

## **Analysing the Impact of Global Commodity Prices on the IDX Energy Index**

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### **Abstract**

This study aims to analyse the influence of global commodity prices on the energy index prices in Indonesia (IDXENERGY). As proxy of the research this research uses world crude oil prices, world gold prices, and world natural gas prices as the variable of global commodities. The research utilizes monthly time series data from January 2021 to December 2023. The ARDL (Autoregressive Distributed Lag) method is employed to model the short-term and long-term relationships between two or more variables. The study finds that, in the short term, world crude oil prices and world gold prices significantly affect the IDXENERGY index, while the world natural gas price variable does not have a significant impact. In the long-term analysis, no variable is found to have a significant influence on the IDXENERGY index.

**Keywords:** commodities, energy, index

### **1. Introduction**

Indonesia is a country blessed with abundant natural resources, particularly in the mining sector. As a nation rich in mining resources, Indonesia plays a significant role in the trade of mining products, both as a producer and consumer. Mining products are categorized as commodities, and with the rapid advancement of the commodity-driven economy, they have been traded in commodity markets, becoming integral to financial markets such as capital and money markets. In Indonesia itself, the mining and oil and gas sectors contribute significantly to the economy. According to data from the Central Statistics Agency (2022), the mining sector contributed 12.22% to economic growth in 2022. Meanwhile, the oil and gas sector contributed 9% to Indonesia's economic growth in the same year. When combined, the mining and oil and gas sectors contribute approximately 21% to the country's economic growth.

The impact of commodity market performance is not only observed at the macroeconomic level but also in the activities of the capital market within a country. Fundamentally, price increases in commodity products can directly affect the performance of companies in related sectors, such as the mining sector. For example, when the price of gold commodities rises, gold sales should increase, contributing to the profitability of companies. Countries with relatively high dependence on mining commodities may face similar challenges. Significant changes in prices of natural resources or trade goods have serious consequences for the economies of countries heavily reliant on natural resources. Income instability from the natural resource sector

significantly affects both public and private sectors in these countries (Badamvaanchig et al., 2021).

In another case, such as in Mexico, a similar situation occurs, particularly concerning energy commodities like crude oil. Mexico, with a development level of around \$2.4 trillion, experienced an average annual growth of 2.48% from 1994 to 2018. The country heavily depends on the petroleum sector and related products. The performance of companies in various sectors in Mexico is expected to be influenced by fluctuations in oil prices and exchange rates (Singhal et al., 2019). Additionally, recent research indicates that stock market reactions to changes in oil prices can vary depending on several factors, such as the type of economy (involving oil export or import, status as a developing or developed country), the rate of oil price changes, the reasons behind oil price changes, and so on.

Furthermore, the impacts observed in commodity trading also extend to activities in the capital market of a country. This even leads to competition on how funds will be utilized from an investor's standpoint. The competition between stock trading and commodity trading generally depends on the type of assets being traded. Stock trading involves financial products, while commodity trading involves raw products (Salisu et al., 2019). Investors are faced with the choice of investing in company stocks or futures contracts related to commonly traded commodities. Therefore, movements in one asset class can influence the behavior of another asset class. Hence, a comprehensive understanding of the functions of both markets is of significant interest in trading and investment activities. In this study, we compile empirical literature that reviews how the intrinsic connection between stock trading and commodity trading can be optimized by analysts to gain valuable insights for investment decision-making and policy formulation in the financial market domain. Tursoy & Faisal (2018) argue that gold has the potential to act as a stabilizer of strength in the financial system by reducing potential losses arising from highly negative market shocks. This suggests that during financial instability, investors tend to opt for holding assets that can protect the value of their investments. This raises a crucial question that needs investigation: whether gold can truly be considered a safe investment to safeguard an investor's portfolio. Therefore, the main motivation of this research is to determine whether the involved variables are interconnected and to explore signs of potential connections.

## 2. Literature Review

Many studies have been conducted with the aim of examining the impact of commodity prices on stock indices. Research has been carried out in various countries using various research methods, yielding different results. Cueppers & Smeets (2015) investigated the influence of changes in crude oil prices on stocks on the German stock exchange during the period from February 1982 to July 2007. This study found that changes in oil prices generally do not have a significant impact on the returns of German DAX companies. Only oil price shocks affect stock returns asymmetrically, where positive shocks lead to a decline in stock returns, and negative shocks do not yield significant results. Certain industries are affected by oil price shocks, while others remain unaffected. The various impacts of oil price shocks are mainly

attributed to the cost and demand dependence on oil faced by various companies. The findings are consistent with existing research in Germany and other industrial (oil-importing) countries. The analysis also indicates that oil prices affect German stock returns in the short term through signaling channels. However, its impact on economic activities, such as GDP or industrial production, likely depends on changes in oil prices in the national currency, reflecting the influence on costs incurred by companies.

Additionally, research has been conducted by Salisu et al. (2019) examining the predictability of commodity prices on stock returns in G7 countries. This study found that commodity prices are a good predictor of stock returns for G7 countries, both in-sample and out-of-sample estimates. The proposed commodity-based stock return model outperforms time series models and historical average models that ignore commodity prices. These conclusions hold strong for various commodity price components, different data samples, and alternative forecast estimates. Moreover, considering inherent characteristics of commodity prices, such as persistence, endogeneity, conditional heteroskedasticity, structural breaks, and asymmetry, improves the accuracy of the model's forecasts. Commodity prices predict stock returns better than historical averages. These findings are consistent across different sample periods, various forecast horizons, and commodity indices. This study establishes the importance of commodity prices in predicting stock returns in G7 countries, providing investors with alternative hedging options to enhance investment returns.

Furthermore, research conducted by Ahmed & Sarkodie (2021) investigates the volatility of stock prices influenced by fluctuations in energy commodity prices. This study found a negative long-term relationship between real oil prices, real coal prices, real natural gas prices, short-term interest rates, and real stock indices, with only the industrial production index reporting a positive relationship with the real stock index in both ARDL and dynamic simulation ARDL models. In the short term, there is a positive relationship between energy commodities (real oil prices, real coal prices, real natural gas prices) and the real stock index, while short-term interest rates and the industrial production index have a negative relationship with the real stock index. Additionally, another study by Musawa & Mwaanga (2017) investigated the performance of the capital market in Zambia. The research results show a long-term and short-term relationship between the stock price index, copper prices, and oil. An increase in copper prices has a positive impact, while an increase in oil prices has a negative impact on the stock exchange.

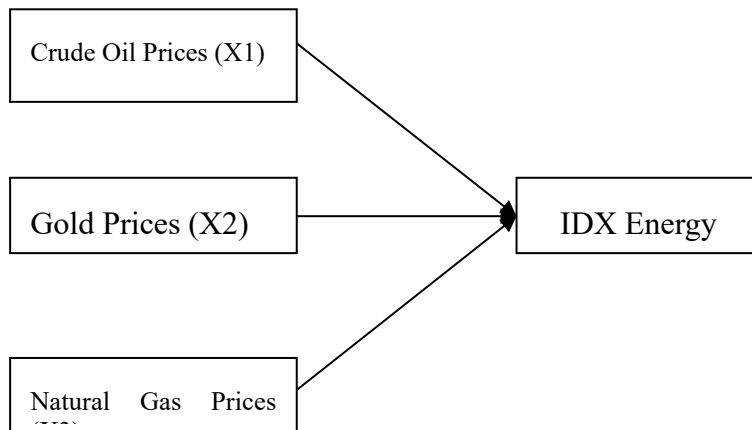


Figure 1. Research Paradigm

### 3. Research Method

This research employs a quantitative approach, and the type of research used is conclusive causality. The study covers the period from January 2021 to December 2023. In this research, secondary data obtained from publications collected through the primary source, the investing.com website, is utilized. The aim of this study is to explore and model the dynamics of the movement of global oil prices, world gold prices, world natural gas prices, and the energy stock index in the Indonesian capital market. To test the long-term relationships between Oil, exchange rates, stock prices, and gold prices, the Bound ARDL approach is employed. The Autoregressive Distributed Lag (ARDL) method is a time series analysis approach used to model short-term and long-term relationships between two or more variables (Pesaran et al., 2001). Cointegration validates systemic co-movements between two or more macroeconomic variables in the long run (Singhal et al., 2019). The ARDL approach has the advantage of being estimable for unit root testing  $I(0)$  and  $I(1)$  or a combination of both, but it cannot be applied to the results of unit root testing  $I(2)$  (Ahmad Ridha et al., 2021). This study utilizes monthly data of Brent Crude Oil Futures prices, Natural Gas Futures prices, and Gold Futures prices as independent variables and the Energy Index price data as the dependent variable.

### 4. Finding and Discussion

**Stationarity Test.** Stationarity testing is conducted to prevent spurious regression. In this study, the method employed to test the stationarity of data is the unit root test, and the model used is the Augmented Dickey Fuller (ADF) model.

Table 1. Stationarity Test Result

| Intermediate ADF test results D |        |     |         |     |
|---------------------------------|--------|-----|---------|-----|
| Series                          | Prob.  | Lag | Max Lag | Obs |
| D(X1)                           | 0.0001 | 0   | 8       | 34  |
| D(X2)                           | 0.0000 | 0   | 8       | 34  |
| D(X3)                           | 0.0000 | 0   | 8       | 34  |
| D(Y)                            | 0.0000 | 0   | 8       | 34  |

Based on the data in the table above, it can be observed that the probability values for X1 (Crude Oil Price), X2 (Gold Price), X3 (Natural Gas Price), and Energy Index Price (Y) are all less than 5% at the first difference level. It can be concluded that the data is stationary.

Cointegration Test. Cointegration test is a examination conducted to determine the long-term equilibrium among variables. In performing the cointegration test, this study employs the Bound test method. The testing is carried out by comparing the F-Statistic value with the Bound Test value. Based on the table below, it can be observed that the F-Statistic value of 4.576 is greater than the I(1) value of 3.67, thus it can be concluded that cointegration exists.

Table 2. Cointegration Test Result

| F-Bounds Test  |          | Null Hypothesis: No levels relationship |                       |      |
|----------------|----------|-----------------------------------------|-----------------------|------|
| Test Statistic | Value    | Signif.                                 | I(0)                  | I(1) |
|                |          |                                         | Asymptotic:<br>n=1000 |      |
| F-statistic    | 4.575698 | 10%                                     | 2.37                  | 3.2  |
| k              | 3        | 5%                                      | 2.79                  | 3.67 |
|                |          | 2.5%                                    | 3.15                  | 4.08 |
|                |          | 1%                                      | 3.65                  | 4.66 |

Optimum Lag Selection. The goal of selecting the optimal lag in the ARDL method is to find the best number of lags that optimally depict the relationship between the variables. There are several methods that can be used to choose the optimal lag in the ARDL method, such as information criteria like the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and others.

Table 3. Optimum Lag Selection

| Model | LogL        | AIC*      | BIC       | HQ        | Adj. R-sq |
|-------|-------------|-----------|-----------|-----------|-----------|
| 10    | -172.149402 | 12.074155 | 12.768020 | 12.300338 | 0.516928  |
| 5     | -171.471604 | 12.094942 | 12.835065 | 12.336204 | 0.506770  |
| 9     | -172.074336 | 12.133828 | 12.873951 | 12.375090 | 0.487212  |
| 4     | -171.228516 | 12.143775 | 12.930155 | 12.400116 | 0.479762  |
| 8     | -171.621230 | 12.169112 | 12.955492 | 12.425452 | 0.466413  |
| 3     | -170.998341 | 12.193441 | 13.026079 | 12.464861 | 0.448002  |
| 7     | -171.598428 | 12.232157 | 13.064794 | 12.503576 | 0.426213  |

|     |             |           |           |           |          |
|-----|-------------|-----------|-----------|-----------|----------|
| 6   | -170.880572 | 12.250359 | 13.129255 | 12.536857 | 0.406529 |
| 2   | -170.946147 | 12.254590 | 13.133486 | 12.541088 | 0.404013 |
| 485 | -182.332288 | 12.279502 | 12.649564 | 12.400133 | 0.351786 |

In the lag selection process, the Optimal Lag is determined by referring to the AIC values in the below. In the 10th model, the AIC value is the lowest, so the selected model is model 10. Then, referring to the graph below, the lag configuration for the ARDL model used is 4, 4, 3, 0.

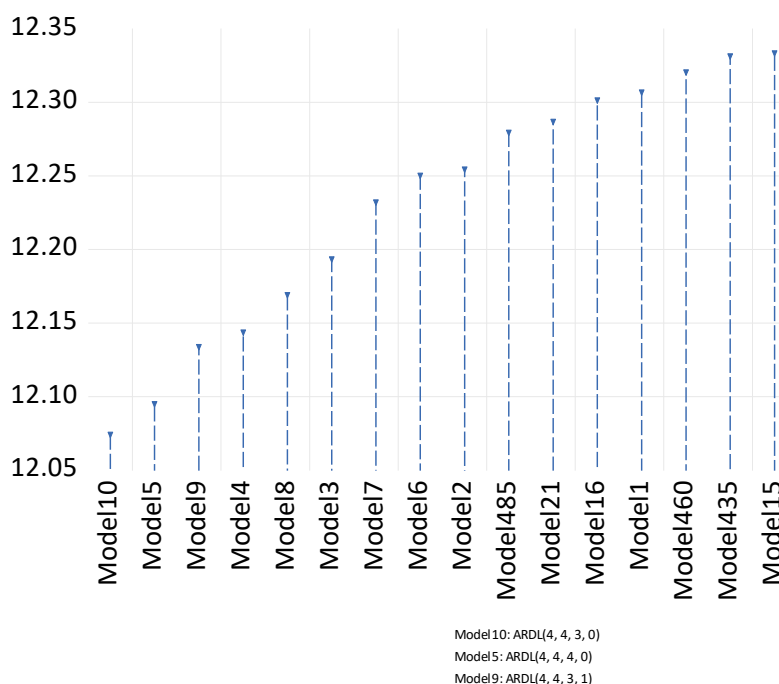


Figure 2. Lag Configuration

Autocorrelation Test. The Autocorrelation Test in this study employs the Breusch-Godfrey Serial Correlation LM Test method. According to Gujarati (2013), for a sufficiently large number of observations, it is recommended to use the Lagrange Multiplier (LM) test, which can be conducted on a regression that includes lags of the dependent variable as independent variables.

Table 4. Autocorrelation Test

|                                                        |          |                     |        |
|--------------------------------------------------------|----------|---------------------|--------|
| Breusch-Godfrey Serial Correlation LM Test:            |          |                     |        |
| Null hypothesis: No serial correlation at up to 4 lags |          |                     |        |
| F-statistic                                            | 0.884871 | Prob. F(4,12)       | 0.5019 |
| Obs*R-squared                                          | 7.060978 | Prob. Chi-Square(4) | 0.1327 |

Based on the table above, the Chi-Square probability value of 0.1327 is greater than the alpha

probability value of 10%, thus it can be concluded that there is no autocorrelation.

Heteroscedasticity Test. The heteroskedasticity test is conducted using the Breusch-Pagan-Godfrey method. Based on the table below, the Chi-Square probability value is 0.8135, which is greater than the alpha value of 10%. Therefore, it can be concluded that there is no heteroskedasticity issue.

Table 5. Heteroscedasticity Test

| Heteroskedasticity Test: Breusch-Pagan-Godfrey |          |                      |        |
|------------------------------------------------|----------|----------------------|--------|
| Null hypothesis: Homoskedasticity              |          |                      |        |
| F-statistic                                    | 0.687414 | Prob. F(14,16)       | 0.7567 |
| Obs*R-squared                                  | 11.64299 | Prob. Chi-Square(14) | 0.6349 |
| Scaled explained SS                            | 9.268000 | Prob. Chi-Square(14) | 0.8135 |

ARDL Estimation Results. After conducting stationarity and bound tests, and selecting the optimal lag, the next step is to perform the ARDL model regression. ARDL regression is used to examine the long-term and short-term relationships among the variables in the study.

Table 6. ARDL Estimation Results

| Variable           | Coefficient<br>t | Std. Error            | t-Statistic | Prob.*   |
|--------------------|------------------|-----------------------|-------------|----------|
| D(Y(-1))           | -0.117014        | 0.196693              | -0.594908   | 0.5602   |
| D(Y(-2))           | -0.133739        | 0.184826              | -0.723592   | 0.4798   |
| D(Y(-3))           | -0.080784        | 0.185871              | -0.434622   | 0.6696   |
| D(Y(-4))           | 0.826115         | 0.243816              | 3.388267    | 0.0038   |
| D(X1)              | 11.36802         | 2.555062              | 4.449216    | 0.0004   |
| D(X1(-1))          | -0.133287        | 3.176371              | -0.041962   | 0.9670   |
| D(X1(-2))          | 7.995666         | 3.132893              | 2.552167    | 0.0213   |
| D(X1(-3))          | 1.230347         | 3.166481              | 0.388553    | 0.7027   |
| D(X1(-4))          | -11.22375        | 3.699389              | -3.033946   | 0.0079   |
| D(X2)              | -0.885323        | 0.422758              | -2.094162   | 0.0525   |
| D(X2(-1))          | -0.980828        | 0.312589              | -3.137755   | 0.0064   |
| D(X2(-2))          | -0.583440        | 0.257832              | -2.262874   | 0.0379   |
| D(X2(-3))          | -0.730296        | 0.295257              | -2.473427   | 0.0250   |
| D(X3)              | -12.21207        | 18.56830              | -0.657684   | 0.5201   |
| C                  | 45.46351         | 20.33083              | 2.236186    | 0.0399   |
| R-squared          | 0.742361         | Mean dependent var    |             | 43.98871 |
| Adjusted R-squared | 0.516928         | S.D. dependent var    |             | 125.0560 |
| S.E. of regression | 86.91818         | Akaike info criterion |             | 12.07415 |
| Sum squared resid  | 120876.3         | Schwarz criterion     |             | 12.76802 |
| Log likelihood     | -172.1494        | Hannan-Quinn          |             | 12.30034 |

|                   |          |                    |          |
|-------------------|----------|--------------------|----------|
|                   |          | criter.            |          |
| F-statistic       | 3.293035 | Durbin-Watson stat | 2.031030 |
| Prob(F-statistic) | 0.012461 |                    |          |

Short Term and Long-Term Estimation Results. After conducting the ARDL estimation, the next step is to perform short-term and long-term estimations.

Table 6. Short Term Estimation Result

| Variabel | Coefficient | Std. error | t-statistic | Prob.* | Status          |
|----------|-------------|------------|-------------|--------|-----------------|
| D(X1)    | 11.36802    | 2.555062   | 4.449216    | 0.0004 | Significant     |
| D(X2)    | -0.885323   | 0.422758   | -2.094162   | 0.0525 | Significant     |
| D(X3)    | -12.21207   | 18.56830   | -0.657684   | 0.5201 | Not Significant |

From the results of the short-term estimation, it can be found that the variables of world crude oil prices and world gold prices have a significant impact on the energy index of the Indonesian capital market.

Table 7. Long Term Estimation Result

| Variabel | Coefficient | Std. error | t-statistic | Prob.* | Status          |
|----------|-------------|------------|-------------|--------|-----------------|
| D(X1)    | 18.27580    | 13.28019   | 1.376170    | 0.1877 | Not Significant |
| D(X2)    | -6.291543   | 4.602024   | -1.367125   | 0.1905 | Not Significant |
| D(X3)    | -24.16209   | 39.72843   | -0.608181   | 0.5516 | Not Significant |

From the results of the long-term estimation, no variables were found to have a significant impact on the energy index of the Indonesian capital market.

## 5. Conclusion

Based on the data analysis results using the Auto-Regressive Distributed Lag (ARDL) method that has been conducted, the conclusions can be outlined as follows: (1) The variable of future crude oil prices (X1) has a significantly positive impact on the IDXENERGY index in the short term. At Lag 1 and Lag 3, or one and three months before, the future crude oil prices do not have a significant impact on the IDXENERGY index. However, looking at Lag 2 and Lag 4, the variable of future crude oil prices has a significant influence on the IDXENERGY index. In the long term, the variable of future crude oil prices does not have a significant impact on the IDXENERGY index. (2) The variable of future gold prices (X2) has a significantly negative impact on the IDXENERGY index in the short term. It means that the movement of future gold prices moves in the opposite direction to the IDXENERGY index; for example, when there is an increase in future gold prices, there will be a decrease in the value of the IDXENERGY index. Furthermore, at Lag 1, 2, and 3, or 1 to 3 months before, the variable of future gold prices also has a significant impact on the IDXENERGY index. In the long term, the variable of future gold prices does not have a significant impact on the IDXENERGY index. (3) The variable of future natural gas prices (X3) does not have a significant impact on the IDXENERGY index in the short term. In the long-term estimation results, the variable of future natural gas prices also does not have a significant impact on the IDXENERGY index. Therefore, it can be concluded that in the long term, all variables used in this study do not have a significant impact on the

IDXENERGY index.

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