

FINANCE | RESEARCH ARTICLE

# Commodity Price Returns and Energy Sector Stock Returns: Evidence from Indonesia

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## ABSTRACT

Global commodity price fluctuations have become an important factor influencing the performance of the energy sector in capital markets. This study aims to examine the effects of world oil price returns, world gold price returns, and world coal price returns on energy sector stock returns on the Indonesia Stock Exchange (IDX) during the 2021–2025 period. The study employs secondary daily data from 27 main board energy sector companies listed on the IDX, selected using a purposive sampling method. The data were analyzed using Ordinary Least Squares (OLS), while Vector Autoregression (VAR) and the Granger Causality Test were employed as complementary analytical methods. The results indicate that world oil price returns and world coal price returns have positive and significant effects on energy sector stock returns, whereas world gold price returns do not have a significant effect. These findings suggest that global energy commodities, particularly oil and coal, play a more influential role than gold in explaining energy sector stock returns in Indonesia. The study provides practical implications for investors by highlighting the importance of monitoring global commodity price movements in investment decision-making. In addition, it contributes empirical evidence to the growing literature on the relationship between commodity price returns and energy sector stock returns in emerging markets.

**Keywords:** Energy Sector, Stock Returns, Oil Prices, Gold Prices, Coal Prices.

**JEL Code:** C58, G11, G14, G15, Q41.

## I. Introduction

Global commodity price fluctuations have become one of the key factors influencing capital market performance, particularly in the energy sector. Changes in the prices of major commodities such as oil, gold, and coal can affect investor expectations, corporate performance, and stock market dynamics. In recent years, the global economy has experienced considerable uncertainty due to the post-pandemic recovery, geopolitical conflicts, energy supply disruptions, and heightened volatility in global commodity markets. These developments have intensified fluctuations in energy commodity prices and attracted increasing attention from both investors and researchers regarding their impact on stock market performance. Global commodity price fluctuations may influence the Indonesian energy sector through several transmission mechanisms. Changes in oil and coal prices affect production costs, operating revenues, and corporate profitability, which, in turn, shape investors' expectations of future corporate performance. As new information becomes available, investors adjust their investment decisions, causing stock prices and stock returns to respond accordingly. Consequently, commodity price movements are widely regarded as

important external indicators for evaluating the performance of energy sector companies in the Indonesian capital market. Indonesia provides a particularly relevant setting for this study because it is one of the world's largest coal exporters and a major energy-producing country. This structural dependence on the energy industry makes companies listed in the energy sector on the Indonesia Stock Exchange (IDX) particularly sensitive to developments in global commodity markets. The importance of examining commodity price movements has increased substantially as global financial and commodity markets have become more integrated. Energy commodities such as oil and coal are not only essential production inputs but also important indicators of broader economic conditions. Meanwhile, commodity price volatility may increase uncertainty for investors, particularly in sectors that are closely linked to global energy markets. Therefore, understanding how commodity price movements affect stock returns has become increasingly relevant for both academics and market participants.

According to the Arbitrage Pricing Theory (APT) proposed by Ross (1976), stock returns are influenced by various macroeconomic and external factors, including fluctuations in global commodity prices. Similarly, the Efficient Market Hypothesis (EMH) introduced by Fama (1970) suggests that capital markets respond rapidly to publicly available information, including information related to changes in global commodity prices. Consequently, fluctuations in world commodity prices may be reflected in stock return movements in the capital market. Previous studies have reported inconsistent findings regarding the relationship between commodity prices and stock returns. Ady (2021) found that world oil prices and world gold prices did not have a significant effect on mining sector stock returns in Indonesia. In contrast, Basit (2020), Setiawan et al. (2025), and Purwani and Santoso (2023) reported that commodity price movements significantly influenced stock market performance, particularly within Indonesia's energy sector. These inconsistent findings suggest that the relationship between commodity prices and stock returns may vary depending on sectoral characteristics, the study period, and prevailing market conditions. This study seeks to address this research gap by focusing specifically on the Indonesian energy sector using daily time-series data covering the 2021–2025 period, which captures the post-pandemic economic recovery and heightened uncertainty in global energy markets. Furthermore, this study simultaneously examines the effects of world oil, gold, and coal price returns on energy sector stock returns. Unlike many previous studies that primarily focused on broader market indices or the mining sector, this study specifically investigates the energy sector and incorporates Vector Autoregression (VAR) and the Granger Causality Test as complementary analytical techniques to provide a more comprehensive understanding of the dynamic relationships among the variables. Based on this background and the findings of previous studies, this study aims to examine the effects of world oil price returns, world gold price returns, and world coal price returns on energy sector stock returns listed on the Indonesia Stock Exchange (IDX). The findings are expected to contribute to the growing literature on commodity prices and capital markets, particularly in the context of Indonesia's energy sector, while providing practical insights for investors and valuable references for future research. Moreover, this study contributes additional empirical evidence on the relationship between global commodity price dynamics and sector-specific stock market performance in emerging economies.

## II. Literature Review and Hypothesis Development

### 2.1. Arbitrage Pricing Theory (APT)

The Arbitrage Pricing Theory (APT), proposed by Ross (1976), explains that stock returns are influenced by multiple systematic factors arising from macroeconomic conditions and market dynamics. According to this theory, changes in external factors, such as global commodity prices, may affect investor expectations, corporate performance, and stock returns. In the energy sector, fluctuations in world oil and coal prices may directly influence business operations and corporate profitability, while movements in gold prices may affect investor behavior and portfolio allocation decisions in the capital market. APT emphasizes that stock returns are not determined by a single source of risk but rather by multiple systematic risk factors that

simultaneously influence asset prices. These factors may include macroeconomic conditions, commodity market developments, monetary policy, inflation, exchange rate movements, and other external variables that shape investor expectations. In commodity-dependent industries such as the energy sector, changes in global commodity prices represent important sources of systematic risk because they directly affect production costs, revenues, and future business prospects. Consequently, fluctuations in commodity prices may be reflected in stock return movements through the transmission mechanism described by APT. Several empirical studies support the application of APT in explaining the relationship between macroeconomic variables and stock returns. Zunara and Hartoyo (2016) found that macroeconomic variables, including inflation, exchange rates, and world oil prices, were significantly associated with stock returns within the APT framework. Similarly, Purwani and Santoso (2023) reported that world oil and coal price returns had positive and significant effects on the IDXENERGY Index in Indonesia. These findings suggest that changes in global commodity prices may influence stock return movements, particularly in sectors that are highly dependent on energy commodities. Collectively, this empirical evidence reinforces the relevance of APT as a theoretical framework for explaining how global commodity price fluctuations represent systematic risk factors affecting energy sector stock returns in Indonesia.

## 2.2. Efficient Market Hypothesis (EMH)

The Efficient Market Hypothesis (EMH), introduced by Fama (1970), states that stock prices fully reflect all publicly available information. In an efficient market, information regarding global commodity price movements is rapidly incorporated into stock prices, causing stock returns to adjust accordingly. Therefore, fluctuations in oil, gold, and coal prices may influence investor reactions and market behavior toward energy sector stocks. According to EMH, investors continuously evaluate newly available information and incorporate it into asset prices. Consequently, stock prices adjust quickly whenever new information enters the market. In the context of this study, information regarding global commodity price movements may serve as an important signal of the future performance of energy sector companies. As a result, changes in oil, gold, and coal prices may affect stock returns when market participants perceive such information as relevant to corporate profitability and future growth prospects. Several empirical studies support the relevance of EMH in explaining the relationship between market information and stock price movements. Wahyudi and Rahmawati (2025) found that volatility in world oil prices significantly affected sectoral stock performance in Indonesia, including the energy sector. Likewise, Raza et al. (2016) demonstrated that commodity price movements and volatility significantly influenced stock markets in emerging economies. These findings indicate that information regarding global commodity prices is rapidly incorporated into stock prices and reflected in stock return movements. Accordingly, EMH provides a strong theoretical foundation for explaining how information on global commodity price movements is incorporated into investor expectations and subsequently reflected in the stock returns of energy sector companies in the Indonesian capital market.

## 2.3. Effect of Oil Price Returns on Energy Sector Stock Returns

World oil prices are widely regarded as one of the key indicators influencing the global energy sector and capital markets. Changes in oil prices may affect production costs, corporate revenues, profitability, and investor expectations toward energy-related companies. Rising oil prices may improve the financial performance of energy companies and generate positive market responses toward energy sector stocks. Several previous studies have reported that oil price movements are associated with stock market performance. Basit (2020) found that world oil prices had a positive and significant effect on the Indonesian stock market. Similarly, Setiawan et al. (2025) showed that world oil prices significantly influenced energy sector stock performance in Indonesia. Purwani and Santoso (2023) also found that world oil price returns had a positive and significant effect on the IDXENERGY Index of the Indonesia Stock Exchange. However, previous

findings have not been entirely consistent. Ady (2021) reported that world oil prices did not have a significant effect on mining sector stock returns in Indonesia. These inconsistent findings suggest that the relationship between oil price returns and stock returns may vary depending on sectoral characteristics, the observation period, and prevailing market conditions. Therefore, further investigation focusing specifically on the Indonesian energy sector remains necessary. The mixed findings reported in previous studies indicate that the relationship between oil prices and stock returns may be influenced by the characteristics of the market under investigation. In emerging economies such as Indonesia, the impact of oil price movements may differ from that observed in developed markets because of differences in market structure, energy dependence, and investor behavior. Therefore, empirical evidence from the Indonesian energy sector is important for enriching the existing literature and providing context-specific insights. Based on the theoretical framework and previous empirical findings, the following hypothesis is proposed:

*H1: World oil price returns have a significant effect on energy sector stock returns on the Indonesia Stock Exchange (IDX).*

#### 2.4. Effect of Gold Price Returns on Energy Sector Stock Returns

Gold is widely recognized as a safe-haven asset during periods of economic uncertainty and market volatility. Changes in gold prices may influence investor preferences and portfolio allocation decisions in the capital market. During periods of heightened uncertainty, investors often shift their investments toward gold because it is perceived as a relatively safer asset than other financial instruments. Previous studies examining the relationship between gold prices and stock returns have produced mixed results. Basit (2020) found that world gold prices had a negative but insignificant relationship with the Indonesian stock market. In contrast, Prasada and Pangestuti (2022) reported that gold prices had a positive and significant effect on the Indonesian Composite Index (IHSG) in both the short and long run. Furthermore, Raza et al. (2016) found that gold price movements significantly influenced stock markets in emerging economies. These inconsistent findings suggest that the effect of gold price returns on stock returns may vary across sectors, study periods, and market conditions. Therefore, further research focusing specifically on the Indonesian energy sector remains necessary. Based on these findings, the following hypothesis is proposed:

*H2: World gold price returns have a significant effect on energy sector stock returns on the Indonesia Stock Exchange (IDX).*

#### 2.5. Effect of Coal Price Returns on Energy Sector Stock Returns

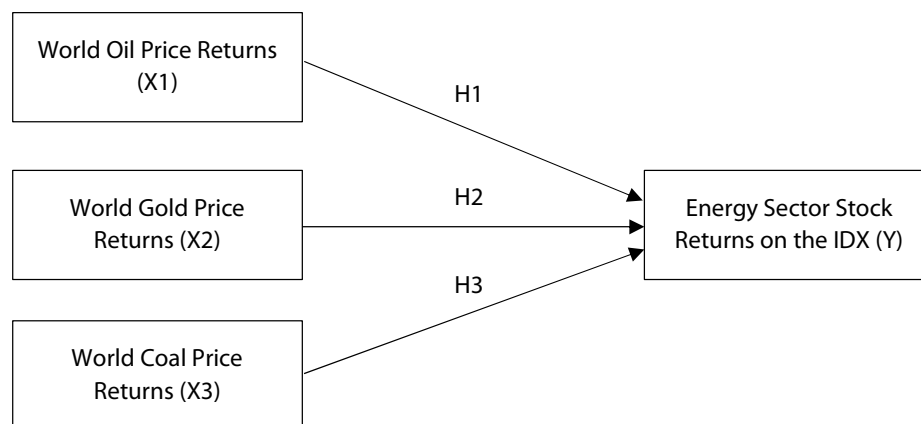
Coal is one of Indonesia's primary energy commodities and plays a vital role in the operational activities and financial performance of energy companies. As one of the world's largest coal exporters, Indonesia is highly exposed to fluctuations in global coal prices. Changes in coal prices may influence corporate revenues, profitability, investor expectations, and overall stock market performance within the energy sector. Several previous studies have shown that coal price movements are associated with stock market performance, particularly in energy-related industries. Setiawan et al. (2025) found that world coal prices significantly affected energy sector stock prices in Indonesia. Similarly, Purwani and Santoso (2023) reported that coal price returns had a positive and significant effect on the IDXENERGY Index. Goh et al. (2025) also demonstrated that coal prices had a strong and consistent relationship with the Indonesian Energy Stock Price Index. However, some previous studies have reported different findings. Prasada and Pangestuti (2022) found that coal prices did not have a significant effect on the Indonesian Composite Index (IHSG). Likewise, Nugraha and Putera (2021) reported that coal prices had a negative long-term relationship with mining sector stock indices in Indonesia. These differing findings indicate that the relationship between coal prices and stock returns remains inconclusive and may vary depending on the research context and prevailing market

conditions. The Indonesian energy sector provides an important context for examining the effect of coal prices because coal remains one of the country's most significant export commodities. Fluctuations in global coal prices may affect not only firm-level performance but also investor sentiment toward the broader energy sector. Consequently, investigating the role of coal price returns may provide a deeper understanding of how global commodity markets influence stock market performance in Indonesia. Based on these findings, the following hypothesis is proposed:

*H3: World coal price returns have a significant effect on energy sector stock returns on the Indonesia Stock Exchange (IDX).*

## 2.6. Hypothesis Development

Based on the theoretical foundations of the Arbitrage Pricing Theory (APT) and the Efficient Market Hypothesis (EMH), together with the empirical findings discussed in Sections II.3–II.5, this study formulates three hypotheses regarding the effects of world oil, gold, and coal price returns on energy sector stock returns on the Indonesia Stock Exchange (IDX). This study contributes to the existing literature by focusing specifically on the Indonesian energy sector using daily time-series data covering the 2021–2025 period, which captures the post-pandemic economic recovery and heightened uncertainty in global energy markets. The relationship between commodity prices and stock returns is particularly relevant to the energy sector because energy companies are closely linked to developments in global commodity markets. Changes in commodity prices may influence production costs, revenues, profitability, and investor expectations. Although previous studies have generally reported that commodity prices affect stock market performance, empirical findings remain inconsistent across countries, sectors, and observation periods. These inconsistencies highlight the need for further investigation, particularly in the Indonesian energy sector, which plays a vital role in the national economy and is highly exposed to fluctuations in global energy markets. Furthermore, examining these relationships is important because the Indonesian energy sector is one of the country's strategic industries, contributing significantly to both economic activity and capital market development. Understanding how global commodity price movements affect energy sector stock returns may provide valuable insights for investors, policymakers, and corporate managers in assessing market risks and identifying investment opportunities. Therefore, investigating the effects of commodity price returns remains relevant from both theoretical and practical perspectives. Based on the theoretical foundations and empirical evidence discussed above, the conceptual framework presented in Figure 1 illustrates the relationships among the underlying theories, research variables, and the hypotheses proposed in this study.



**Figure 1. Conceptual Framework**

### III. Research Method

#### 3.1. Research Design and Data

This study employs a quantitative research design using a time-series approach to examine the effects of global commodity price returns on energy sector stock returns on the Indonesia Stock Exchange (IDX). The study utilizes secondary daily data covering the 2021–2025 period. This observation period was selected to capture the post-pandemic economic recovery and the heightened volatility in global commodity and energy markets. The selected observation period is particularly relevant because global commodity markets experienced substantial fluctuations following the COVID-19 pandemic. During this period, global energy demand gradually recovered, while geopolitical events, such as the Russia–Ukraine conflict, contributed to significant uncertainty in commodity markets. These developments created an environment in which commodity price movements became increasingly important in shaping investor expectations and influencing stock market performance, particularly in sectors closely related to energy production and distribution. The population of this study consists of all energy sector companies listed on the Indonesia Stock Exchange (IDX). The sample was selected using a purposive sampling technique based on several criteria, including companies listed on the main board, companies that completed their Initial Public Offering (IPO) before the observation period, companies that were not subject to trading suspension during the study period, and companies with complete daily stock price data throughout 2021–2025. The final sample consists of 27 energy sector companies listed on the IDX. The dependent variable is energy sector stock returns, constructed using the equally weighted average daily stock returns of the sampled companies. The independent variables consist of world oil price returns, world gold price returns, and world coal price returns.

**Table 1. Sample Selection Criteria**

| No. | Sample Criteria                                                            | Total |
|-----|----------------------------------------------------------------------------|-------|
| 1   | Energy sector companies listed on the Indonesia Stock Exchange (IDX)       | 91    |
| 2   | Companies listed on the Development Board                                  | (38)  |
| 3   | Companies listed on the Special Monitoring Board                           | (13)  |
| 4   | Companies that conducted an Initial Public Offering (IPO) during 2021–2025 | (12)  |
| 5   | Companies subject to trading suspension during the observation period      | (1)   |
|     | Final sample                                                               | 27    |

The selection of companies listed on the main board was intended to ensure the continuity and consistency of the daily stock price observations. The sampling criteria required companies to have been listed before the observation period, remain actively traded without suspension, and provide complete daily stock price data throughout 2021–2025. Excluding companies listed on the Development Board and the Special Monitoring Board also helped create a more homogeneous sample based on listing classification. These criteria supported the construction of a consistent time-series dataset for the Indonesian energy sector. The purposive sampling technique was considered appropriate because this study required companies that consistently satisfied specific selection criteria throughout the observation period. Accordingly, the selected sample was intended to provide a reliable basis for examining the relationship between global commodity price returns and energy sector stock returns rather than to statistically represent the entire population of listed companies. The data used in this study were obtained from Investing.com and other supporting sources relevant to the research. The study utilizes daily historical data on stock prices and global commodity prices. World oil prices are proxied by Crude Oil WTI Futures, world gold prices by XAU/USD spot prices, and world coal prices by Newcastle Coal Futures. The secondary data were collected through manual retrieval of historical price data available on Investing.com during the research period. Daily observations were aligned using identical trading dates to ensure consistency across all variables. Only observations with complete daily

price information for every variable were included in the final dataset to maintain consistency throughout the analysis. The downloaded data were subsequently reviewed to verify their completeness and consistency before being transformed into logarithmic returns for further analysis. Investing.com was selected because it provides publicly accessible historical data for the financial and commodity price series examined in this study. To provide an overview of the dataset prior to the econometric analysis, descriptive statistics for all research variables are presented in the Results and Discussion section.

### 3.2. Variable Measurement

All variables in this study are measured using logarithmic returns (log returns), which are commonly used in financial time series analysis because they are considered more suitable for daily financial data and may help produce more stable statistical distributions. The use of log returns is common in financial time series studies because it allows returns to be expressed in a continuously compounded form and may provide more desirable statistical properties for empirical analysis (Tsay, 2010; Brooks, 2019). The use of log returns is particularly appropriate for this study because both global commodity prices and energy sector stock prices are observed on a daily basis and exhibit relatively frequent fluctuations. Log returns facilitate comparisons across variables with different price levels and provide a consistent measure for examining the dynamic relationships between commodity price movements and energy sector stock returns within the Indonesian capital market. The log return calculation is formulated as follows:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

Where  $R_t$  represents the return at time  $t$ ,  $P_t$  represents the price at time  $t$ , and  $P_{t-1}$  represents the price at time  $t-1$ . Logarithmic returns were selected instead of simple returns because they represent continuously compounded returns and facilitate the interpretation of return dynamics over time (Brooks, 2019). The same logarithmic return formula was applied consistently to all research variables. Energy sector stock returns (IDX\_R) were calculated from the equally weighted average daily closing prices of the sampled companies listed on the Indonesia Stock Exchange (IDX). World oil price returns (OIL\_R) were calculated using daily closing prices of Crude Oil WTI Futures, world gold price returns (GOLD\_R) were calculated using daily XAU/USD spot prices, and world coal price returns (COAL\_R) were calculated using daily Newcastle Coal Futures prices. All variables were measured using daily observations over the 2021–2025 period. The regression model used in this study is formulated as follows:

$$\text{IDX}_{Rt} = \alpha + \beta_1 \text{OIL}_{Rt} + \beta_2 \text{GOLD}_{Rt} + \beta_3 \text{COAL}_{Rt} + \varepsilon_t$$

where  $\text{IDX}_R$  represents energy sector stock returns,  $\text{OIL}_R$  represents world oil price returns,  $\text{GOLD}_R$  represents world gold price returns,  $\text{COAL}_R$  represents world coal price returns,  $\alpha$  denotes the intercept,  $\beta_1$ – $\beta_3$  denote the regression coefficients, and  $\varepsilon$  represents the error term.

### 3.3. Data Analysis Technique

The data were analyzed using EViews 13 software. Prior to estimating the regression model, the daily price series were transformed into logarithmic returns. The transformed return series were subsequently subjected to outlier treatment using the Z-score method with a threshold of  $|Z| < 2.5$  to reduce the influence of extreme observations. This threshold was adopted because standardized scores exceeding  $\pm 2.5$  are generally considered extreme observations that may distort statistical estimation results (Hair et al., 2014). Following the outlier treatment process, the number of observations decreased from 1,204 to 1,175. Because this study employs a time-series approach, stationarity was first examined using the Augmented Dickey–Fuller (ADF) test to ensure that the variables were free from unit roots and to avoid spurious regression results. After stationarity had been confirmed, the regression model was evaluated through a series of classical assumption

tests, including normality, autocorrelation, heteroskedasticity, and multicollinearity tests. These procedures are widely applied in econometric analysis to ensure that the regression model satisfies the assumptions underlying the Ordinary Least Squares (OLS) estimator (Gujarati & Porter, 2009). Residual normality was assessed using the Jarque–Bera test. Autocorrelation was examined using the Breusch–Godfrey Serial Correlation LM test, while heteroskedasticity was evaluated using the White test. Multicollinearity was assessed using the pairwise correlation matrix, with correlation coefficients below 0.80 indicating the absence of serious multicollinearity. The regression model was considered appropriate for estimation once all of these assumptions had been satisfied.

Hypothesis testing was conducted using the t-test, F-test, and the coefficient of determination ( $R^2$ ). Ordinary Least Squares (OLS) was selected as the primary analytical method because it is one of the most widely used techniques for examining the relationship between independent and dependent variables in financial and economic research. OLS enables the estimation of both the direction and statistical significance of the relationship between global commodity price returns and energy sector stock returns while providing measures of model performance through the coefficient of determination, t-statistics, and F-statistics. To complement the static relationships estimated by OLS, this study also employs Vector Autoregression (VAR) and the Granger Causality Test to examine the dynamic interactions among the variables. While OLS estimates the contemporaneous effects of commodity price returns on energy sector stock returns, VAR captures the dynamic interrelationships among the variables over time, and the Granger Causality Test determines whether changes in one variable systematically precede changes in another. Consequently, these complementary methods provide additional evidence regarding the temporal relationships between global commodity price returns and energy sector stock returns. The VAR analysis began with the selection of the optimal lag length based on the Likelihood Ratio (LR), Final Prediction Error (FPE), and Akaike Information Criterion (AIC). After the optimal lag structure had been determined, model stability was evaluated before conducting the Granger causality analysis. The application of VAR and the Granger Causality Test follows the time-series framework commonly used in econometric studies to analyze dynamic relationships among economic and financial variables (Juanda & Junaidi, 2012). All statistical analyses were performed using EViews 13.

## IV. Result and Discussion

### 4.1. Descriptive Statistics

This study uses 1,175 daily observations after the outlier treatment process. Outliers were identified and removed using the Z-score method to reduce the influence of extreme observations on the analysis. The variables examined in this study include energy sector stock returns (IDX\_R), world oil price returns (OIL\_R), world gold price returns (GOLD\_R), and world coal price returns (COAL\_R).

**Table 2. Descriptive Statistics**

| Variable | Mean     | Std. Dev. | Minimum   | Maximum  |
|----------|----------|-----------|-----------|----------|
| IDX_R    | 0.001399 | 0.011530  | -0.031856 | 0.034295 |
| OIL_R    | 0.000518 | 0.022388  | -0.130134 | 0.108681 |
| GOLD_R   | 0.000796 | 0.009627  | -0.054579 | 0.035227 |
| COAL_R   | 0.000287 | 0.029512  | -0.432454 | 0.340572 |

Source: Processed Data

Based on Table 2, energy sector stock returns (IDX\_R) have a mean value of 0.001399 and a standard deviation of 0.011530, indicating a moderate level of volatility during the observation period. Among the explanatory variables, world oil price returns (OIL\_R) and world coal price returns (COAL\_R) exhibit relatively higher volatility than the other variables, as reflected in their standard deviations of 0.022388 and 0.029512, respectively. In contrast, world gold price returns (GOLD\_R) display the lowest volatility, with a standard

deviation of 0.009627. This finding is consistent with the well-established role of gold as a safe-haven asset, whose price movements tend to be more stable than those of energy commodities. Overall, the descriptive statistics indicate that each commodity exhibits distinct return characteristics and levels of volatility over the 2021–2025 observation period.

#### 4.2. Regression Results

Before estimating the regression model, stationarity was examined using the Augmented Dickey–Fuller (ADF) test, which confirmed that all variables were stationary at their levels. Furthermore, the regression model satisfied all classical assumption tests, including tests for normality, autocorrelation, heteroskedasticity, and multicollinearity. Therefore, the data were considered suitable for subsequent regression and time-series analyses.

**Table 3. OLS Regression Results**

| Variable                                                                                                                                                                                      | Coefficient | t-Statistic | Probability |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|
| C                                                                                                                                                                                             | 0.001304    | 3.931100    | 0.0001      |
| OIL_R                                                                                                                                                                                         | 0.072225    | 4.758401    | 0.0000      |
| GOLD_R                                                                                                                                                                                        | 0.059712    | 1.713773    | 0.0868      |
| COAL_R                                                                                                                                                                                        | 0.034492    | 3.037076    | 0.0024      |
| <ul style="list-style-type: none"> <li>• R-squared = 0.036291</li> <li>• Adjusted R-squared = 0.033822</li> <li>• F-statistic = 14.69910</li> <li>• Prob. (F-statistic) = 0.000000</li> </ul> |             |             |             |

Source: Processed Data

The regression results presented in Table 3 indicate that world oil price returns have a positive and statistically significant effect on energy sector stock returns. This relationship is reflected by a positive regression coefficient of 0.072225 and a p-value of 0.0000, which is below the 5% significance level. The positive coefficient suggests that increases in world oil price returns are associated with increases in energy sector stock returns. This finding indicates that fluctuations in global oil prices remain an important determinant of investor expectations and the performance of energy-related companies in Indonesia. Similarly, world coal price returns have a positive and statistically significant effect on energy sector stock returns, as indicated by a regression coefficient of 0.034492 and a p-value of 0.0024, both of which are significant at the 5% level. This result suggests that coal price movements continue to play an important role in shaping the performance of Indonesia's energy sector, reflecting the country's position as one of the world's leading coal producers and exporters. By contrast, world gold price returns have a positive but statistically insignificant effect on energy sector stock returns, as indicated by a regression coefficient of 0.059712 and a p-value of 0.0868, which exceeds the 5% significance level. This finding suggests that fluctuations in gold prices do not directly influence the performance of energy sector stocks during the observation period. One possible explanation is that gold is generally regarded as a safe-haven asset and is therefore less closely associated with the operational performance of energy companies than energy-related commodities such as oil and coal. The regression results further indicate that the independent variables jointly have a statistically significant effect on energy sector stock returns, as evidenced by an F-statistic of 14.69910 and a corresponding p-value of 0.000000, which is below the 5% significance level. This finding suggests that global commodity price movements collectively contribute to explaining variations in energy sector stock returns in Indonesia.

Nevertheless, the coefficient of determination remains relatively low, with an adjusted  $R^2$  of 0.033822. This result indicates that approximately 3.38% of the variation in energy sector stock returns is explained by world oil, gold, and coal price returns, while the remaining 96.62% is attributable to other factors not included

in the model. These factors may include macroeconomic variables such as exchange rate fluctuations, inflation, and interest rates, as well as market sentiment, global energy demand, domestic energy policies, geopolitical uncertainty, and firm-specific characteristics. These variables were intentionally excluded because the primary objective of this study was to examine the explanatory role of global oil, gold, and coal price returns rather than to develop a comprehensive model of all determinants of energy sector stock returns. Although the explanatory power of the model is relatively modest, this does not necessarily imply that the model is inadequate. In financial time-series research, stock returns are inherently influenced by numerous macroeconomic, market-specific, and firm-specific factors, many of which cannot be fully captured within a single regression model. Consequently, the relatively low adjusted  $R^2$  reflects the complex and multifactor nature of stock return behavior rather than any weakness in the estimated regression model.

#### 4.3. Additional Analysis: VAR and Granger Causality

To complement the main regression analysis, this study employs Vector Autoregression (VAR) and the Granger Causality Test to examine the dynamic relationships among the variables within a time-series framework. Based on the optimal lag selection results, lag 2 was identified as the optimal lag length because it was supported by the majority of the selection criteria. The VAR stability test further indicates that the estimated model satisfies the stability condition, as all modulus values are less than one and the inverse roots lie inside the unit circle. Accordingly, the VAR model is considered stable and suitable for subsequent dynamic analysis.

**Table 4. Granger Causality Test**

| Excluded Variable | Chi-Square | Probability | Conclusion      |
|-------------------|------------|-------------|-----------------|
| OIL_R             | 49.68049   | 0.0000      | Significant     |
| GOLD_R            | 1.778212   | 0.4110      | Not Significant |
| COAL_R            | 26.13511   | 0.0000      | Significant     |
| All Variables     | 91.41082   | 0.0000      | Significant     |

Source: Processed Data

Table 4 presents the results of the Granger Causality Test, which was conducted to examine whether global commodity price returns possess predictive power for energy sector stock returns. The results indicate that world oil price returns and world coal price returns have significant causal relationships with energy sector stock returns, as evidenced by p-values of 0.0000, which are below the 5% significance level. In contrast, world gold price returns do not exhibit a significant causal relationship, with a p-value of 0.4110. Among the explanatory variables, world oil price returns demonstrate the strongest causal relationship with energy sector stock returns, as reflected by the highest Chi-square statistic (49.68049). Overall, the VAR and Granger causality analyses produce findings that are consistent with the OLS regression results. These additional analyses suggest that the Indonesian energy sector is more strongly associated with fluctuations in global energy commodities, particularly oil and coal, than with movements in gold prices.

#### 4.4. Discussion

The findings of this study indicate that world oil price returns have a positive and statistically significant effect on energy sector stock returns on the Indonesia Stock Exchange (IDX). This result suggests that increases in oil price returns improve investor expectations regarding the future performance of energy sector companies, particularly those engaged in energy production and distribution. These findings are consistent with those reported by Basit (2020), Setiawan et al. (2025), and Purwani and Santoso (2023), all of whom found that oil price movements significantly influenced stock market performance, particularly within Indonesia's energy sector. The significant effect of world oil price returns can also be explained by the strategic

role of oil as one of the world's primary energy commodities. Throughout the 2021–2025 period, oil price fluctuations reflected changes in global energy demand, supply disruptions, and geopolitical developments. These conditions shaped investors' expectations regarding the future profitability of energy companies. Consequently, increases in oil price returns tended to generate favorable market sentiment toward energy sector stocks, resulting in higher stock returns. These findings are consistent with the Arbitrage Pricing Theory (APT), which argues that stock returns are influenced by systematic macroeconomic factors, including global commodity price movements. They also support the Efficient Market Hypothesis (EMH), which proposes that financial markets rapidly incorporate publicly available information into stock prices. Consequently, information regarding global oil price movements is quickly reflected in the valuation of energy sector stocks. The results further reveal that world coal price returns have a positive and statistically significant effect on energy sector stock returns. This finding indicates that coal remains one of the most influential commodities affecting Indonesia's energy sector. As one of the world's largest coal exporters, Indonesia is highly exposed to fluctuations in global coal prices, which directly influence corporate revenues, profitability, and investor sentiment toward energy sector companies.

This finding is consistent with the results reported by Setiawan et al. (2025), Goh et al. (2025), and Purwani and Santoso (2023), who found that coal price movements significantly influenced energy sector stock performance in Indonesia. The strong relationship between coal price returns and energy sector stock returns is also consistent with Indonesia's strategic position as one of the world's leading coal exporters. Changes in global coal prices directly affect the revenues and profitability of coal-related companies, which constitute a substantial portion of the Indonesian energy sector. Consequently, investors tend to closely monitor developments in the global coal market when evaluating investment opportunities in energy sector stocks. The additional VAR and Granger causality analyses further reinforce these findings by demonstrating a strong dynamic relationship between coal price returns and energy sector stock returns. In contrast, world gold price returns do not have a statistically significant effect on energy sector stock returns. This finding suggests that fluctuations in gold prices are not directly associated with the performance of energy sector companies during the observation period. One possible explanation is that gold primarily functions as a safe-haven asset rather than as a commodity directly linked to the operational activities of energy companies. This result is consistent with the findings of Ady (2021), who reported that gold prices did not significantly affect mining sector stock returns in Indonesia. Similar evidence was presented by Basit (2020), who found that gold prices were not significantly associated with the Indonesian stock market, although the direction of the relationship differed from that observed in the present study. Although some previous studies have reported contrasting findings, the evidence from this study suggests that Indonesia's energy sector is considerably more sensitive to fluctuations in energy-related commodities, particularly oil and coal, than to movements in safe-haven assets such as gold.

Another possible explanation for the insignificant effect of world gold price returns is that gold and energy sector stocks generally serve different investment objectives. Energy sector stocks are primarily associated with growth opportunities and corporate profitability, whereas gold is widely regarded as a defensive asset used to preserve wealth during periods of economic uncertainty. Consequently, fluctuations in gold prices may not necessarily influence investors' valuation of energy sector companies, particularly when market participants are more responsive to developments in energy-related commodity markets. From a theoretical perspective, the insignificant effect of world gold price returns does not contradict either the Arbitrage Pricing Theory (APT) or the Efficient Market Hypothesis (EMH). APT argues that stock returns are influenced by multiple systematic risk factors, although the relevance of each factor depends on the characteristics of the market and industry under investigation. Similarly, EMH suggests that investors incorporate available information into stock prices according to its perceived relevance. Therefore, within the Indonesian energy sector, market participants are likely to respond more strongly to information regarding energy commodities, such as oil and coal, than to information regarding gold, which is primarily viewed as a safe-haven asset. Compared with previous studies, the findings of this study both confirm and extend the existing literature on commodity prices and stock returns. Consistent with earlier research, world oil and coal

price returns were found to have positive and statistically significant effects on energy sector stock returns, whereas world gold price returns remained statistically insignificant. However, unlike many previous studies that focused on broader market indices or mining companies, the present study specifically examines the Indonesian energy sector using daily time-series data covering the 2021–2025 period. Consequently, this study provides additional empirical evidence that energy-related commodities exert stronger influences on energy sector stock returns than non-energy commodities within the Indonesian capital market. Although world oil and coal price returns were found to significantly influence energy sector stock returns, these variables should not be interpreted as the sole determinants of stock market performance. Stock returns are inherently influenced by numerous factors, including macroeconomic conditions, firm-specific characteristics, investor sentiment, and broader market developments. This broader perspective is also reflected in the relatively modest explanatory power of the regression model, suggesting that commodity price returns represent only one component of the complex set of factors affecting energy sector stock returns in Indonesia.

## V. Conclusion

This study examines the effects of world oil price returns, world gold price returns, and world coal price returns on energy sector stock returns on the Indonesia Stock Exchange (IDX) during the 2021–2025 period. The analysis employs the Ordinary Least Squares (OLS) method, complemented by Vector Autoregression (VAR) and the Granger Causality Test to examine the dynamic relationships among the variables. The findings indicate that world oil price returns and world coal price returns have positive and statistically significant effects on energy sector stock returns. These results suggest that the Indonesian energy sector remains closely linked to fluctuations in global energy commodity markets, particularly oil and coal. In contrast, world gold price returns do not have a statistically significant effect on energy sector stock returns, indicating that gold price movements are less directly associated with the operational and financial performance of energy sector companies. The additional VAR and Granger causality analyses produce results that are broadly consistent with the main regression findings. Specifically, world oil and coal price returns exhibit stronger dynamic relationships with energy sector stock returns than world gold price returns. From a theoretical perspective, the findings are generally consistent with the Arbitrage Pricing Theory (APT) and the Efficient Market Hypothesis (EMH). The results suggest that information related to global oil and coal price movements is incorporated into energy sector stock returns, although the relevance of commodity price information varies across different commodities. This study also contributes to the existing literature by focusing specifically on the Indonesian energy sector using daily time-series data covering the post-pandemic period and a period of heightened uncertainty in global energy markets. From a practical perspective, the findings imply that investors and other market participants should pay close attention to global oil and coal price movements when evaluating investment opportunities in the Indonesian energy sector. Since world gold price returns were found to have no statistically significant effect, fluctuations in gold prices appear to provide less relevant information for assessing short-term energy sector stock performance than fluctuations in energy-related commodities.

In addition, portfolio managers and market analysts may incorporate information on global commodity price movements into portfolio risk assessment and investment decision-making. Likewise, energy companies may consider developments in global commodity markets as an important input in their strategic and financial decision-making processes. This study has several limitations. First, it examines only three global commodity variables and focuses exclusively on the Indonesian energy sector. Second, the relatively low coefficient of determination indicates that the independent variables included in the model explain only approximately 3.38% of the variation in energy sector stock returns. This finding suggests that many other factors not included in the model may also influence stock return performance, including macroeconomic conditions, exchange rate fluctuations, interest rates, investor sentiment, geopolitical developments, and firm-specific characteristics. Future research could extend the present study by employing longer observation periods to capture different phases of commodity market cycles and economic conditions.

Researchers may also investigate other industrial sectors or conduct cross-country comparative studies to determine whether the relationships observed in Indonesia are consistent across different market environments. Furthermore, incorporating additional commodity variables, such as natural gas and other energy-related commodities, together with macroeconomic and firm-specific variables, may provide a more comprehensive explanation of stock return dynamics and improve the explanatory power of future empirical models.

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