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ANALYSIS OF INDONESIA'S COAL EXPORT COMPETITIVENESS IN THE INTERNATIONAL MARKET AND ITS DETERMINANT FACTORS

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Abstract :

Indonesia is one of the world's largest coal exporters, with a significant contribution to meeting global energy demand. However, the competitiveness of Indonesia's coal exports is strongly influenced by international market dynamics and external factors. This study aims to analyze the competitiveness of Indonesia's coal exports in the global market using the Vector Autoregression (VAR) model for the period 2004–2023. The variables analyzed include Foreign Direct Investment (FDI), international coal prices (HBI), exchange rate (NT), national coal production, and competitiveness measured through the Revealed Comparative Advantage (RCA). The results indicate that Indonesia still lags behind Australia in terms of RCA, although the gap has narrowed between 2018 and 2023. Conversely, compared to Russia, Indonesia consistently outperforms. The impulse response function (IRF) analysis reveals that FDI has a positive impact on RCA, while rising international coal prices tend to weaken competitiveness. National coal production shows a positive effect in the medium term, whereas the exchange rate responds negatively to price fluctuations. Variance decomposition (VD) results show that FDI had a dominant contribution in the early period (70–75%) but declined to around 20%, while the influence of international coal prices increased to 40%. Overall, Indonesia's coal export competitiveness is largely shaped by external factors, requiring strategies such as market diversification, downstream industry development, efficiency improvements, and the optimization of global geopolitical opportunities.

Keywords : *Competitiveness, Coal Exports, RCA, VAR.*

INTRODUCTION

International trade in the era of globalization plays a crucial role in strengthening economic integration and enhancing the competitiveness of a country in the global market. Exports serve as a key mechanism to utilize comparative advantages, increase foreign exchange earnings, create employment, and drive national economic growth (Hodijah & Angelina, 2022). In the context of Indonesia, non-oil and gas exports dominate with a significant

upward trend, particularly in the agricultural, industrial, and mining sectors (Patone et al., 2020). One of the leading commodities is coal, with reserves of approximately 186.6 billion tons, making Indonesia the world's third-largest producer, contributing 8.5% to global production (Afin & Kiono, 2021).

Indonesian coal has strong international appeal due to its varied quality and relatively low price, especially for power generation. However, its use generates externalities such as greenhouse gas emissions and environmental degradation (Pahlevi et al., 2024). In the global trade arena, Indonesia faces competition from Australia, Russia, and the United States, although China's policy to restrict coal imports from Australia provides Indonesia with a strategic opportunity (Liliandana, 2021).

The competitiveness of Indonesia's coal exports is influenced by several external factors, including international price fluctuations, exchange rates, and foreign direct investment (FDI). Volatile international prices determine export levels (Firmansyah, 2024), while a weaker exchange rate can enhance export price competitiveness (Hidayati et al., 2017). FDI plays a crucial role by providing capital, transferring technology, and improving production efficiency, thereby strengthening Indonesia's position in the global market (Shi et al., 2024). With such vast potential and existing challenges, strategies such as downstream development, market diversification, and efficiency improvements are required to maintain the sustainability of Indonesia's coal export competitiveness in the international market.

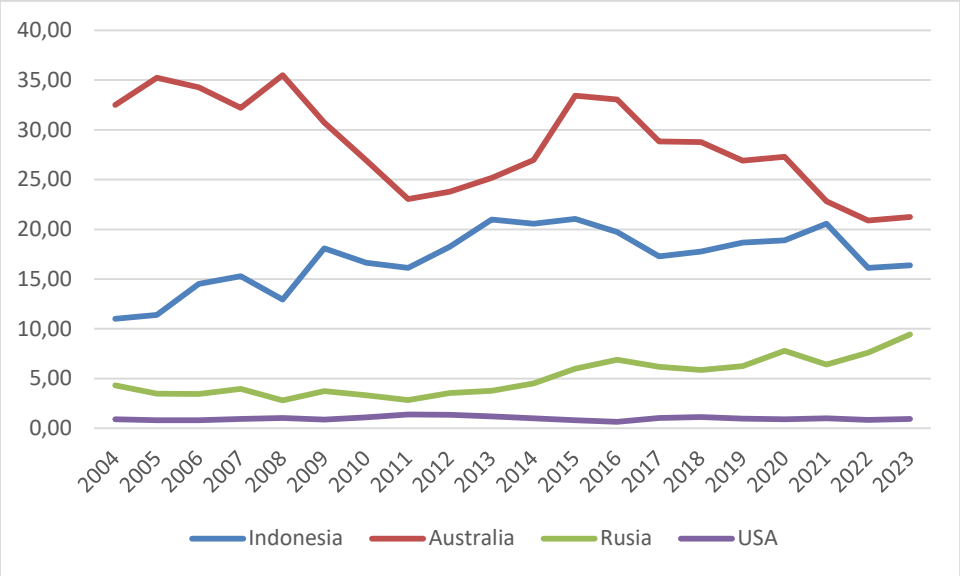
RESEARCH METHOD

This research employs a quantitative approach using the Revealed Comparative Advantage (RCA) analysis to measure the competitiveness of Indonesia's coal exports, as well as Vector Auto Regression (VAR) to examine the response and contribution among variables, namely coal export competitiveness, international prices, exchange rates, production, and FDI. This study refers to Admi et al. (2022), who applied RCA, and Febrianti et al. (2021), who applied VAR. Data analysis is carried out using Microsoft Excel and Eviews.

The data used are annual secondary data for the period 2004–2023. The research variables include coal export value, total export value, coal production, exchange rate, international prices, and FDI. Coal export value, total export value, and international price data are obtained from TradeMap, production data from CEIC Data, exchange rate data from the Ministry of Trade of the Republic of Indonesia, and FDI data from Statistics Indonesia (BPS).

FINDINGS AND DISCUSSION

Coal Export Competitive (RCA)



Source: TradeMap (2024), processed data

The analysis of the Revealed Comparative Advantage (RCA) shows that Indonesia possesses strong coal export competitiveness in the international market. Compared to Australia, although Indonesia's RCA value remains lower, the trend indicates a narrowing gap, particularly during the 2018–2023 period, with Indonesia's RCA reaching 16.39 and Australia's 21.24 in 2023. This reflects an improvement in Indonesia's relative competitiveness, supported by market diversification and downstream policies.

Although Australia remains the country with the highest competitiveness in coal exports, Indonesia shows promising prospects to strengthen its position, especially if the downward trend in Australia's RCA continues. In addition, the diplomatic tensions and trade war between China and Australia in 2020, which led the Chinese government to halt coal imports from Australia, opened strategic opportunities for Indonesia to expand its export market share in China and potentially replace Australia as a main supplier.

In comparison with Russia, Indonesia's RCA value has consistently been higher throughout the 2004–2023 period. Although Russia recorded a significant increase, reaching 9.44 in 2023, Indonesia maintained a stronger position with RCA values ranging between 16 and 21.

Meanwhile, the United States shows an RCA value far lower than Indonesia. Over the past two decades, the U.S. RCA has averaged below 1, indicating the absence of comparative advantage in coal exports. In contrast, Indonesia has sustained strong competitiveness with RCA values consistently above 15.

Overall, these findings confirm that Indonesia holds a strong comparative advantage in coal exports, with promising prospects in the global market, although it continues to face intense competition from Australia and the rising competitiveness of Russia.

Vector Autoregression (VAR)

1. Stationarity Test of Data

Variabel	*Level*	*First Difference*
	Probability	Probability
RCA	0.1307	0.0008
Produksi	0.9758	0.0107
Harga	0.1235	0.0046
Nilai Tukar	0.9145	0.0240
FDI	0.9821	0.0182

Source: E-Views Output

The first step that must be carried out is the stationarity test using the Augmented Dickey-Fuller (ADF). The results in Table 4.2 show that all variables are non-stationary at the level (p-value > 0.05), but become stationary at the first difference (p-value < 0.05). Thus, all variables are classified as I(1) and meet the requirements to be analyzed using the VAR model.

2. Optimal Lag Determination

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-630.0695	NA*	1.93e+26	74.71406	74.95913*	74.73842
1	-608.7992	27.52632	3.51e+26	75.15285	76.62322	75.29901
2	-567.3149	29.28301	1.47e+26*	73.21352*	75.90921	73.48148*

Source: E-Views Output

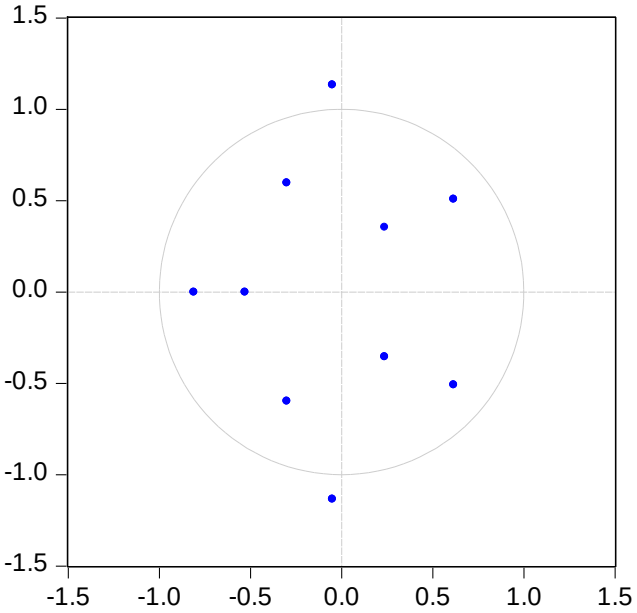
After confirming that all variables are stationary at the first difference, the next step is to determine the optimal lag. A lag that is too short may eliminate important information, while a lag that is too long increases the risk of overfitting. Therefore, selecting the optimal lag aims to obtain an efficient and stable model estimation.

In this study, the optimal lag was determined using the Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HQ). The results in Table 4.3 show that AIC and HQ reached their minimum values at lag 2, while SC reached its minimum at lag 0. However, lag 0 is considered less representative for a dynamic model. Thus, lag 2 was selected as the optimal lag for estimating the VAR model.

3. Stability Test of the Model

Root	Modulus
-0.049931 - 1.134004i	1.135103
-0.049931 + 1.134004i	1.135103
-0.811361	0.811361
0.614742 - 0.508079i	0.797528
0.614742 + 0.508079i	0.797528
-0.299964 - 0.597567i	0.668629
-0.299964 + 0.597567i	0.668629
-0.529993	0.529993
0.236509 - 0.354715i	0.426332
0.236509 + 0.354715i	0.426332

Inverse Roots of AR Characteristic Polynomial



Source: E-Views Output

The stability test was conducted by evaluating the characteristic polynomial roots and their modulus values. The estimation results show that two pairs of complex conjugate roots have a modulus greater than 1 (1.135103), indicating that the model is not fully stable since some roots lie outside the unit circle. This condition suggests potential explosive responses, making the model less suitable for long-term or predictive interpretation. Therefore, the analysis in this study focuses on examining the relationship patterns among variables descriptively and comparatively.

4. Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

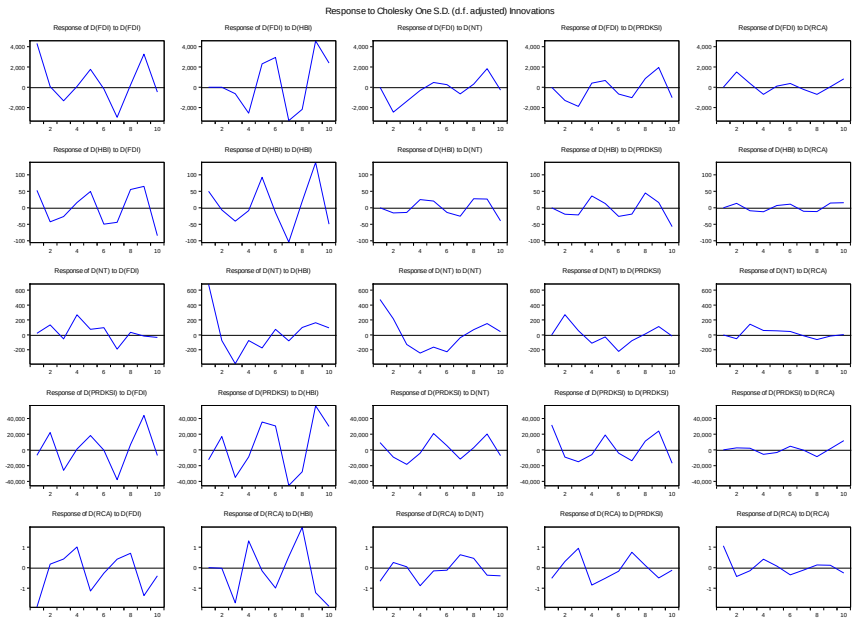
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.956060	117.5795	69.81889	0.0000
At most 1 *	0.916482	64.45567	47.85613	0.0007
At most 2	0.460379	22.24987	29.79707	0.2849
At most 3	0.417477	11.76279	15.49471	0.1687
At most 4	0.140619	2.576225	3.841466	0.1085

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: E-Views Output

Cointegration testing was conducted using the Johansen method through the trace statistic to identify long-term relationships among the variables. The results in Table 4.4 indicate two cointegration equations, as shown by trace statistic values of 117.5795 and 64.4557 with p-values < 0.05. This suggests the existence of long-term linkages among the variables. However, the previous stability test revealed characteristic roots outside the unit circle, making the VECM model invalid. Therefore, this study continues to employ the VAR model to analyze the dynamic relationships among the variables.

5. Impulse Response Function



Source: E-Views Output

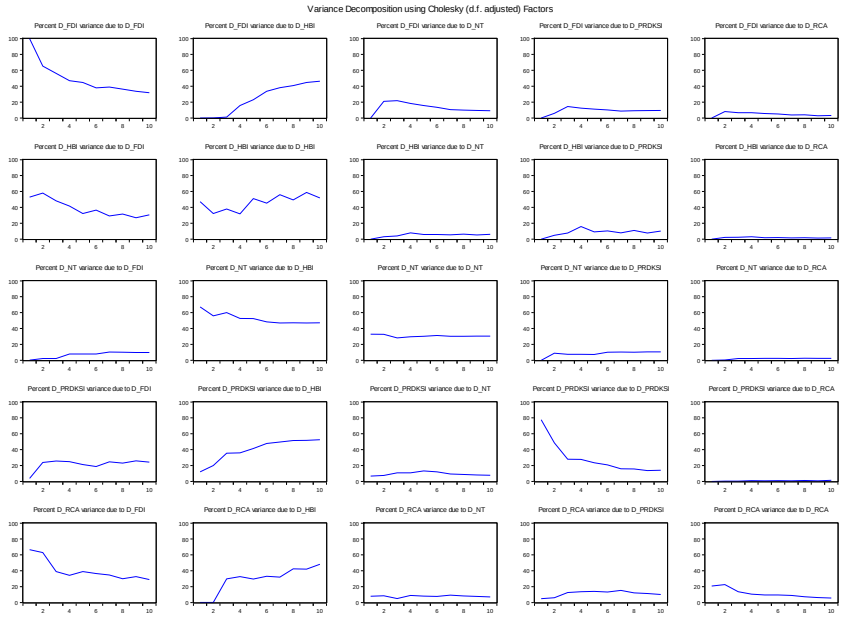
After the cointegration test, the analysis proceeded with the Impulse Response Function (IRF) to evaluate the dynamic responses among variables to a one-standard-deviation shock. The IRF results indicate that FDI has a positive and stable effect on itself, suggesting short-term

investment momentum. However, FDI shows a negative response to shocks from international coal prices (HBI), while conversely, HBI reacts positively to shocks from FDI, indicating a reciprocal relationship between investment flows and commodity prices.

The exchange rate exhibits depreciation in response to HBI shocks, whereas production increases significantly when affected by FDI shocks, although it initially declines when influenced by HBI. Furthermore, RCA responds positively to FDI shocks, confirming that foreign investment can strengthen Indonesia's coal export competitiveness. In contrast, HBI shocks sharply reduce RCA, suggesting that rising international coal prices may weaken export competitiveness.

Meanwhile, RCA's response to production shows a fluctuating pattern but tends to move positively in the medium term. Overall, these findings highlight that interactions among variables in the VAR system are dynamic and diverse, with FDI and production contributing positively to competitiveness, while higher coal prices tend to exert negative pressure.

6. Decomposition of Variance



Source: E-Views Output

The variance decomposition analysis shows that in the early period, variations in FDI were almost entirely explained by its own shocks. However, its contribution gradually declined to around 50% and was replaced by the influence of HBI, which increased to 40%. This highlights the significant role of international coal prices in determining FDI inflows to Indonesia, particularly in the mining and energy sectors.

Variations in HBI were largely explained by its own shocks (up to 60%), while the influence of domestic variables such as the exchange rate and production remained relatively small (<5%). The exchange rate itself was dominated by shocks from HBI (40–60%), with a stable self-

contribution of around 30%. This indicates that exchange rate fluctuations are more strongly influenced by global commodity price dynamics than by domestic factors.

For production, the largest contribution initially came from its own shocks (90%), but this influence declined and was increasingly replaced by HBI, which accounted for up to 50% in the later period. Meanwhile, RCA was strongly influenced by FDI in the early period (70–75%), but its contribution declined to around 20% toward the end, in line with the increasing influence of HBI, which rose to 40%. Overall, these results emphasize that the competitiveness of Indonesia's coal exports is largely driven by external factors, particularly FDI and international coal prices (HBI).

CONCLUSION

Global commodity price fluctuations, international capital flows, and exchange rate movements increase uncertainty in coal trade, making Indonesia's export competitiveness highly sensitive to external shocks. This condition requires responsive and adaptive trade strategies and industrial policies.

The analysis shows that Indonesia's coal export competitiveness (RCA) remains below Australia's, although the gap has narrowed during 2018–2023. Indonesia consistently outperforms Russia, though Russia's rising RCA trend needs to be anticipated, and it is far more competitive compared to the United States, whose RCA remains below 1 for most of the observed period. FDI has a positive impact on RCA, while rising international coal prices tend to weaken competitiveness. Coal production positively affects RCA in the medium term, whereas the exchange rate responds negatively to increases in coal prices.

From the perspective of variance decomposition, RCA was initially dominated by FDI (70–75%), but its contribution declined to around 20%, while the influence of international coal prices consistently increased to 40%. Exchange rate and production contributed only marginally (5–10%). Therefore, key strategic policies include export market diversification, leveraging geopolitical dynamics, improving production efficiency, and strengthening coal downstreaming to maintain competitiveness stability and reduce dependence on uncontrollable external factors.

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