated by the outbreak of the Russia-Ukraine conflict, which caused several stock sectors to weaken, such as the transportation and logistics sector which weakened by 4.93%, the consumer cyclicals sector by 2.25%, the technology sector fell by 2.13%, and the property and real estate sector fell by 2.07%. However, the energy sector soared by 2.23%. One of the reasons for the surge in investor enthusiasm in investing in the energy sector is because many countries have previously started to abandon coal power plants, and this energy crisis has made the demand for coal increase again so that Indonesia, as the largest coal exporter, benefits from this energy crisis.

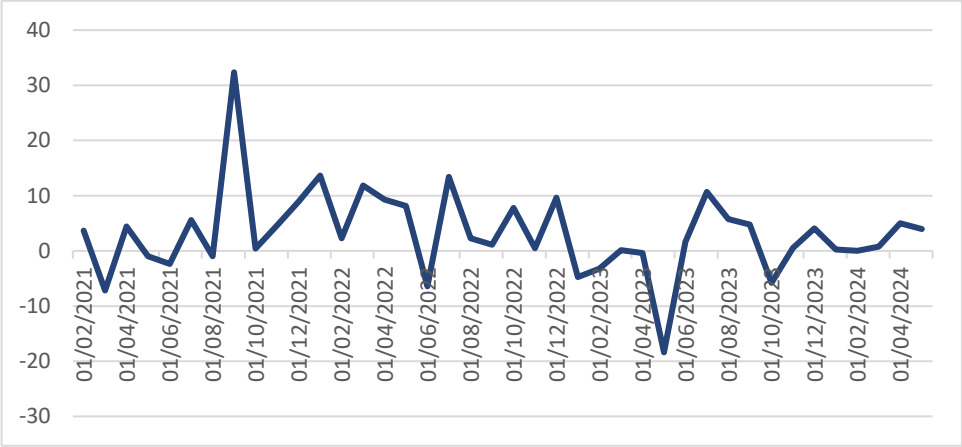

Figure 1. Stock Return Trend Chart (Monthly) in 2021 -2024

From the chart above, during the 2021-2024 period, fluctuations in the return of energy sector stocks (source www.idx.co.id) can be observed. The stock returns have fluctuated noticeably. In the August 2021 period, stock returns increased quite significantly, due to concerns related to the energy crisis. At that time, one of the energy sector stocks that became

the top driver of the JCI at the end of September 2021 was PT Indo Straits Tbk (PTIS), with shares rising 24.8% to a level of IDR 352 per share.

Changing global dynamics and the demands of the energy transition are pushing energy sector companies to focus not only on financial performance but also on environmental responsibility. On the other hand, investors need certainty that the returns on the stock earned reflect its fundamental value and long-term sustainability. However, there is still a gap in research that empirically examines how internal factors such as liquidity, profitability, leverage, and company size affect stock returns, especially when moderated by environmental performance. Therefore, this research is important to fill the literature gap and contribute to ESG-minded investment decision-making.

Liquidity is an important factor in explaining the rate of return on stocks, with less liquid stocks providing higher returns as compensation for higher liquidity risks (Martines et al., 2023). However, according to a study by Smith and Brown (2020) in the Journal of Financial Markets, liquidity did not have a significant influence on stock returns in the US capital market during their study period. This study used panel data and regression analysis methods to test the relationship, and the results showed that the liquidity variable did not contribute significantly to the variability of stock returns.

Profitability has a significant positive impact on stock returns in Asian markets; companies with higher levels of profitability can generate greater returns (Li and Zhao, 2022). More profitable companies tend to provide higher returns to their investors, both in developed and emerging markets. This is because more profitable companies have a better ability to generate sustainable profits and overcome economic uncertainty. However, other studies show that the relationship between profitability and stock returns is not always significant. According to a study by Lee and Kim (2020) in the Journal of Financial Economics, profitability did not have a significant influence on stock returns in the Korean capital market during their study period. This study used panel data and regression analysis methods to test the relationship, and the results showed that the profitability variable did not contribute significantly to the variability of stock returns.

Leverage has a significant relationship with stock returns. High leverage can increase stock returns due to the potential for increased profits, but it also carries greater risks, including higher return volatility and vulnerability to market fluctuations, especially during periods of economic instability. Several studies show that the impact of leverage on stock returns can vary based on industry sectors and economic conditions (Kim et al., 2022). However, previous research has shown that the relationship between leverage and stock returns is not always significant. According to a study by Johnson and Wang (2020) in the Journal of Corporate Finance, leverage did not have a significant influence on stock returns in the European capital market during their study period. This study used panel data and regression analysis methods to test the relationship, and the results showed that the leverage variable did not contribute significantly to the variability of stock returns.

The size of the company is also an important factor that affects stock returns. Small companies tend to provide higher returns compared to large companies, which can be explained by various factors including higher risk, greater growth potential, and economic cyclical effects (Li and Zhao, 2022). According to other studies, the relationship between company size and stock returns is not always significant. Ahmed and Khan (2020) found that company size did

not have a significant influence on stock returns in the Indian capital market during their study period. This study used panel data and regression analysis methods to test the relationship, and the results showed that the company size variable did not contribute significantly to the variability of stock returns.

Good environmental performance has a positive relationship with stock returns. Companies that demonstrate a commitment to sustainable environmental practices tend to be rewarded by investors, both in the form of higher stock returns and lower costs of capital. This reflects the increasing awareness and concern for environmental issues among investors and the capital market in general. High environmental performance leads to better stock returns in the long run. Long-term investors value companies that demonstrate a commitment to sustainability and environmental responsibility (Engelhardt et al., 2021).

However, fluctuating stock returns in the energy sector indicate underlying volatility and investor uncertainty. Changing global dynamics and energy transition demands are pushing companies to balance financial performance with environmental responsibility. Investors now seek returns that reflect not only fundamental value but also long-term sustainability. Despite this, a gap remains in empirical research examining how internal factors like liquidity, profitability, leverage, and firm size affect stock returns, especially when moderated by environmental performance. Previous studies show mixed results: liquidity and profitability are not always significant determinants (Smith & Brown, 2020; Lee & Kim, 2020), while leverage has a variable impact (Kim et al., 2022), and firm size may not consistently influence returns (Ahmed & Khan, 2020). Environmental performance, though increasingly relevant, is not yet a primary factor in investor decisions (Engelhardt et al., 2021).

This research aims to fill this gap by analyzing the influence of liquidity, profitability, leverage, and firm size on stock returns, with environmental performance as a moderating variable in energy sector companies listed on the IDX from 2019 to 2024. The benefits of this study are twofold: theoretically, it contributes to the literature on financial determinants of stock returns and the role of sustainability in investment decisions; practically, it provides insights for investors to make more informed decisions based on integrated financial and environmental criteria and encourages companies to adopt sustainable practices to enhance investor confidence and market stability.

METHOD

This research employed a causality design to examine the relationships between dependent and independent variables. A quantitative approach was used, generating data through statistical procedures. Secondary data were collected from the Indonesia Stock Exchange and company performance reports from 2019 to 2024. Descriptive analysis described the research variables, while inferential statistical analysis analyzed the sample data applicable to the population. Moderated Regression Analysis (MRA) tested the moderating effect on the relationship between independent and dependent variables. Panel data regression examined the influence of profitability, leverage, and environmental performance on stock returns, with company size as a moderating variable. Common-effect, fixed-effect, and random-effect models were applied, alongside tests such as the Chow test, Hausman test, and Lagrange multiplier test to identify the most suitable model. After descriptive analysis and model selection, hypothesis testing was conducted using the F test and t-test to assess the influence of

independent variables on the dependent variable, with the coefficient of determination evaluating how well the model explained the variance.

RESULTS AND DISCUSSION

Results of Panel Data Regression Analysis

Panel Data Regression Model Selection

The panel data regression model is a model that must go through testing steps to determine the right estimation model to determine the influence of a dependent variable on the independent variable of a research object in a certain period. There are three tests in determining the right model estimation, namely common effect, fixed effect and random effect.

1. Common Effect Model

The Common Effect Model assumes that interceptions and slopes always remain constant both over time and between individuals. Everyone (n) regressed to determine the relationship between the dependent variable and its independent variable will give both the intercept and slope values the same. Similarly with time (t), the intercept and slope values in the regression equation describing the relationship between the dependent variable and the independent variable are the same for each time.

The basis used in panel data regression is to ignore the influence of individuals and time on the model they form. Below is a table of the results of the analysis with the regression of the Common Effect Model panel data using the 12 lite eviews program as follows:

Table 1. Common Effect Model Panel Data Regression Results

Dependent Variable: Y
Method: Panel Least Squares
Date: 06/09/25, Time: 13:09
Sample: 2019-2024
Periods Included: 6
Cross-sections Included: 19
Total Panel (Balanced) Observations: 114

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.891187	0.818831	1.088365	0.2789
X1	-0.021088	0.118698	-0.177657	0.8593
X2	-0.006395	0.011316	-0.565109	0.5732
X3	-0.284722	0.077936	-3.653296	0.0004
X4	-0.026141	0.090473	-0.288941	0.7732
X1_Z	0.009576	0.025661	0.373178	0.7098
X2_Z	0.001470	0.002404	0.611529	0.5422
X3_Z	0.089187	0.025491	3.498831	0.0007
X4_Z	0.005744	0.020301	0.282932	0.07778
Z	-0.203568	0.184832	-1.101370	0.2733
R-squared:		0.156552	Mean dependent var:	0.106371
Adjusted R-squared:		0.083561	S.D. dependent var:	0.161062
S.E. of regression:		0.154186	Akaike info criterion:	-0.817685
Sum squared resid:		2.472421	Schwarz criterion:	-0.577668
Log likelihood:		66.60805	Hannan-Quinn criterion:	-0.720275
F-statistic:		2.144817	Durbin-Watson stat:	2.123588
Prob(F-statistic):		0.031964		

2. Fixed Effect Model

Fixed Effect Model is the value of the regression coefficient or slope that varies due to different aspects of observation units and changes in time periods. A fixed effect is an object

that has a constant magnitude for different periods of time. Likewise, the regression coefficient will remain large from time to time (time invariant). Below is a table of analysis results with Fixed Effect Model panel data regression using the 12 lite Eviews program as follows:

Table 2. Data Regression Panel Fixed Effect Model

Dependent Variable: Y
Method: Panel Least Squares
Date: 06/09/25, Time: 13:20
Sample: 2019-2024
Periods Included: 6
Cross-sections Included: 19
Total Panel (Balanced) Observations: 114

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.548300	0.997498	0.549675	0.5840
X1	-0.061760	0.145764	-0.423697	0.6728
X2	-0.008742	0.194760	-0.044948	0.9671
X3	-0.451375	0.096900	-0.657838	0.5114
X4	-0.063635	0.097924	-0.648694	0.5185
X1_Z	0.024523	0.092654	0.266896	0.7919
X2_Z	-0.019036	0.092654	-0.205736	0.8381
X3_Z	-0.016399	0.092654	-0.177296	0.8593
X4_Z	-0.009265	0.092654	-0.100153	0.6925
Z	-0.009265	0.092654	-0.100153	0.6925
Effect Specification				
Cross-section fixed (dummy variables)				
R-squared:	0.289221	Mean dependent var:		0.106371
Adjusted R-squared:	0.066069	S.D. dependent var:		0.161062
S.E. of regression:	0.155650	Akaike info criterion:		-0.673033
Sum squared resid:	2.083524	Schwarz criterion:		-0.000984
Log likelihood:	66.362785	Hannan-Quinn criterion:		-0.400286
F-statistic:	1.296074	Durbin-Watson stat:		2.439470
Prob(F-statistic):	0.184161			

3. Random Effect Model

The Random Effect Model estimates panel data that residual variables are thought to have relationships between time and between subjects. The panel data analysis method with the Random Effect Model must meet the requirements that the number of cross sections must be greater than the number of research variables. Below is a table of analysis results with Random Effect Model panel data regression using the Eviews 12 lite program with the following results:

Table 3. Random Effect Model Panel Data Regression Results

Dependent Variable: Y
Method: Panel Least Squares
Date: 06/09/25, Time: 13:24
Sample: 2019-2024
Periods Included: 6
Cross-sections Included: 19
Total Panel (Balanced) Observations: 114
Swamy and Arora Estimator of Component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
c	0.891187	0.826609	1.078125	0.2835
X1	0.021088	0.119826	-0.175985	0.8606
X2	0.006395	0.011423	-0.559792	0.5768
X3	0.284722	0.078676	3.618023	0.0005
X4	0.026141	0.091333	-0.286222	0.7753
X5	0.009576	0.025905	0.369667	0.7124

X6	0.001470	0.002427	0.605775	0.5460
X7	0.089187	0.025733	3.465911	0.0008
X8	0.005744	0.020494	0.280269	0.7798
Zz	-0.203568	0.186587	-1.091008	0.2778
Effects Specification				
			S.D.	**Rho**
Cross- Section random			0.000000	0.0000
Idiyosycrati random			0.155650	1.0000
Weighted Statistics				
R-squared:	0.156552	Mean dependent var:		0.106371
Adjusted R-squared:	0.083561	S.D. dependent var:		0.161062
S.E. of regression:	0.154186	Sum squared resid		2.472421
F-statistic:	2.144817	Durbin-Watson stat:		2.123588
Prob(F-statistic):	0.031964			
Unweighted Statistics				
R-squared	0.156552	Mean dependent var		0.106371
Sum squared resid	2.472421	Durbin-Watson stat		2.123588

Test Panel Data Regression Model

Test the panel data model in determining the right model for each equation. In determining the selection of the right model, the Chow Test, the Hausman Test, and the Lagrange Multiplier (LM) Test were carried out.

1. Chow Test

The Chow test is used to compare or select which model is best between the Common Effect Model and the Fixed Effect Model. The hypotheses in the Chow test are as follows:

H0: The right model is the Common Effect Model

H1: The right model is the Fixed Effect Model

This study uses a significance level or alpha of 5%, so that hypothesis decision-making is if the probability value (Prob.) cross section chi-square < 0.05 then subtract H0 or accept H1, meaning that the selected model is the Fixed Effect Model. Conversely, if the value of probability (Prob.) cross section chi- square > 0.05, then accept H0 or subtract H1 which means that the selected model is the Common Effect Model.

Based on table 4.10 probability value (Prob.) cross section F is 0.5895 (>0.05) and Prob (chi square) 0.3611 > 0.005 then accept H0 or subtract H1. Thus, based on the Chow test, the MRA model of panel data in this study was selected as Common Effect Model (CEM) or Pooled OLS.

Table 4. Chow Test Results

Redundant Fixed Effects Tests **Equations: EQ** **Test cross-sections fixed effects**			
Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	0.891788	(18,86)	0.5895
Cross-section Chi-square	19.509613	18	0.3611
Cross-section Fixed Effects Test Equation: **Dependent Variable:** Y **Method:** Panel Least Squares **Date:** 06/09/25 **Time:** 13:22 **Sample:** 2019-2024 **Periods included:** 6 **Cross-sections included:** 19 **Total panel (balanced) observations:** 114			

Variable	Coefficient	Std. Error	t-Statistic
c	0.891187	0.81831	1.088265
X1	0.021088	0.118698	-0.177657
X2	0.006395	0.011316	0.565109
X3	-0.284722	0.077936	-3.653206
X4	-0.026141	0.090473	-0.288941
X5	0.009576	0.025661	0.373178
X6	0.001470	0.002404	0.611529
X7	0.089187	0.025401	3.498831
X8	0.005744	0.020301	0.282932
Z	0.203568	0.184832	-1.101370

R-squared	**0.156552**	**Mean dependent var**	**0.106371**
Adjusted R-squared	0.083661	**S.D. dependent var.**	0.161062
S.E. of regression	0.154186	**Akaike info criterion**	-0.817685
Sum squared resid	2.472421	**Schwarz criterion**	-0.577668
Log likelihood	6.60805	**Hannan-Quinn crit.**	-0.720275
F-statistic	2.144817	**Durbin-Watson stat**	2.123588
Prob(F-statistic)	0.031964		

2. Hausman Test

The Hausman test is used to compare or select which model is best between the Random Effect Model and the Fixed Effect Model. The hypotheses in the Hausman test are as follows:

H0: The right model is the Random Effect Model

H1: The right model is the Fixed Effect Model

This study uses a significance level or alpha of 5%, so that hypothesis decision-making is if the probability value (Prob.) cross section random < 0.05 then subtract H0 or accept H1, meaning that the selected model is the Fixed Effect Model. Conversely, if the value of probability (Prob.) cross section random > 0.05, then accept H0 or minus H1 which means that the selected model is a Random Effect Model.

In the thirst test in Table 4.11, the result was obtained that the probability value (Prob.) Random cross section is 0.2277 (>0.05) then accept H0 or subtract H1 which means that the right model to use is the Random Effect Model.

Table 5. Hausman Test Results

Correlated Random Effects – Hausman Test
Equation- EQ
Test Cross-Section random effects

Test Summary	Chi-Sq Statistic	Chi-Sq d.f.	Prob.
Cross-section random	11.750633	9	0.2277
* WARNING : estimated			

Variable	Fixed	Random	Var(Diff)	Prob.
X1	-0.061760	-0.021088	0.006889	0.6241
X2	-0.006874	-0.000395	0.000013	0.5106
X3	0.014513	0.284722	0.003201	0.0032
X4	0.036292	-0.026141	0.004140	0.3319
X1-Z	0.024523	0.009576	0.000208	0.3004
X2-Z	0.001893	0.001470	0.000000	0.8281
X3-Z	0.144370	0.080187	0.000355	0.0034
X4-Z	-0.009268	0.008744	0.000128	0.1797
Z	0.138367	-0.203568	0.011005	0.5343

Cross-section random effects test equation:
Dependent Variable: Y

Method: Panel Least Squares
Date: 06/09/25, Time: 13:24
Sample: 2019-2024
Periods included: 6
Cross-sections included: 19
Total panel (balanced) observations: 114

Variable	Coefficient	Std. Error	t-Statistic	Prob.
c	0.548300	0.997498	0.549675	0.5840
X1	-0.061760	0.145764	0.423607	0.6728
X2	-0.0008742	0.011967	0.730480	0.4671
X3	0.01451378	0.096906	-3.657838	0.0000
X4	0.036292	0.111720	0.824649	0.0728
X1-Z	0.024523	0.029654	0.826076	0.4105
X2-Z	0.001803	0.002400	0.6720	0.8240
X3-Z	0.144370	0.031887	4.527602	0.0000
X4-Z	-0.009268	0.023348	0.300807	0.6025
Z	0.138367	0.214056	0.646408	0.5197

Effects Specification

Cross-Section fixed (Dummy Variables)

R-squared:	0.289221	Mean dependent var:	0.106371
Adjusted R-squared:	0.066069	S.D. dependent var:	0.161062
S.E. of regression:	0.155650	Akaike info criterion:	-0.673033
Sum squared resid:	2.083524	Schwarz criterion:	-0.000984
Log likelihood:	66.36285	Hannan-Quinn criterion:	-0.400286
F-statistic:	3.96074	Durbin-Watson stat:	2.439470
Prob(F-statistic):	0.184161		

3. Lagrange Multiplier Test

The Lagrange Multiplier test is used to compare or select which model is best between the Common Effect Model and the Random Effect Model. The hypotheses in the Lagrange Multiplier test are as follows:

H0: Common Effect Model

H1: Random Effect Model

This study uses a significance level or alpha 5% so that the hypothesis decision making is if the probability value (Prob.) cross section random < 0.05 then subtract H0 or accept H1, which means that the selected model is a Random Effect Model. Conversely, if the value of probability (Prob.) cross section random > 0.05, then accept H0 or subtract H1 which means that the selected model is the Common Effect Model.

Based on table 4.12, the probability value (Prob.) cross section random both is (0.2507) <0.05 then subtract H0 or accept H1, which means that the selected model is the Common Effect Model (CEM) or Pooled PLS.

Table 6. Lagrange Multiplier Test Results

Lagrange Multiplier Tests for Random Effects
Null Hypotheses: No effect
Alternative Hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternative

Test	Cross-section Statistic	Time	Both Statistic
Breusch–Pagan	0.956691	0.362707	1.319398
	(0.3280)	(0.5470)	(0.2507)
Honda	-0.978106	-0.602252	-1.117482
	(0.8360)	(0.7265)	(0.8681)

King–Wu	-0.978106	-0.602252	-0.988827
	(0.8360)	(0.7265)	(0.8386)
Standardized Honda	-0.444641	-0.162608	-4.732163
	(0.6717)	(0.5646)	(1.0000)
Standardized King–Wu	-0.444641	-0.162608	-4.147356
	(0.6717)	(0.5646)	(1.0000)
Gourieroux, et al.	—	—	0.000000
			(1.0000)

4. Conclusion of Model Selection Test

From the results of the three model selection tests, it shows that:

1) Chow Test: A test between *the Common Effect Model* and *the Fixed Model Effect,* then *the Common Effect Model* is more appropriate to use the regression equation estimation model.
2) Hausman *Test*: A test between *a Fixed Model Effect* and *a Random Model Effect*, then *the Random Model Effect* is more appropriate to use a regression equation estimation model.
3) Lagrange Multiplier *Test*: A test between *the Common Effect Model* and *the Random Effect Model*, then the *more appropriate Common Effect Model* is used in regression equations.
4) Based on the results of testing or model selection, it can be concluded that the best model approach used in this study is the Common Effect Model (CEM).

5. Common Structure Moderated Regression Analysis (MRA)

The selection of the model was carried out in the previous section with the result that the Common Effect Model (CEM) or also known as Pooled Least Square (PLS) was selected as the best approach model in this study. This is based on the results of the Chow Test and Lagrange Multiplier (LM) Test which show that there are no significant fixed or random effects on the model.

In the context of Moderated Regression Analysis (MRA), the regression model is developed by adding interaction terms between independent variables and moderator variables. The goal is to find out whether environmental performance (Z) can moderate the influence of independent variables (X1, X2, X3, and X4) on dependent variables (Y), i.e. stock returns.

The results of MRA regression using the Common Effect Model method based on table 4.7 above are obtained as follows:

$$Y = 0.891 - 0.021X1 - 0.006\ X2 - 0.285\ X3 - 0.204Z - 0.026\ X4 + 0.010\ X1*Z + 0.001\ X2*Z + 0.089\ X3*Z + 0.006\ X4*Z$$

1) Based on the results of the MRA regression equation of the panel data:
2) The Stock Return variable (Y) has a positive constant of 0.891. This means that if all independent variables and interaction variables are zero, then the stock return will be worth 0.891 units.
3) The Liquidity variable (X1) has a negative regression coefficient value of -0.021. This shows that every increase in one unit of Liquidity will decrease the stock return by 0.021 units. On the other hand, if there is a decrease in one unit of Liquidity, the share return will increase by 0.021 units.
4) The Profitability variable (X2) has a negative regression coefficient value of -0.006. This means that an increase in one unit of profitability reduces the return of shares by 0.006 units. On the other hand, a decrease in profitability will increase the return of the stock by 0.006 units.

5) The Leverage variable (X3) has a negative regression coefficient value of -0.285. This shows that every increase in one unit of leverage will decrease the stock return by 0.285 units. On the other hand, a decrease in leverage will increase the stock return by 0.285 units.
6) The Firm Size variable (X4) has a negative regression coefficient value of -0.026. This means that an increase in one unit of firm size will reduce the return of shares by 0.026 units, and a decrease in the size of the company will increase the return of shares by the same amount.
7) The Environmental Performance variable (Z) has a negative regression coefficient value of -0.204. This shows that an increase in one unit of environmental performance will reduce *stock returns* by 0.204 units. On the other hand, a decline in environmental performance will increase stock *returns* by 0.204 units.

Based on the regression results testing the moderating role of Environmental Performance (Z) on Stock Return (Y), the interaction between Liquidity (X1) and Z yields a coefficient of 0.010 (t = 0.373178; p = 0.7098), indicating a positive but statistically insignificant effect; thus, Z functions only as a homologizer (potential moderator) and the hypothesis that Environmental Performance moderates the liquidity–return relationship is not supported. Similarly, the interaction between Profitability (X2) and Z shows a very small positive coefficient of 0.001 (t = 0.611529; p = 0.5422) that is not statistically significant, so Z again acts as a homologizer and the profitability–return moderation hypothesis is not accepted. By contrast, the interaction between Leverage (X3) and Z is 0.089 (t = 3.498831; p = 0.0007), significant at the 1% level, implying that good Environmental Performance meaningfully moderates (attenuates or even reverses) the direct negative effect of leverage on stock returns; here Z operates as a pure moderator and the moderation hypothesis is accepted. Finally, the interaction between Company Size (X4) and Z is 0.006 (t = 0.282932; p = 0.7778), a positive but insignificant effect, so Z again behaves as a homologizer and the hypothesis that Environmental Performance moderates the size–return relationship is not supported.

Hypothesis Test

1. Simultaneous Test f

The F test (simultaneous) is used to test whether all independent variables together have a significant effect on the dependent variable, namely *Stock Return* (Y). Data as follows:

Table 7. Simulation Test Results

Statistics	Value	Statistics	Value
R-squared	0.156552	Mean dependent var	0.106371
Adjusted R-squared	0.083561	S.D. dependent var	0.161062
S.E. of regression	0.154186	Akaike info criterion	-0.817685
Sum squared resid	2.472421	Schwarz criterion	-0.577668
Log likelihood	56.60805	Hannan-Quinn criter.	-0.720275
F-statistic	2.144817	Durbin-Watson stat	2.123588
Prob(F-statistic)	0.031964		

Source: Test results using Eview 12 Lite, 2025

The hypotheses used in the F test are as follows:

a. H_0: $\beta_1 = \beta_2 = \beta_3 = ... = 0$(All independent variables have no simultaneous significant effect on *Stock Return*)

b. H_1: There is at least one $\beta \neq 0$ (There is a significant simultaneous effect on *the Stock Return*)

Based on the results of the panel regression estimation using the Pooled Least Square (PLS) method displayed in the EViews output, the following values were obtained:

a. F-statistic = 2.144817
b. Prob (F-statistic) = 0.031964

The probability value is smaller than the significance level of 5% ($\alpha = 0.05$), so the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. Thus, it can be concluded that simultaneously, all independent variables, namely Liquidity (X1), Profitability (X2), Leverage (X3), Firm Size (X4), Environmental Performance (Z) and the interaction of each independent variable with Environmental Performance (X1*Z, X2*Z, X3*Z, X4*Z) have a significant effect on Stock Return (Y).

These results show that the panel regression model used has a fairly good ability to explain the variation in stock returns simultaneously. Therefore, this model can be used as a basis for partially analyzing the influence of each variable and testing the role of moderation of environmental performance variables in the relationship between independent variables on stock returns.

2. Partial Test (t)

This partial (t) test aims to determine the magnitude of the influence of each independent variable individually (partially) on the dependent variable. Here are the results of the t-test as follows:

Table 8. Partial Test Results (t)

Variable	Coefficient	t-Statistics	Probability	Results
Liquidity (X1) -> *Return* of Shares (Y)	-0.021088	-0.177657	0.8593	Insignificant
Profitability (X2) -> *Stock Return* (Y)	-0.006395	-0.565109	0.5732	Insignificant
***Leverage* (X3) -> *Return* Saham (Y)**	-0.284722	-3.653296	0.0004	Significant
Company Size (X4) -> *Stock Return* (Y)	-0.026141	-0.288941	0.7732	Insignificant
Environmental Performance (Z) -> *Stock Return* (Y)	0.009576	0.373178	0.7098	Insignificant
Liquidity (X1) -> Environmental Performance (Z) -> *Stock Return* (Y)	0.001147	0.611529	0.5422	Insignificant
Profitability (X2) -> Environmental Performance (Z) -> *Stock Return* (Y)	-0.203568	-1.10137	0.2733	Insignificant
***Leverage* (X3) -> Environmental Performance (Z) -> *Stock Return* (Y)**	0.089187	3.498831	0.0007	Significant
Company Size (X4) -> Environmental Performance (Z) -> *Stock Return* (Y)	0.005744	0.282932	0.7778	Insignificant

Based on the results of the t-test or partial test, it is known that the leverage variable (X3) has a significant negative effect on stock returns, with a p value of 0.0004. This indicates that any increase in the leverage level will decrease the company's stock returns. Theoretically, this could indicate that companies with high debt burdens face greater financial risks, potentially lowering investor confidence in long-term profit prospects. An unhealthy capital structure is often considered an indicator of instability, so the market responds negatively.

Furthermore, the interaction between leverage and environmental performance (X3*Z) showed a significant positive influence on stock returns, with a p value of 0.0007. These findings confirm that environmental performance plays a role as a moderator that improves investors' perception of high leverage risk. In this context, companies with large debt structures can still be considered attractive by the market if they demonstrate a real commitment to sustainability practices and environmental responsibility. This reflects that ESG (Environmental, Social, and Governance) practices, especially in environmental aspects, have begun to be integrated in investment decision-making by stakeholders.

Meanwhile, the variables liquidity (X1), profitability (X2), and company size (X4) showed insignificant results, with p-values of 0.8593, 0.5732, and 0.7732, respectively. This means that these three variables do not have a strong enough partial influence on stock returns. These results can be interpreted that although liquidity and profitability are important financial indicators, in the context of the energy sector and in the observation period, these factors have not yet been the main determinants in influencing fluctuations in the value of stocks. Similarly, the size of the company does not seem to be a significant consideration for investors in assessing the performance of stocks in the sector.

All other interaction variables, namely X1*Z (Liquidity × KL), X2*Z (Profitability × KL), and X4*Z (Firm Size × KL), also showed no statistically significant influence, with probability values of 0.5422, 0.2733, and 0.7778, respectively. This indicates that environmental performance does not function as a moderator in the relationship between liquidity, profitability, and company size on stock returns.

Overall, these results show that leverage and commitment to the environment are key factors in influencing the stock value of energy companies. These findings confirm that the market is increasingly paying attention to financial risks and sustainability dimensions as part of the evaluation of company value. Companies that have high levels of debt, but are accompanied by responsible environmental practices, still have a great chance of maintaining attractiveness in the eyes of investors.

3. Coefficient Determination Test

The determination coefficient (R-squared) is used to measure how much of the variation of dependent variables (stock returns) can be explained by independent variables in a regression model.

Based on the regression output obtained from the Pooled Least Square (PLS) model estimation, the following values were obtained:

R-squared = 0.156552

Adjusted R-squared = 0.083561

The R-squared value of 0.156552 indicates that approximately 15.66% variation in stock returns (Y) can be explained by the independent variables used in the model, namely Liquidity (X1), Profitability (X2), Leverage (X3), Company Size (X4), Environmental Performance (Z), as well as the interaction of each variable with environmental performance (X1*Z, X2*Z, X3*Z, and X4*Z). Meanwhile, the remaining 84.34% is explained by other factors not included in this model, such as market sentiment, energy commodity prices, macroeconomic conditions, government policies, or other specific factors beyond the scope of the study.

An Adjusted R-squared value of 0.083561 indicates an adjustment of R^2 taking into account the number of independent variables in the model. Although lower, this value provides

a more conservative and realistic estimate of the model's predictive strength, especially in regression models with many variables.

After testing the panel data regression model, simultaneous test, partial test, and determination coefficient test, the next stage is to discuss these results. The discussion was arranged based on independent variables and moderation variables, and based on previous theories and empirical findings.

The Effect of Liquidity (X1) on Stock Return

The results of the t-test showed that the liquidity variable (X_1) had no significant effect on stock returns, as shown by a p value of 0.8593. A negative regression coefficient indicates that the higher the liquidity ratio, the lower the stock return, even though the relationship is not statistically significant. These findings contradict the predictions of pecking order theory and trade-off theory, which state that high levels of liquidity provide flexibility in financing and lower financial risk, so they should have a positive impact on investor perception and stock performance (Myers & Majluf, 1984; Frank & Goyal, 2003).

Several empirical studies show that the level of liquidity does not always have a significant impact on stock returns, Pratama and Wiksuana (2016) stated that liquidity does not affect stock returns in mining sector companies on the IDX. Investors are more concerned with profitability and market value than the ability to pay short-term obligations. Kusumawati and Danny (2021) also found that the liquidity ratio does not have a significant influence on stock returns in energy sector companies. They mentioned that high liquidity can actually be considered as idle cash that has not been used efficiently. Fama and French (1992) in the Three-Factor Model also did not include liquidity as the main factor in explaining stock returns. They emphasized that the size and book-to-market ratios explain the variability of stock returns more than traditional financial variables such as liquidity. Hasan & Gupta (2021) analyzed mining sector companies in India and concluded that the liquidity ratio is not significant to stock returns. They said that in the capital-intensive sector, investors pay more attention to leverage and ROI than liquidity indicators. Putra and Restika (2019) stated that stock returns are not affected by liquidity, because investors tend to look at long-term aspects such as revenue growth, dividends, and business expansion, rather than short-term cash ratios.

Thus, in the context of the energy industry, high liquidity is not necessarily a positive signal for the market. This provides a new perspective that contextual factors such as industry structure, investment policy, and market perception of fund management efficiency are important in assessing the relationship between financial indicators and stock returns.

The Effect of Profitability (X2) on Stock Return

The results of the t-test showed that the profitability variable (X_2) had no significant effect on stock returns, with a p value of 0.5732 and a negative coefficient direction. This indicates that an increase in profitability is not necessarily followed by an increase in stock returns. These findings are not in line with signaling theory, which states that high profits are a positive signal for investors, as they reflect good business prospects and the potential for future increase in the company's value (Myers & Majluf, 1984).

This insignificance can be explained by two possibilities. First, the profits earned by the company are not necessarily directly distributed to investors in the form of dividends, so they do not have a real impact on investment returns during the observation period. Second,

companies can choose to withhold profits for reinvestment purposes, where the impact of the investment has not been seen directly in the current year period.

These findings are in line with research by Sulastri et al. (2023) who analyzed fintech companies listed on the NASDAQ and found that profitability did not have a positive effect on stock returns, even showing a negative relationship. The study confirms that in industries that are growing or transforming, increased profits are not always considered a positive signal by investors if they are not accompanied by the distribution of profits to shareholders.

Similarly, Sugito et al. (2020) in their research on automotive companies in Indonesia also found that profitability did not have a significant effect on stock returns (t-value of –0.219 and p of 0.827). They concluded that earnings results are not necessarily received directly by investors, especially if the company has a profit holding policy to support long-term investments.

In addition, Kurniawan and Herlina (2021) in their research on manufacturing companies in the energy and utility sectors listed on the IDX, also stated that ROA and ROE as indicators of profitability do not have a significant effect on stock returns. According to them, investors pay more attention to macro variables such as energy commodity prices, inflation, and exchange rates which affect returns in the sector more than internal financial performance.

Another study by Ali, M., & Chowdhury, T. (2020) on energy companies in Bangladesh listed on the Dhaka Stock Exchange also showed that stock returns are not affected by profitability ratios, including ROA and ROE. They argue that the energy sector is highly dependent on government policies and long-term projects, so investors tend to focus on project sustainability and external factors rather than short-term profits.

Thus, in the context of the capital-intensive and long-term oriented energy sector, the relationship between profitability and stock returns seems more complex. Investors may not only pay attention to how much profit is generated, but also how those profits are managed—whether they are distributed as dividends or used for continued business expansion. This explains why in this study, profitability did not show a significant influence on stock returns.

The Effect of Leverage (X3) on Stock Returns

The results of the t-test show that leverage (X_3) has a significant negative effect on stock returns, with a p value of 0.0004. These findings support the capital structure theory that an increase in the proportion of debt will increase the company's financial risk, thereby lowering investor confidence and depressing the stock market value.

In the context of the capital-intensive energy sector, investors tend to be particularly sensitive to the level of leverage because heavily indebted companies have high risk of profit volatility and cash flow. As a result, overly aggressive capital structures are seen negatively, as per the argument that shares of high-leveraged companies often provide lower returns (Muradoglu & Sivaprasad, 2009).

An empirical study from Aalto University (Saarikko, 2022) reinforces these findings by concluding that high levels of leverage have a negative effect on stock returns in several regions (Asia Pacific, Europe, and the US). This study found that investors actually avoid stocks with high DER because of the increased risk of distress.

Meanwhile, international research by Adami et al. (2015) and Penman et al. (2007) also shows that the debt-to-equity ratio (leverage) tends to be negatively correlated with stock

returns, especially in the industrial and energy sectors. Their findings indicate that investors in these sectors are reluctant to pay a premium for the added risk of high leverage.

Overall, the results of this study support the modified Trade-Off and Modigliani–Miller theories, which state that the existence of debt provides tax benefits, but on the other hand increases the potential cost of bankruptcy. In the energy sector, these risks appear to be more dominant, so high leverage actually has a negative impact on stock returns.

The Effect of Company Size (X4) on Stock Return

The results of the t-test showed that the company size variable (X_4) had no significant effect on stock returns, with a p value of 0.7732 and a negative regression coefficient direction. This means that while large companies are often associated with stability, access to wider resources, and diversification of efforts, large size does not guarantee high returns on stocks.

In the context of a dynamic energy sector and influenced by changes in environmental policies and technological demands, large companies may experience obstacles in the speed of adaptation. Companies that are too large tend to face internal bureaucracy and difficulty in making quick decisions. This makes them less agile in responding to market opportunities and threats than smaller, more agile companies.

This finding is in line with Oktaviani et al. (2019) who stated that company size has a negative effect on financial performance, especially when companies face diseconomies of scale, which is a condition when scale growth reduces efficiency.

Furthermore, in a meta-analysis by Bachmann and Kataishi (2025), it was found that the relationship between company size and innovation performance is highly heterogeneous. While large companies have the potential to enjoy economies of scale, they can also face constraints in responsiveness, especially in industries with high innovation pressures such as energy.

In a study by Saarikko (2022) from Aalto University, although the main focus is on leverage, it was also mentioned that investors in sectors such as energy are less likely to give more premiums to large companies if these measures are not accompanied by innovative performance and are adaptive to external changes.

Several other studies also found similar results, namely that company size does not have a significant effect on stock returns, Sari and Santoso (2020) in their research on the manufacturing sector on the IDX found that company size does not have a significant influence on stock returns, because investors focus more on profitability indicators and dividend policies. Rahmadani and Wibowo (2021) also concluded that company size is not the main determinant of stock returns in the mining sector. In their research, investors are more likely to assess external factors such as fluctuations in commodity prices and geopolitical risks. Widyaningsih and Novita (2018) stated that in the energy and infrastructure sectors, the size of the company does not have a significant influence on stock returns, especially if large companies do not show good managerial efficiency.

Thus, in the context of the energy sector in Indonesia, the size of the company is not the only benchmark of success or stock attractiveness for investors. Flexibility, innovation, and operational efficiency are key, especially in the face of global challenges such as the energy transition, climate change, and technological disruption.

The Effect of Environmental Performance (Z) on Stock Returns

The environmental performance variable (Z) shows that this variable has no significant effect on stock returns, with a p value of 0.2733. This indicates that the company's

environmental practices have not been considered the main factor in determining the amount of return received by investors.

In an energy sector that is still focused on operational efficiency and financial profitability, investors tend not to fully internalize the value of environmental performance into stock price valuations. Although globally there is an increasing trend of attention to Environmental, Social, and Governance (ESG), the response of the domestic stock market to environmental aspects has not been consistent.

Research by Soedjatmiko, Tjahjadi, and Soewarno (2021) supports this result. In their study of companies in Indonesia, it was found that environmental performance had no direct effect on the company's value. However, they state that environmental performance can have an indirect effect through improved operational efficiency or financial performance. This means that the market will appreciate environmentally friendly practices if they are proven to produce real financial benefits.

In addition, a study from Assael, Carlier, and Challet (2022) used a machine learning approach to the stock market in Europe and concluded that ESG only has a significant impact on stock returns when combined with other factors such as leverage, company size, and ownership structure. In other words, the direct influence of environmental variables on stock returns is not statistically strong enough, but more meaningful as a moderation variable or in an interaction model.

Several other studies that support that environmental performance does not always have a significant effect on stock returns, Putri and Rachmawati (2020), in their research on manufacturing sector companies on the IDX, found that environmental disclosure does not have a significant effect on stock returns. Investors prioritize financial factors over CSR or environmental indicators. Wijaya et al. (2021), in a study on mining companies, found that the Environmental Performance Index (EPI) does not have a significant influence on stock prices and returns. The author emphasizes that market perception in Indonesia of environmental performance is still low. Luo, Lan, and Tang (2012) examined companies in China and concluded that environmental disclosure does not significantly affect the stock market value, except when supported by strong financial performance.

Thus, in the context of Indonesia's energy sector, environmental performance has not been a strong signal for investors in determining stock returns. However, its strategic potential as a moderation variable remains relevant, especially in strengthening investors' perception of long-term governance and risk management.

The Effect of Environmental Performance (Z) in Moderating Liquidity (X1) on Stock Returns (Y)

The interaction between liquidity and environmental performance (X1*Z) was also insignificant ($p = 0.7098$). This shows that despite the company's high liquidity and commitment to environmental practices, the combination has not been enough to convince the market to increase the stock's valuation.

According to Soedjatmiko, Tjahjadi, & Soewarno (2021), the market has not fully internalized environmental value directly, unless combined with financial strength or operational efficiency. In the context of this study, the environmental value followed by high liquidity without any indication of investment or real operational efficiency is not enough to drive market perception of the company's performance.

The study of Assael, Carlier, & Challet (2022) reinforces this with the argument that volatility of the influence of ESG (including the environment) on stock returns can occur only when ESG becomes part of a strong financial structure (e.g. a combination with financial parameters such as leverage and size). Without the right financial foundation, the synergy between liquidity and environmental performance is not enough to form a positive signal to investors.

The Effect of Environmental Performance (Z) in Moderating Profitability (X2) on Stock Returns (Y)

The interaction between profitability and environmental performance (X2*Z) was found to be insignificant (p = 0.5422), suggesting that the combination of high profits and environmental commitment has not been enough to create synergies that increase stock returns. The market does not seem to have considered this combination as a key indicator of the increase in the value of a company's shares.

Research by Lestari et al. (2024) on the mining sector on the IDX shows that although profitability has a positive influence on stock prices, this influence is not strengthened when combined with environmental indicators (green accounting). The study concluded that when high profits were combined with environmental performance, the moderation effect was not significant. This is particularly relevant to the findings in this thesis that the X2*Z interaction does not have a real effect on stock returns.

In this study, environmental performance is not enough to be a moderation that has a real function on the effect of profitability on stock returns. Thus, the insignificance of the X2*Z interaction reflects the need for a stronger communication strategy and integration between financial performance and environmental sustainability in order to be appreciated by the market. Companies need to prove that investment in environmental aspects is not just a moral obligation, but a real contributor to long-term economic value.

The Effect of Environmental Performance (Z) in Moderating Leverage (X3) on Stock Return (Y)

The interaction between leverage and environmental performance (X3*Z) showed a significant positive influence (p = 0.0007). This indicates that energy sector companies that have high leverage but also show a strong commitment to environmental practices, actually get a higher appreciation from the market. This means that environmental performance functions as an effective moderator, where environmental sustainability helps to reduce the perception of risk that is usually inherent in high debt.

Research from Franziska Pedroni et al. (2024) strengthens this finding. They found that leverage was positively associated with expected returns in companies with high ESG scores, while companies with low ESG experienced penalties in the market. It describes the role of ESG as a variable that changes the perception of risk—similar to the findings of research in the energy sector.

Another study by Chen et al. (2023) showed that non-financial companies with high ESG scores not only have healthier debt ratios, but also significantly lower the cost of capital. Thus, environmental performance not only helps investors feel safer against leverage risk but also increases capital efficiency which ultimately lifts stock returns.

The Effect of Environmental Performance (Z) in Moderating Company Size (X4) on Stock Return

The interaction between firm size and environmental performance (X4*Z) was not significant (p = 0.7778). This reveals that the market has not seen the synergy between the company's scale and environmental sustainability as a factor that strengthens the value of the stock. In other words, the size of a large company combined with environmental commitments alone is not enough to attract investors.

This phenomenon is reflected in the study by Azdra (2023), which shows that although environmental performance has a positive impact on financial performance, variations in company size do not have a significant effect on overall financial performance. These results support the thesis finding that X4*Z is not strong enough to affect stock returns, as investors seem to pay more attention to how large companies use their resources, rather than just looking at their external size and sustainability.

In addition, a study from Piotr (2023) on global banking highlights the existence of a non-linear relationship between ESG size and risk, namely U-shaped. Initially, large companies can better handle environmental risks, but past a certain point, diseconomies of scale lead to inefficiencies and increased risks. This explains why large sizes do not automatically translate into added value in the eyes of investors, despite the environmental commitments.

CONCLUSION

The study found that liquidity, profitability, company size, and environmental performance did not significantly affect stock returns in energy sector companies listed on the Indonesia Stock Exchange from 2019 to 2025. However, leverage had a significant negative impact, indicating that higher leverage reduced stock returns. Environmental performance did not moderate the effects of liquidity, profitability, or company size on stock returns but did positively moderate the negative effect of leverage, suggesting it can influence the leverage-return relationship. Future research could explore additional moderating variables or investigate these relationships in other sectors or markets to better understand the complex interactions between financial and sustainability factors.

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