

# The Effect Of Coal Production, International Prices, And Gdp On The Volume Of Indonesia's Coal Exports

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## Abstract

*This study aims to examine the impact of coal production, international prices, and the average GDP of India and China on the volume of Indonesian coal exports for the period 2005–2024. The data used consists of secondary time-series data for the 2005–2024 period, sourced from the Indonesian Central Statistics Agency (BPS), the Ministry of Energy and Mineral Resources, and the World Bank Group. Data analysis was conducted using multiple linear regression with the assistance of Eviews 10 software. The results of the study indicate that coal production has a positive and significant effect on the volume of Indonesia's coal exports during the study period. International prices were found to have a positive and significant effect on the volume of Indonesia's coal exports. The average GDP of India and China was also found to have a positive and significant effect on the volume of Indonesia's coal exports. A coefficient of determination of 0.914913 indicates that the independent variables in this model explain 91.49% of the variation in the dependent variable.*

**Keywords:** *Produksi Batubara, Harga Internasional, GDP rata-rata India dan China, Volume Ekspor Batubara Indonesia.*

## A. INTRODUCTION

The economic philosophy known as mercantilism (popular from the sixteenth century to the mid-eighteenth century in countries such as England, Spain, France, and the Netherlands) states that the most important way for a country to become wealthy and powerful is by exporting more than it imports (Salvatore, 1994).

Many countries differ in terms of natural resources, weather conditions, and geographical characteristics. These differences create a gap between human needs and the means available to fulfill them. This gap arises because the available resources are insufficient to meet continuously increasing needs. Every country in the world faces a similar problem, namely that no country can truly stand alone, as nations are interdependent and complement one another (Qisthina et al., 2024).

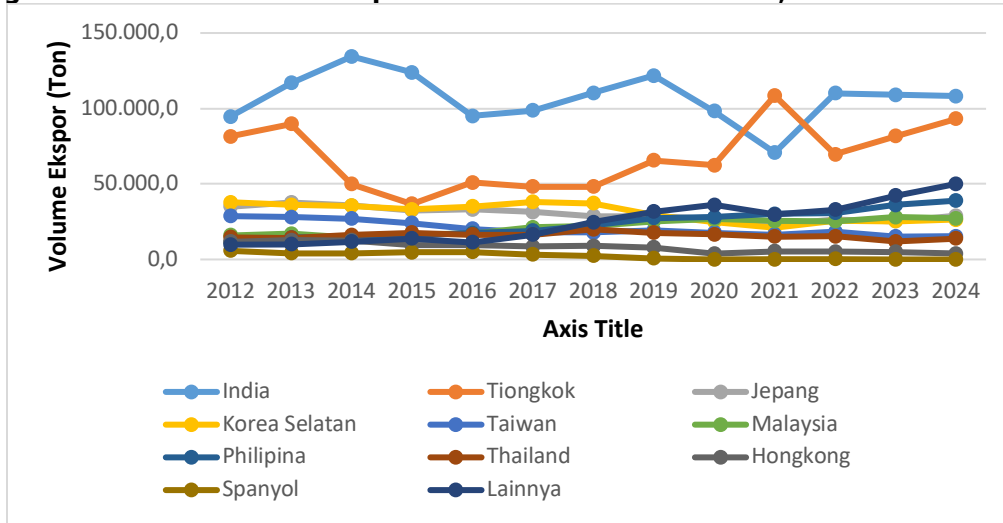
Indonesia, as an open economy integrated into the global supply chain, is not immune to the impact of changes in global geopolitical dynamics. The vulnerability or exposure of Indonesia's economy to geopolitical issues stems from trade activities, exports and imports, as well as the financial sector, including foreign direct investment (FDI), external debt, and portfolio flows into stock markets and other securities (Mohammad et al., 2021).

One of Indonesia's key energy resources that has long been utilized as capital for national development is coal. Coal is relatively easy to mine and produces low-cost electricity. To date, most power plants in Indonesia still rely on coal as their primary energy source. Coal may also contain Coal Bed Methane (CBM). If successfully exploited, this gas can be utilized as an energy source comparable to conventional natural gas (Ministry of Energy and Mineral Resources, 2025).

An agreement between an importer and an exporter to sell goods from one country to another is known as export. Importers and exporters agree on the quantity, quality, terms of sale, and payment methods. Export demand refers to the volume of goods or services that a country intends to export to another country (Sukirno, 2006).

According to Carolina (2018), Gross Domestic Product (GDP) reflects the level of consumption or purchasing power of a country for goods and services, based on the standard assessment of average national income. The GDP of export destination countries has a significant influence on the trade activities of exporting countries. The following figure presents a graph of Indonesia's coal exports to several destination countries from 2012 to 2024.

**Figure 1. Indonesia's Coal Exports to Destination Countries, 2012–2024**



Source: *www.bps.go.id (processed data)*

It can be seen from the figure that India and China are the countries that import more Indonesian coal compared to other importing countries, making them representative countries for the GDP of Indonesia's coal importers.

Furthermore, Table 1 presents data on coal production, international prices, GDP representing importing countries, and coal exports in Indonesia from 2005 to 2024.

**Table 1. Data on Coal Production, International Coal Prices, India's GDP, and Indonesia's Coal Exports, 2005–2024**

| Year | Coal Production (Tons) | International Coal Price (US\$/Ton) | Average GDP of India & China (Million US\$) | Coal Exports (Tons) |
|------|------------------------|-------------------------------------|---|---------------------|
| 2005 | 149.665.233            | 53,05                               | 1.570.000                                   | 129.044.100         |
| 2006 | 162.294.657            | 43,19                               | 1.630.000                                   | 184.009.000         |
| 2007 | 188.663.068            | 51,29                               | 1.770.000                                   | 195.785.900         |
| 2008 | 178.930.188            | 91,75                               | 1.760.000                                   | 201.021.700         |
| 2009 | 228.806.887            | 79,40                               | 1.830.000                                   | 234.793.100         |
| 2010 | 325.325.793            | 97,00                               | 2.000.000                                   | 298.844.400         |
| 2011 | 415.765.068            | 132,48                              | 2.070.000                                   | 353.398.100         |
| 2012 | 466.307.241            | 116,46                              | 2.075.000                                   | 347.504.500         |
| 2013 | 458.462.513            | 92,77                               | 2.090.000                                   | 381.384.200         |
| 2014 | 435.742.874            | 81,61                               | 2.180.000                                   | 356.302.800         |
| 2015 | 405.871.432            | 61,44                               | 2.210.000                                   | 328.387.400         |
| 2016 | 419.000.000            | 49,02                               | 2.305.000                                   | 311.329.800         |
| 2017 | 461.087.221            | 83,73                               | 2.485.000                                   | 319.098.400         |
| 2018 | 557.983.706            | 106,45                              | 2.510.000                                   | 343.124.300         |
| 2019 | 616.154.054            | 98,56                               | 2.580.000                                   | 374.935.300         |
| 2020 | 565.640.928            | 69,66                               | 2.495.000                                   | 341.547.600         |

|      |             |        |           |             |
|------|-------------|--------|-----------|-------------|
| 2021 | 614.058.577 | 86,74  | 2.745.000 | 345.453.200 |
| 2022 | 687.402.285 | 276,58 | 2.835.000 | 360.115.200 |
| 2023 | 775.183.592 | 201,15 | 2.980.000 | 379.705.200 |
| 2024 | 836.130.000 | 121,48 | 3.115.000 | 405.761.200 |

Source: *Statistics Indonesia (BPS), Ministry of Energy and Mineral Resources, World Bank Group.*

Table 1 shows that the volume of Indonesia’s coal exports fluctuates but exhibits an overall upward trend. In 2005, Indonesia recorded its lowest coal export volume at approximately 129,044,100 tons, while in 2024, it reached the highest level at 405,761,200 tons, with an average of 309,577,270 tons per year.

Furthermore, Indonesia’s coal production also fluctuates but tends to increase over time. In 2005, the lowest production was recorded at approximately 149,665,233 tons, while in 2024, it reached its highest level at 836,130,000 tons, with an annual average of 447,423,765 tons. The international price of Indonesian coal likewise fluctuates but shows an upward trend, with the lowest price recorded in 2006 at US\$43.19 per ton and the highest in 2022 at US\$276.58 per ton, with an average of US\$99.69 per ton annually. Meanwhile, the average GDP of India and China demonstrates a consistent upward trend, with an average of US\$2,261,750 per year.

**B. METHODOLOGY OF RESEARCH**

This study aims to analyze the factors influencing the volume of Indonesia’s coal exports, namely coal production, international coal prices, and the GDP of India. The data used in this research are secondary time series data covering the period from 2005 to 2024, sourced from Statistics Indonesia (BPS), the Ministry of Energy and Mineral Resources, and the World Bank Group. The analytical method employed to examine the effect of coal production, international coal prices, and India’s GDP on Indonesia’s coal export volume during the 2005–2024 period is multiple linear regression analysis. This method is used to identify both the direction and magnitude of the relationships between the independent variables and the dependent variable.

The regression model applied in this study is formulated as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \epsilon_i \quad (i = 1, 2, 3, \dots, n),$$

where Y represents Indonesia’s coal export volume (tons),  $\beta_0$  is the intercept, X1 denotes coal production (tons), X2 represents international coal prices (US\$/ton), X3 indicates the average GDP of India and China (million US\$), and  $\epsilon_i$  is the error term.

**C. RESULT AND DISCUSSION**

**Multiple Linear Regression**

**Table 2. Results of Multiple Linear Regression Estimation**

| Variable           | Coefficient | Std. Error            | t-Statistic | Prob.     |
|--------------------|-------------|-----------------------|-------------|-----------|
| C                  | 14.95775    | 0.543404              | 27.52604    | 0.0000    |
| LnX1               | 0.067590    | 0.010721              | 6.304287    | 0.0000    |
| LnX2               | 0.116079    | 0.054902              | 2.114301    | 0.0505    |
| LnX3               | 0.193497    | 0.044572              | 4.341203    | 0.0005    |
| R-squared          | 0.914913    | Mean dependent var    |             | 19.51188  |
| Adjusted R-squared | 0.898959    | S.D. dependent var    |             | 0.306558  |
| S.E. of regression | 0.097445    | Akaike info criterion |             | -1.642196 |
| Sum squared resid  | 0.151929    | Schwarz criterion     |             | -1.443049 |
| Log likelihood     | 20.42196    | Hannan-Quinn criter.  |             | -1.603320 |

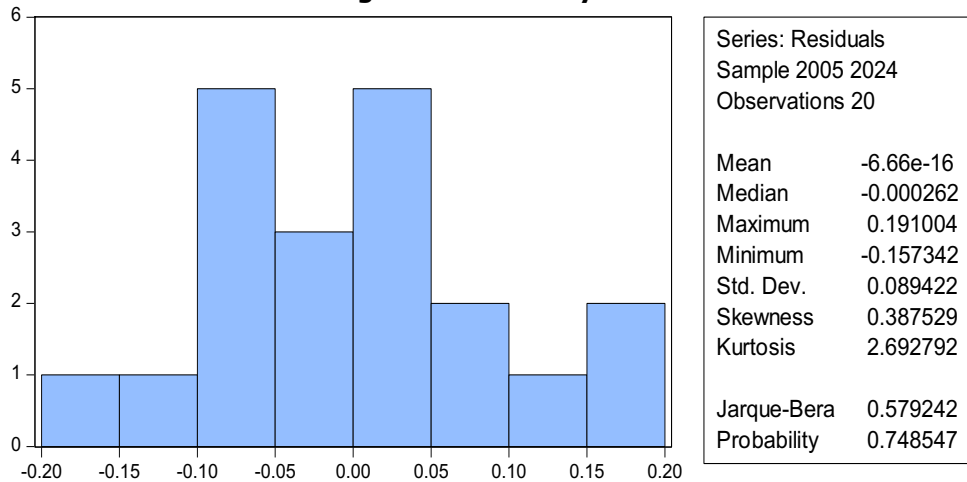
|                   |          |                    |          |
|-------------------|----------|--------------------|----------|
| F-statistic       | 57.34755 | Durbin-Watson stat | 1.061759 |
| Prob(F-statistic) | 0.000000 |                    |          |

Source: EViews 10 (processed data)

Based on the estimation results of the regression model, the constant value is 14.95775. This positive constant indicates that when the variables of coal production, international coal prices, and the average GDP of India and China are equal to zero, Indonesia’s coal export volume would increase by 14.95775%.

The regression coefficient for coal production is 0.067590, which is positive. This implies that a 1% increase in coal production will lead to an increase in Indonesia’s coal export volume by 0.067590%. The regression coefficient for international coal prices is 0.116079, also positive, indicating that a 1% increase in international coal prices will increase Indonesia’s coal export volume by 0.116079%. Furthermore, the GDP regression coefficient is 0.193497, which is positive, meaning that a 1% increase in the average GDP of India and China will increase Indonesia’s coal export volume by 0.193497%.

**Figure. 2 Normality test**



Source: EViews 10 (processed data)

One of the approaches used to test normality is by comparing the probability value of the Jarque-Bera (JB) test with a significance level of 0.05. If the JB probability value is greater than 0.05, the residuals are considered to be normally distributed, and vice versa. Based on the test results presented in Figure 2, the JB probability value is 0.748547; therefore, it can be concluded that the residuals are normally distributed.

**Table 3. Results of the Multicollinearity Test**

| Variable | Coefficient | Uncentered | Centered |
|----------|-------------|------------|----------|
|          | Variance    | VIF        | VIF      |
| C        | 0.295288    | 621.9478   | NA       |
| LnX1     | 0.000115    | 81.65856   | 1.558116 |
| LnX2     | 0.003014    | 129.8831   | 1.280266 |
| LnX3     | 0.001987    | 879.1933   | 1.568319 |

Source: EViews 10 (processed data)

The purpose of the multicollinearity test is to determine whether there is a significant relationship among the independent variables. This can be assessed by examining the Variance Inflation Factor (VIF); multicollinearity is considered absent if the VIF value is less than 10. Based on the results of data processing using EViews 10 as presented in Figure 4.2, the centered VIF values for each independent variable are below 10. Therefore, it can be concluded that there is no indication of multicollinearity in this research model.

**Table 4 Run test**

|                      |          |                     |        |
|----------------------|----------|---------------------|--------|
| <b>F-statistic</b>   | 2.346210 | Prob. F(2,14)       | 0.1322 |
| <b>Obs*R-squared</b> | 5.020667 | Prob. Chi-Square(2) | 0.0812 |

The results of the Run test indicate that Prob. Chi-Square(2) = 0.0812 >  $\alpha$  = 0.05. This implies that there is no autocorrelation in the model, as the obtained probability value is greater than the significance level of 0.05.

The coefficient of determination ( $R^2$ ) measures the extent to which the variation in the independent variables explains the variation in the dependent variable. Table 2 shows an  $R^2$  value of 0.914913, indicating that 91.49% of the variation in the dependent variable is explained by the independent variables included in the model. The remaining 8.51% is explained by other variables not included in the model. Furthermore, the F-statistic value is 57.34755 with a probability (F-statistic) of 0.000000. Since the probability value is less than 0.05, it can be concluded that coal production, international coal prices, and the average GDP of India and China simultaneously have a significant effect on Indonesia's coal export volume.

The significance of each independent variable is evaluated using the t-test. The null hypothesis ( $H_0$ ) is rejected and the alternative hypothesis ( $H_1$ ) is accepted if the probability value of each independent variable is less than  $\alpha$  (0.05). The results show that coal production has a t-statistic of 6.304287, which is greater than the t-table value of 2.086, with a significance level of 0.0000 < 0.05, indicating a positive and significant effect on Indonesia's coal export volume. Similarly, the international coal price variable has a t-statistic of 2.114301, exceeding the t-table value of 2.086, with a significance level of 0.0505 < 0.05, indicating a positive and significant effect. Lastly, the average GDP of India and China has a t-statistic of 4.341203, also greater than the t-table value of 2.086, with a significance level of 0.0005 < 0.05, confirming that it has a positive and significant effect on Indonesia's coal export volume.

#### **D. CONCLUSION**

Based on the results and discussion of the study, it can be concluded that Indonesia's coal production has a positive and significant effect on the volume of Indonesia's coal exports. International coal prices also have a positive and significant effect on the volume of Indonesia's coal exports. Furthermore, the average GDP of India and China has a positive and significant effect on Indonesia's coal export volume.

Simultaneously, coal production and international coal prices together have a positive and significant effect on Indonesia's coal export volume. The coefficient of determination ( $R^2$ ) is 0.914903, indicating that variations in Indonesia's coal production, international coal prices, and the average GDP of India and China explain 91.49% of the variation in Indonesia's coal export volume, while the remaining 8.51% is explained by other variables not included in the model.

Based on the classical assumption tests in the research model of Indonesia's coal exports, there are no violations detected, meaning the model is free from multicollinearity, autocorrelation, and normality issues.

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