

The Role of Macroeconomic Indicators and Global Oil Prices in Influencing Indonesia's Crude Oil Exports to South Korea

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ABSTRACT

Purpose: This study analyzes the impact of macroeconomic indicators and global oil prices on Indonesia's crude oil exports to South Korea, one of its strategic trading partners in the East Asia region.

Method: A quantitative approach was employed using annual time series data comprising 24 observations from 2000 to 2023. Secondary data were obtained from official sources such as Statistics Indonesia (BPS), the World Bank, and Index Mundi. Data analysis was conducted using multiple linear regression with the Ordinary Least Squares (OLS) method.

Results: The analysis indicates that South Korea's inflation and GDP per capita growth positively affect Indonesia's crude oil exports to the country. Conversely, the exchange rate and global oil prices negatively impact these exports.

Practical Implications for Economic Growth and Development: These findings provide relevant policy insights for the Indonesian government in responding to global economic dynamics, including strategies for exchange rate stabilization, export market diversification, and strengthening economic diplomacy.

Originality/Value: This study makes an original contribution by specifically examining the bilateral relationship of Indonesia's crude oil exports to South Korea based on the dynamics of external variables. Its focus on a specific region and extended time coverage renders it a unique study that delivers tangible contributions rarely found in Indonesia's international trade literature.

Keywords: *Crude Oil Exports, Macroeconomic Indicators, Global Oil Prices, OLS Regression*

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INTRODUCTION

Crude oil is one of the most strategic commodities in international trade, playing a vital role in the dynamics of the global economy. Exporting countries generally rely on this commodity as a major source of national income, while importing countries depend heavily on it to meet their domestic energy needs (Osintseva, 2022). Indonesia, one of the largest crude oil producers in Southeast Asia, has long contributed to the global oil market. Crude oil exports serve not only as a significant source of foreign exchange but also as an indicator of the performance of the energy sector and international trade (Liddle et al., 2020).

Over the past decade, Indonesia's crude oil exports have shown a sharp downward trend accompanied by high volatility (see Figure 1). Export volumes, which reached 13,016.9 thousand tons in 2013, drastically declined to 2,180.7 thousand tons in 2022 before experiencing a slight increase in 2023. This decline has been influenced by several structural factors, including decreasing domestic production, limited investment in the exploration

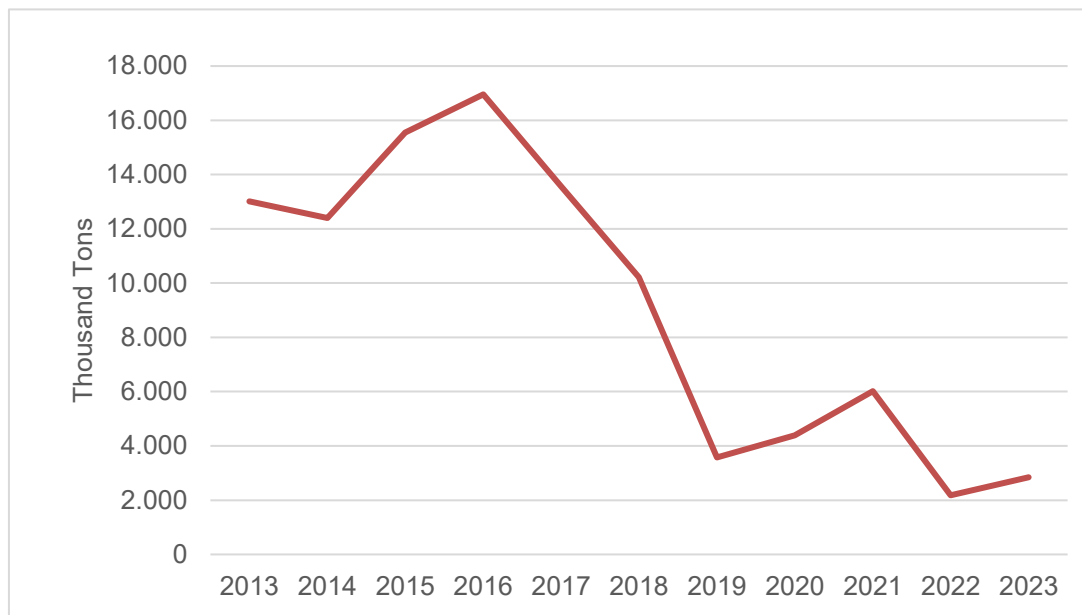


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sector, rising domestic consumption, and a national policy direction that emphasizes downstream processing and energy resilience (Husin et al., 2023). Furthermore, fluctuations in global oil prices and geopolitical tensions have exerted additional pressure on Indonesia's export performance (Le et al., 2021).

South Korea is a relevant trade partner to analyze, given its high dependency on energy imports and its strong bilateral economic relations with Indonesia (Adhani & Lubis, 2024). Additionally, South Korea's energy transition policies and stricter environmental regulations have influenced demand patterns for crude oil from Indonesia.

Figure 1. Data on the Development of Indonesia's Crude Oil Exports from 2013 to 2023



Source: Badan Pusat Statistik (2025)

A number of previous studies have evaluated the macroeconomic factors affecting crude oil exports, including inflation, exchange rates, economic growth in the destination country, and global oil prices (Liddle et al., 2020; Nurrahmi et al., 2023; Rosyadi et al., 2021; Wibisono & Nuraini, 2022). Inflation in importing countries tends to suppress import demand due to declining consumer purchasing power (Aliraqi & Salih, 2022). Currency depreciation enhances export competitiveness by lowering the relative price of products (Adams & Metwally, 2021; Hu et al., 2017). Meanwhile, economic growth in the destination country can increase energy demand, including for crude oil (Jiménez-Rodríguez, 2022). Conversely, fluctuations in global oil prices reflect global uncertainty, which also influences the export policies of oil-producing countries (Chatziantoniou et al., 2021; Song et al., 2022).

Although many studies have discussed the influence of macroeconomic variables on crude oil exports (Liddle et al., 2020; Nurrahmi et al., 2023; Rosyadi et al., 2021; Wibisono & Nuraini, 2022), most are general in nature and have yet to examine the simultaneous effects of these variables on exports to a specific partner country in a sustained manner. This study offers a novel contribution by focusing on the bilateral trade relationship between Indonesia and South Korea during the period from 2000 to 2023. This timeframe encompasses several globally significant events, such as the 2008 global financial crisis, the COVID-19 pandemic, fluctuations in global oil prices, and South Korea's energy transition policies toward renewable energy sources. As such, this study provides a new longitudinal perspective on understanding

the dynamics of Indonesia's crude oil exports amidst structural changes and global policy shifts.

This study aims to analyze the impact of inflation in South Korea, the exchange rate of the Indonesian rupiah against the US dollar, South Korea's economic growth, and global oil prices on Indonesia's crude oil exports to South Korea. The results are expected to contribute to the development of international trade literature and serve as a reference for policymakers and industry players in designing export strategies that are responsive to global macroeconomic dynamics.

Hypotheses Development

Inflation and Crude Oil Exports to South Korea

Inflation in importing countries, such as South Korea, can influence the dynamics of demand for energy commodities, particularly crude oil. According to aggregate demand theory, rising inflation is generally correlated with increased aggregate consumption and industrial activity, which subsequently drives energy demand (Alarenan et al., 2020). When domestic production is insufficient to meet this surge in demand, importing countries tend to seek energy sources from abroad, including exporting countries like Indonesia. Additionally, the price competitiveness theory suggests that under high inflation, the prices of domestic goods in the importing country become relatively more expensive compared to imported goods, including energy commodities (Ascari & Haber, 2021). Consequently, crude oil from exporting countries with more competitive prices has the potential to become the primary choice for meeting energy needs.

A study by Vlieghe (2024) indicates that inflation in advanced industrial countries often positively correlates with an increase in energy commodity imports, including crude oil, particularly during periods of economic expansion. Similar findings were presented by Kilmer and Rodríguez (2017), who stated that global oil demand rises alongside inflation and economic growth in major importing countries. Based on this, the proposed hypothesis is:

H1: Inflation in the importing country (South Korea) has a positive effect on Indonesia's crude oil exports.

Exchange Rate and Crude Oil Exports to South Korea

The exchange rate is a key factor in international trade that influences a country's export performance. According to the Marshall–Lerner elasticity theory, a depreciation of the domestic currency can enhance exports by making domestic goods more competitively priced in international markets (Adams & Metwally, 2021). However, in the context of crude oil exports, this relationship is more complex. Crude oil exports heavily rely on input costs, much of which are derived from imports, and transactions are generally conducted in U.S. dollars. A depreciation of the exchange rate—for example, a weakening rupiah against the U.S. dollar—results in higher costs for imported inputs, which in turn raises production costs and lowers profit margins for exporters. This situation can potentially reduce export volumes, particularly in the short term (Sugiharti et al., 2020).

Kayani et al. (2023) found that exchange rate fluctuations negatively impact exports from developing countries, especially in sectors reliant on imported inputs and vulnerable to external uncertainties. Research by Iqbal and Nawaz (2021) also confirms that exchange rate instability is a significant barrier to cross-border energy trade, particularly when the exporting country experiences high volatility against major currencies. Therefore, the proposed hypothesis is:

H2: The exchange rate of the rupiah against the U.S. dollar has a negative effect on Indonesia's crude oil exports to South Korea.

Economic Growth and Crude Oil Exports to South Korea

The derived demand theory posits that an increase in a country's economic output leads to greater demand for production inputs, including energy (Jiménez-Rodríguez, 2022). In this context, per capita GDP growth in an industrialized country like South Korea directly influences the rise in energy consumption, particularly crude oil. Economic activities such as expansion in the industrial, services, and transportation sectors necessitate a greater energy supply. According to the Keynesian approach, rising household income stimulates aggregate demand, which in turn drives energy demand for both production and household consumption (Gang et al., 2022). As a strategic commodity, crude oil plays a vital role in fulfilling these energy needs.

Dedeoğlu and Kaya (2013) found that economic growth has a significant positive correlation with energy imports, primarily crude oil. Similarly, Aliraqi and Salih (2022) noted that economic growth in developed countries is a major factor in increasing energy consumption, particularly oil. Meanwhile, Liddle et al. (2020) discovered that energy demand in both developed and developing countries is highly sensitive to changes in per capita GDP. Accordingly, the proposed hypothesis is:

H3: Per capita GDP growth in the importing country (South Korea) has a positive effect on the volume of Indonesia's crude oil exports.

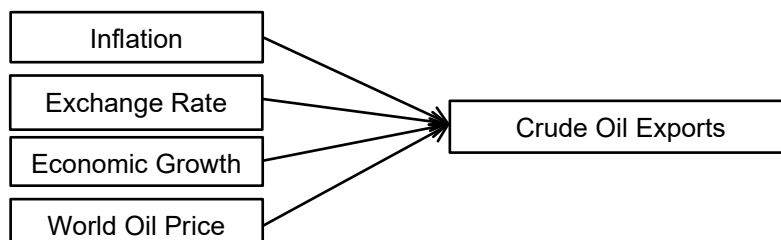
World Oil Prices and Crude Oil Exports to South Korea

World oil prices reflect the dynamics of the global energy market, which is driven by the balance of supply and demand. According to the law of supply and demand, oil price spikes are typically caused by supply disruptions or increased global demand (Ajija et al., 2021). However, from the perspective of importing countries, rising oil prices tend to negatively impact demand volume due to higher energy costs. Based on energy substitution and price effect theory, when oil prices rise significantly, importing countries such as South Korea are likely to reduce import volumes to cut costs or switch to cheaper alternative energy sources (Liddle et al., 2020).

Jing et al. (2020) noted that surges in world oil prices reduce oil import demand in industrialized countries due to increased costs and improved energy efficiency. Similarly, Kilmer and Rodríguez (2017) demonstrated that high oil prices prompt changes in consumer and industry behavior toward alternative energy sources. Adhani and Lubis (2024) revealed that oil price shocks significantly impact the trade balance of both exporting and importing countries, including the patterns of crude oil exports. Based on these insights, the proposed hypothesis is:

H4: Rising world oil prices have a negative effect on Indonesia's crude oil exports to South Korea.

Figure 2. Research Framework



Source: Developed by the authors (2025)

METHOD

This study employs a quantitative approach utilizing time series data to analyze the macroeconomic factors and global oil prices that influence Indonesia's crude oil export volume to South Korea. The secondary data were obtained from the Badan Pusat Statistik (BPS), the World Bank, and Index Mundi, covering the period from 2000 to 2023. The variables analyzed in this study include inflation, exchange rate, economic growth, global oil prices, and crude oil export volume. Details for each variable are presented in Table 1.

Table 1. Research Variables

Variables	Operational Definition of Variables	Measurement	Source
Inflation	South Korea's inflation rate based on the annual change in the GDP deflator	Percent (%)	WDI
Exchange Rate	The average official exchange rate over a given period, expressed in local currency units per 1 US dollar	Rp/US\$	WDI
Economic Growth	The annual economic growth rate percentage of South Korea's GDP per capita	Percent (%)	WDI
World Oil Price	Crude oil prices based on a specific year	US\$/Barrel	WDI
Crude Oil Exports	The volume of Indonesia's crude oil exports to South Korea	Thousand tons	BPS

Source: World Bank Indicators (WDI) & Badan Pusat Statistik (BPS) (2025)

Data analysis was conducted using multiple linear regression with the Ordinary Least Squares (OLS) approach (Kilmer & Rodríguez, 2017). This method was selected because OLS is an efficient estimation technique for identifying relationships between dependent and independent variables, based on the assumption of the Best Linear Unbiased Estimator (BLUE) (Song et al., 2022). The econometric model utilized in this study is formulated as follows:

$$\text{EXPORTS}_t = \alpha_0 + \alpha_1 \text{INFLATION}_t + \alpha_2 \text{EXCHANGE RATE}_t + \alpha_3 \text{GROWTH}_t + \alpha_4 \text{PRICE}_t + e_t$$

Notes:

EXPORTS	: Indonesia's Crude Oil Exports to South Korea (thousand tons)
INFLATION	: Inflation in South Korea (percent)
EXCHANGE RATE	: Rupiah Exchange Rate against the US Dollar (Rp/US\$)
GROWTH	: South Korea's GDP per Capita Growth (percent)
PRICE	: World Oil Price (US\$/Barrel)
α_0	: Constant in Equation (1)
α_1	: Coefficient of INFLATION in Equation (1)
α_2	: Coefficient of EXCHANGE RATE in Equation (1) (1)
α_3	: Coefficient of GROWTH in Equation (1)
α_4	: Coefficient of PRICE in Equation (1)
t	: 1–24 (time series period from 2000 to 2023)

This model modifies previous studies by Anzani et al. (2023), Jiménez-Rodríguez (2022), Nurrahmi et al. (2023), and Tambunan et al. (2022). Model estimation was conducted using EViews version 14 software. To ensure the validity of the regression model, a series of classical assumption tests were performed: (1) a multicollinearity test using the Variance Inflation Factor (VIF), where VIF values less than 10 indicate no multicollinearity (O'Brien, 2007), and (2) an autocorrelation test using the Breusch-Godfrey test, where a chi-square

probability greater than 10% indicates no autocorrelation (Husin et al., 2023). Hypothesis testing was conducted in two stages. First, the coefficient of determination (R^2) was analyzed to evaluate the extent to which the independent variables explain the variation in the dependent variable. Second, partial t-tests were conducted to assess the individual significance of each independent variable on the dependent variable, using significance levels of 1% and 5%.

RESULT AND DISCUSSION

Multicollinearity

Before conducting a causal relationship analysis between variables, it is essential to ensure that there are no multicollinearity issues within the model. Multicollinearity can result in biased parameter estimates and diminish the accuracy of interpreting regression coefficients.

Table 2. Multicollinearity Test

Variables	VIF	Conclusion
INFLATION	1.050	No Multicollinearity (VIF < 10)
EXCHANGE RATE	1.519	No Multicollinearity (VIF < 10)
GROWTH	1.437	No Multicollinearity (VIF < 10)
PRICE	1.109	No Multicollinearity (VIF < 10)

Source: Processed data (2025)

The results of the multicollinearity test are presented as the Variance Inflation Factor (VIF) values for each independent variable: INFLATION (1.050), EXCHANGE RATE (1.519), GROWTH (1.437), and PRICE (1.109). All VIF values are below the threshold of 10, indicating the absence of strong linear relationships among the independent variables. Consequently, the model is free from multicollinearity issues and is suitable for further analysis.

Autocorrelation

The purpose of the autocorrelation test is to determine the presence of relationships among the residuals in a regression model. Autocorrelation violates the classical assumptions of Ordinary Least Squares (OLS) and can affect the model's validity.

Table 3. Autocorrelation Test

BG Test	BG Stat. X^2	Prob. X^2	Conclusion
	0.440	0.803	No Autocorrelation (Prob. $X^2 > 0.1$)

Source: Processed data (2025)

The autocorrelation test was conducted using the χ^2 statistic, which resulted in a value of 0.440 and a probability of 0.803. Since the probability exceeds the 10% significance level, it can be concluded that no autocorrelation is present in the regression model. This finding enhances the reliability of the model's estimates in explaining the relationships between variables.

Coefficient of Determination

The coefficient of determination (R^2) measures the extent to which the variation in the dependent variable can be explained by the independent variables in the model.

Table 4. Coefficient of Determination (R^2)

Coefficient of Determination	R^2	Adj. R^2
	0.842 (84.2%)	0.809 (80.9%)

Source: Processed data (2025)

An adjusted R^2 value of 0.809 indicates that 80.9% of the variation in Indonesia's crude oil exports to South Korea can be explained by the independent variables: inflation, exchange rate, growth, and price. The remaining 19.1% is influenced by other factors outside the model. This high adjusted R^2 value suggests that the model has strong predictive power concerning the studied variable.

Hypotheses Testing

Hypothesis testing was conducted using the t-test to evaluate the individual effect of each independent variable on the dependent variable, while assuming that the other independent variables are held constant. This test compares the probability value of the t-statistic against the significance level (α) to determine whether each independent variable has an individual impact on the dependent variable.

Table 5. Hypotheses Testing

Variables	Coefficient	Prob.	Conclusion
INFLATION	$\beta_1 = 384.89$	0.030	Positively influences at ($\alpha = 0.05$)
EXCHANGE RATE	$\beta_2 = -0.514$	0.000	Negatively influences at ($\alpha = 0.01$)
GROWTH	$\beta_3 = 200.781$	0.092	Positively influences at ($\alpha = 0.05$)
PRICE	$\beta_4 = -2.461$	0.004	Negatively influences at ($\alpha = 0.01$)

Source: Processed data (2025)

The t-test results indicate that inflation and per capita Gross Domestic Product (GDP) growth in South Korea positively influence Indonesia's crude oil exports to South Korea. Conversely, the exchange rate of the rupiah to the US dollar and global oil prices exert a negative impact.

The coefficient for INFLATION is 384.89, with a probability of 0.030 (significant at the 5% level), suggesting that a 1% increase in inflation in South Korea could potentially increase Indonesia's crude oil exports by 384.89 thousand tons. This finding implies that rising general prices in the importing country may drive demand for crude oil from exporting nations, particularly those, like Indonesia, with more efficient cost structures. Under high inflation conditions, domestic products become relatively more expensive, prompting importers to seek more competitively priced foreign alternatives. The coefficient for EXCHANGE RATE is -0.514, with a probability of 0.000 (significant at the 1% level), indicating that a depreciation of the rupiah by Rp1 per US dollar may reduce Indonesia's crude oil exports to South Korea by 0.514 thousand tons. This finding confirms that currency depreciation does not always result in positive export effects and can, in some instances, be counterproductive. This may be attributed to increased production costs that arise from reliance on imported inputs or trade contracts denominated in US dollars, along with heightened exchange rate uncertainty that can dampen export volumes.

The coefficient for GROWTH is 200.781, with a probability of 0.092 (approaching significance at the 10% level), suggesting that a 1% increase in South Korea's per capita GDP may elevate Indonesia's crude oil exports by 200.781 thousand tons. This result indicates that rising income levels in the importing country correlate positively with energy consumption, for both household and industrial needs, ultimately increasing demand for crude oil from Indonesia. The coefficient for PRICE is -2.461, with a probability of 0.004 (significant at the 1% level), implying that a US\$1 per barrel increase in global oil prices will decrease Indonesia's crude

oil exports to South Korea by 2.461 thousand tons. This finding suggests that crude oil demand in South Korea is price-elastic. Rising oil prices tend to reduce import volumes or lead to substitutions with alternative energy sources, thereby negatively impacting Indonesia's exports.

Discussion

The empirical findings of this study indicate that inflation in South Korea exerts a positive influence on Indonesia's crude oil exports. This suggests that domestic price pressures in South Korea do not necessarily erode purchasing power, particularly with regard to strategic commodities such as crude oil. On the contrary, demand for Indonesian crude oil appears to increase, aligning with the relatively inelastic nature of energy consumption in the short term. In this context, inflation in South Korea may reflect not a contraction in consumption, but rather an expansion of economic activity—particularly within energy-intensive sectors such as manufacturing and transportation, which constitute the backbone of the South Korean economy (Kilmer & Rodríguez, 2017).

South Korea's structural dependence on imported energy—especially crude oil—further reinforces the resilience of demand despite domestic inflationary pressures. This dependency is attributed to the country's limited domestic energy resources and the sustained energy requirements of its robust industrial sector. Accordingly, inflation does not significantly curtail crude oil imports from Indonesia, as the demand from productive sectors must continue to be fulfilled. Within the framework of bilateral trade, this dynamic strengthens Indonesia's position as a crude oil supplier, given that the demand from South Korea remains relatively stable, even amid fluctuations in domestic prices (Ajija et al., 2021).

Conversely, an appreciation of the Indonesian rupiah relative to foreign currencies, particularly the US dollar, negatively affects Indonesia's crude oil exports. A stronger rupiah renders Indonesian crude oil more expensive for South Korean importers, thereby diminishing the price competitiveness of Indonesian commodities in that market. Given that price remains a critical factor in international energy trade—especially for energy-importing industrial economies like South Korea—exchange rate movements directly influence trade volumes (Jing et al., 2020).

Moreover, crude oil export contracts are often established on a medium- to long-term basis, which amplifies the pricing risks associated with exchange rate volatility. South Korean importers, seeking to minimize cost uncertainties, may shift preferences toward suppliers with more stable currencies or those offering flexible pricing mechanisms. This presents a significant challenge for Indonesia in maintaining consistent export volumes. Therefore, exchange rate stability emerges as a crucial strategic consideration in the formulation of Indonesia's energy export policies to industrialized markets such as South Korea (Sugiharti et al., 2020).

The analysis also reveals that per capita GDP growth in South Korea positively affects Indonesia's crude oil exports. An increase in income per capita signifies enhanced purchasing power and macroeconomic capacity, both of which translate into greater energy consumption. In South Korea, energy demand is not confined to household consumption but is predominantly driven by core industrial sectors, including automotive, electronics, and petrochemicals, all of which are major consumers of fossil fuels (O'Brien, 2007). Thus, economic growth in South Korea is closely associated with increased imports of crude oil from Indonesia.

Furthermore, income growth facilitates modernization and the expansion of infrastructure across the energy, transportation, and industrial sectors. This expansion broadens the energy consumption base and further consolidates Indonesia's strategic role as a crude oil supplier. Although South Korea is progressively transitioning toward renewable energy, fossil fuels—particularly crude oil—continue to dominate the energy mix during the transitional period (O'Brien, 2007). Hence, South Korea's ongoing economic development presents a strategic

opportunity for Indonesia to augment its crude oil exports in response to rising energy demand in the destination country.

Finally, the study finds that increases in global oil prices have a negative impact on Indonesia's crude oil exports to South Korea. Higher global prices elevate import costs for consumer countries, leading to potential reductions in purchase volumes. When oil prices surpass critical thresholds, South Korean authorities and firms are prompted to enhance energy efficiency measures and explore alternative energy sources (Ajija et al., 2021). Therefore, fluctuations in global oil prices constitute a key external factor that shapes Indonesia's export performance.

As a technologically advanced economy, South Korea is well-positioned to respond to such price shocks by accelerating the implementation of energy diversification policies. Rising oil prices typically prompt South Korea to curtail consumption and expedite the adoption of eco-friendly technologies and energy-efficient practices, particularly within the industrial sector (Utfaeni, 2024). Consequently, although higher oil prices may initially appear beneficial for exporters in terms of revenue, they may, paradoxically, result in reduced export volumes to South Korea due to evolving consumption patterns and cost-optimization strategies in the importing country.

CONCLUSION

This study aims to analyze the key determinants influencing Indonesia's crude oil exports to South Korea, focusing on the role of macroeconomic indicators and global oil prices. Understanding international trade dynamics in the energy sector is essential, particularly for exporting countries like Indonesia, which are significantly affected by external fluctuations and changes in global demand.

Using a quantitative approach with time series data and the Ordinary Least Squares (OLS) method, the study finds that inflation and per capita gross domestic product (GDP) growth in South Korea positively affect the volume of Indonesia's crude oil exports. This indicates that increased purchasing power and energy demand in the export destination present strategic opportunities for Indonesia to strengthen its position in the global energy market. Conversely, the depreciation of the rupiah against the US dollar and volatility in global oil prices negatively affect exports, highlighting Indonesia's energy sector's vulnerability to external economic shocks and global market uncertainties.

The findings offer important policy implications for enhancing Indonesia's energy export performance. Maintaining exchange rate stability is crucial and can be achieved through adaptive and responsive monetary policies to counter external pressures. Additionally, exporters are encouraged to implement hedging strategies to mitigate the impact of global oil price fluctuations on export revenues. Strengthening economic diplomacy with partner countries, such as South Korea, is also a strategic move, particularly in establishing mutually beneficial long-term cooperation in the energy sector. Moreover, diversifying export markets is vital to reduce dependence on a single destination and enhance the resilience of the national export sector to global dynamics. Economic growth and rising inflation in partner countries can also be leveraged as opportunities to expand markets and sustainably increase export volumes.

Future studies should broaden the analysis scope by incorporating additional variables such as logistics costs, non-tariff barriers, and energy policies in the export destination countries. Furthermore, employing approaches like the Autoregressive Distributed Lag (ARDL) or Vector Error Correction Model (VECM) could provide deeper insights into the short- and long-term relationships between macroeconomic variables and export volume. Comparative studies across major export destination countries could also enrich perspectives on the global competitiveness of Indonesia's crude oil exports.

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