

TRACING NICKEL PRICE SHOCKS IN INDONESIA'S REER-TRADE BALANCE NEXUS: SVAR

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ABSTRACT

Indonesia's dominant role in the global supply chain of nickel and its downstream products has changed nickel from a conventional export commodity into a strategic issue in Indonesia's external sector. Nickel price movements may influence Indonesia's external balance. To determine the extent to which global nickel price movements shape the real effective exchange rate (REER) and Indonesia's trade balance, empirical testing is needed because Indonesia's aggregate trade balance is affected not only by nickel exports, but also by import dependence, exchange rate competitiveness, and global demand. This study aims to analyze the structural transmission of global nickel price shocks to REER and Indonesia's trade balance using monthly time-series data from 1994:1 to 2025:12. The method used is Structural Vector Autoregression (SVAR) with three lags, supported by stationarity testing, lag selection, stability testing, impulse response function, and forecast error variance decomposition to capture the response direction, effect duration, and contribution of each shock to changes in the variables. The results show that nickel price shocks generate only a limited and short-lived response to Indonesia's trade balance over a twelve-month horizon. Forecast error variance decomposition in the twelfth month shows that trade balance fluctuations are mainly explained by the trade balance shock itself at 97.89%; nickel price shocks explain only around 2.04%, while REER shocks explain around 0.07%. This finding emphasizes that Indonesia's strategic nickel position does not automatically strengthen its external sector. This study presents nickel-specific SVAR evidence and shows that strategic commodity growth does not always generate strong macroeconomic transmission when trade balance is influenced by broader structural components. Therefore, policy design should not only focus on strategic commodity expansion, but also strengthen export diversification, increase domestic value added, reduce dependence on imported inputs, and build downstream industrial linkages to optimize nickel's strategic role in Indonesia's trade performance.

Keywords: Indonesia, Nickel Price Shocks, Real Effective Exchange Rate, Structural Vector Autoregression, Trade Balance.

1. INTRODUCTION

The current dynamics of the global economy have made nickel no longer limited to its role as an industrial metal for stainless steel production. Nickel has become increasingly important and strategic in the context of clean energy transition, electric vehicle batteries, and global industrial mineral supply chains. The International Energy Agency places nickel alongside copper, lithium, cobalt, graphite, and rare earth elements as one of the key minerals in the energy transition. This condition makes nickel demand and supply increasingly influenced by clean energy technology development, geopolitical risks, and global supply chain concentration. Furthermore, nickel is no longer merely a commodity whose value depends on global price movements, but also a strategic input commodity that can influence trade structure, external competitiveness, and the direction of macroeconomic policy in nickel-exporting countries.

Given these conditions, Indonesia has become a country that plays a key role and occupies a strategic position due to its dominance in global nickel production and processing. According to data from the U.S. Geological Survey, global nickel mine production is projected to decline to approximately 3.7 million tons by 2024, while Indonesia's nickel production is expected to increase by about 8%. Indonesia's nickel mine production is projected to reach 2.2 million tons in 2024, with nickel reserves of approximately 55 million tons. This strategic position has also been further strengthened by the mineral downstreaming policy implemented in Indonesia. Through a series of policies between 2009 and 2019 which gradually restricts nickel ore exports, and the export ban on raw nickel ore has been in effect since January 2020. This indicates a shift from merely exporting nickel or raw minerals to processed nickel products and their derivatives.

Nevertheless, the strengthening of nickel downstream processing does not automatically yield significant macroeconomic impacts. This uncertainty arises because the performance of Indonesia's external sector is not solely influenced by nickel exports. While a strengthening nickel sector can indeed boost exports, this may occur alongside dependence on imports of industrial inputs and capital goods, an oil and gas deficit, exchange rate pressures, and global demand. This situation is reflected in Indonesia's trade balance data, which shows a national trade surplus, yet this coexists with deficits in specific sectors. The Central Statistics Agency reports that Indonesia's trade balance for the January - September 2025 period recorded a surplus of US\$33.48 billion. This surplus stems from a non-oil and gas sector surplus of US\$47.20 billion, while the oil and gas sector posted a deficit of US\$13.72 billion.

Theoretically, the relationship between global nickel price shocks and Indonesia's REER can be explained by the commodity currency framework, which explains how movements in global commodity prices can influence changes in the real exchange rate for commodity-exporting countries. Chen and Rogoff (2003), in their study of commodity-exporting countries such as Australia and New Zealand, revealed that global commodity prices have a strong and stable influence on the real exchange rate in those countries. In line with this, Kassouri and

Altıntaş (2020) also emphasize the importance of examining the dynamics of the real effective exchange rate in open economies, particularly for primary commodity-exporting countries, whose exchange rates tend to follow movements in global commodity prices. Furthermore, Chinn (2006) explains that exchange rates play a crucial role as the primary price in international finance, especially when a country trades with many partners. While Lane and Milesi-Ferretti (2002), link the trade balance and the real exchange rate within the framework of external wealth and external adjustment.

However, that relationship is not always automatic. Findings by Wilson and Tat (2001) regarding Singapore also indicate that the real exchange rate's influence on the trade balance remains weak. Qiao (2007) further emphasizes that changes in the exchange rate's impact on the trade balance can be ambiguous due to the interaction of wealth, price, investment, and absorption effects. In addition, Gaulier et al., (2020) explain that exchange rate elasticities vary across countries and sectors, exchange rate pass-through is imperfect, and trade quantity elasticities are often less than one. Li et al., (2015) reveal that the impact of exchange rate movements on exports varies according to firm characteristics, product characteristics, productivity, import intensity, and market conditions. N. Chen & Juvenal (2016) also explain that exchange rate pass-through is influenced by product quality. Therefore, even if global nickel price shocks may affect REER, their impact on trade balance cannot be understood as a simple one-way mechanism and remain limited.

To strengthen the relevance of the topic, this study conducted a preliminary bibliometric analysis using the Scopus database. The main results of this analysis are shown in Figure 1.

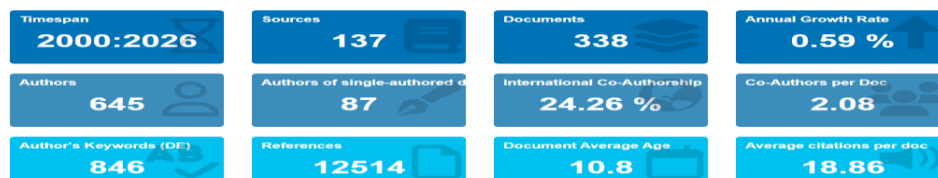


Figure 1.1 Main Information
Sources: Processed by the author using Biblioshiny

Based on Figure 1.1, a literature search in the Scopus database using the keyword combination “(Price OR Oil Price) AND Exchange Rate AND (Trade Balance OR Export OR Import)” yielded 338 documents. These main results show publications related to this topic from 2000 to 2026, yielding 338 documents, 137 sources, 645 authors, 846 author keywords, and 12,514 references, with an average of 18.86 citations per document.

This study also uses network visualization and overlay visualization to examine the relationships between keywords and to identify trends in research topics based on the average year of publication between keywords in the existing literature. The results of the network visualization and overlay visualization are shown in Figure 2 and Figure 3.

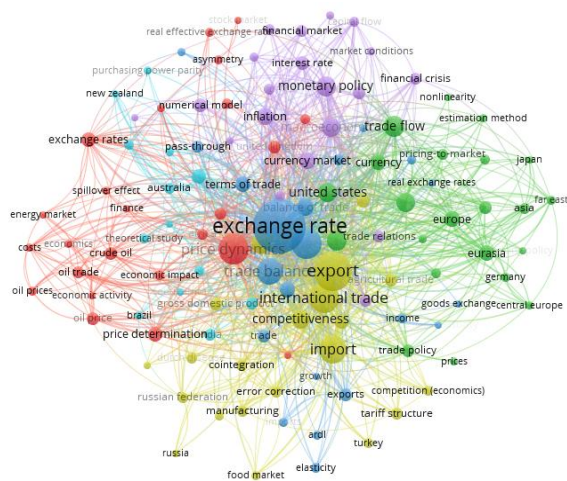


Figure 1.2 Network Visualization
Sources: Processed by author using VOSviewer

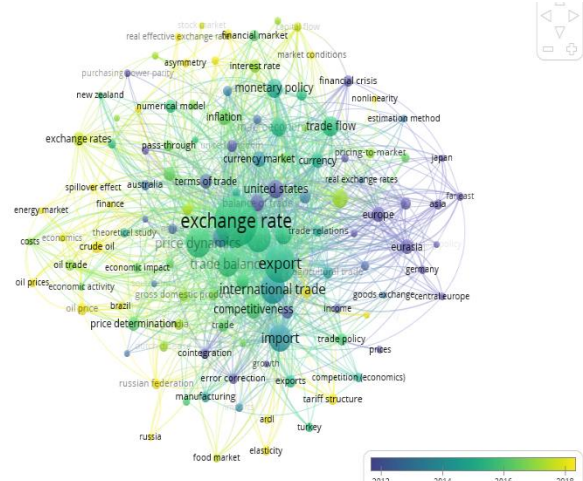


Figure 1.3 Network Visualization
Sources: Processed by author using VOSviewer

Based on Figure 1.2, the keyword “exchange rate” occupies a central position. In this position, the exchange rate also has strong links to exports, imports, the trade balance, price dynamics, international trade, inflation, monetary policy, the currency market, and oil prices. This condition explains that the exchange rate cannot be seen only as a financial variable, because the exchange rate is also part of the mechanism of international trade, price dynamics, and external-sector performance. On the other hand, based on Figure 1.3, the research keywords show a moderate trend, as seen from the green color that appears to dominate several keywords such as exchange rate, exports, import, price dynamics, international trade, trade balance, and oil prices. This research topic is also connected with other relevant topics and newer research issues in the recent international economics literature, as indicated by the appearance of yellow color in several keywords.

However, the analysis has not specifically pointed to the keyword nickel price shock as a dominant theme. This condition shows that studies on nickel price shocks still have room for contribution, particularly in the context of Indonesia, which has a strategic position in the global nickel supply chain. This condition further identifies several research gaps. Oil price shocks or aggregate commodity prices still dominate, Several studies that discuss the relationship between commodity prices and REER have also not further analyzed trade balance, while several studies that discuss REER and trade balance often ignore commodity price shocks that can influence exchange rate dynamics. Furthermore, empirical studies that combine nickel price shocks, Indonesia’s REER, and Indonesia’s trade balance in one Structural Vector Autoregression framework remain limited. Therefore, the novelty and originality of this study lies in the author’s effort to provide SVAR evidence specifically with nickel as the commodity. The purpose is to analyze the structural transmission of global nickel price shocks to Indonesia’s REER and trade balance by examining how global nickel price shocks affect Indonesia’s REER, how does Indonesia’s trade balance respond to nickel price shocks and REER shocks, and to what extent can both explain fluctuations in Indonesia’s trade balance.

2. LITERATURE REVIEW

2.1 Previous Empirical Studies

Tabel 2.1 Previous Empirical Studies

Author(s) & Year	Research Focus	Method	Main findings and Relevance to this study
Chen & Rogoff (2003)	Commodity currencies: the relationship between commodity prices and exchange rates in commodity-exporting countries	OLS Regression; Panel Data Analysis	Commodity prices significantly explain exchange rate movements in commodity-exporting countries. Their influence is strong and stable. This finding is relevant because it provides a theoretical basis for understanding the transmission of nickel prices to Indonesia's REER. As a nickel exporter, the commodity-currency framework is appropriate for explaining Indonesia's situation.
Kassouri & Altıntaş (2020)	Shocks to commodity terms of trade and real effective exchange rate dynamics in Sub-Saharan Africa	Panel VAR (PVAR); Impulse Response Function	A positive shock to the commodity terms of trade affects the REER through appreciation. The magnitude of the appreciation depends on the composition of export commodities. In the medium term, the effect is persistent. These findings are relevant and most closely align with this study, directly supporting Ha ₁ , particularly in the context of developing countries.
Chinn (2006)	Real effective exchange rates: measurement, interpretation, and empirical applications	Conceptual Paper / Survey; Descriptive Analysis	The REER is considered a more accurate measure of external competitiveness than bilateral exchange rates. Changes in the REER subsequently affect trade flows. These findings serve as the theoretical and conceptual basis for selecting research variables, particularly in the context of Indonesia, which has numerous trading partners.
Lane & Milesi-Ferretti (2002)	External wealth, the trade balance, and the real exchange rate: long-run equilibrium relationships	OLS Panel; Cross-Country Regression	In the long run, the real exchange rate is a key determinant of adjustments in the trade balance. The relationship between the two is shown to be significant in the long run. This finding serves as the primary theoretical foundation for understanding the transmission mechanism from the REER to the trade balance and directly supports Ha ₂ .
Wilson & Tat (2001)	Exchange rates and the trade balance: a case study of Singapore from 1970 to 1996	VAR; Impulse Response Function; Cointegration	The impact of the real exchange rate on the trade balance is significant but still weak. The J-curve effect is not always present across all periods. These findings support the argument that changes in the REER do not always automatically lead to an improvement in the trade balance's response and performance, particularly in the context of emerging Asian economies.
Bussière et al. (2020)	Global trade flows: exchange rate elasticity	Panel Regression; Estimation of Trade Elasticity	Exchange rate elasticity has a significant impact on global trade flows but has declined over time. Elasticity varies across countries and sectors, so trade responses are not always uniform. These findings support the argument that the impact of the REER on the trade balance is influenced by much broader structural factors.
Li, Ma, & Xu (2015)	The Impact of Exchange Rate Fluctuations on Exports in China: Micro- and Macro-Level Evidence	Company-Level Panel Data; OLS; IV Estimation	An appreciation in the exchange rate reduces exports. The effects vary across different types of firms and products, depending on productivity levels, import intensity, and market conditions. These findings support H2 regarding the relationship between changes in the REER and the trade balance; however, the response is also influenced by export structure and dependence on imported inputs.
Ali & Vinh (2020)	Inflation targeting, structural changes, and exchange rate pass-through	Time-Varying Parameter VAR (TVP-VAR); Structural Break Analysis	Exchange rate pass-through and trade responses may fluctuate (decrease significantly) following the adoption of inflation targeting. These findings, derived from VAR analysis, support the use of the SVAR method in this study to capture the responses of Indonesia's REER and trade balance to global nickel price shocks.

2.2 Commodity Price Shocks and Commodity Currency Framework

Commodity price shocks refers to a situation in which prices fluctuate particularly the prices of primary commodities (such as oil, minerals, or agricultural products) in the global market; these fluctuations are beyond the control of small countries (exogenous) and highly volatile (Y. Chen & Rogoff, 2003). These shocks are characterized by the emergence of cycles of booms (price surges) and busts (sharp price declines). Both serve as the primary triggers of macroeconomic fluctuations in commodity exporting countries (Kassouri & Altintas, 2020). Chen & Rogoff, (2003) also explained that The Terms of Trade (ToT) are one of the reasons why commodity prices influence the exchange rate of commodity-exporting countries. Commodity price shocks also affect the exchange rate through the wealth effect. A surge in commodity prices causes a transfer of wealth from importing countries to exporting countries (Bodenstein et al., 2011). From the perspective of trade and the external portfolio, a surge in major commodity prices also can increase export revenues, foreign exchange reserves, and the balance of payments surplus. Market confidence in the domestic economy will be high, leading to strong demand for the currency (Kassouri & Altintas, 2020).

The concept of commodity currency explains that commodity-exporting countries have currencies that tend to be sensitive to changes in global commodity prices, especially when the country's export earnings depend on a particular primary commodity. This condition is reflected in countries such as Australia, Canada, and New Zealand. From the perspective of this study, nickel is chosen because it is included as a strategic metal commodity, making it relevant to this topic. When global nickel prices increase, export earnings and foreign exchange inflows in commodity-exporting countries have the potential to increase, so the terms of trade improve and REER appreciates. However, when real appreciation becomes too strong, risks may emerge, ranging from weakened competitiveness in non-commodity sectors to Dutch Disease (Kassouri & Altintas, 2020).

2.3 Real Effective Exchange Rate and External Competitiveness

REER can be interpreted as a geometric weighted average. REER represents a country's bilateral real exchange rate against the currencies of its main trading partners (Ali & Vinh, 2020). The REER value is obtained by adjusting the nominal exchange rate with differences in relative price or cost levels, such as CPI, PPI, or unit labor costs, between the domestic country and its trading partner countries. There are three main components that form REER, including the relative price of tradable goods, the relative price of non-tradable goods to tradable goods in the domestic country, and the relative price of non-tradable goods to tradable goods in foreign countries (Chinn, 2006). Compared to the bilateral exchange rate, REER is considered more relevant and accurate as a macroeconomic indicator because of its ability to describe more clearly and comprehensively the exchange rate position of a country and its external competitiveness (Gaulier et al., 2020).

The bilateral exchange rate only shows the relationship with one currency, for example the Rupiah against the U.S. Dollar. In this case, when exchange rate changes are mostly influenced by specific shocks from that country. On the other hand, REER measures the value of the domestic currency against various currencies of major trading partners and does not depend too much on one particular country (Y. Chen & Rogoff, 2003). When REER increases, it means that real appreciation occurs, and the domestic currency becomes more expensive compared to the currencies of trading partners. As a result, export competitiveness declines because domestic products become relatively more expensive in the global market, while imported goods become relatively cheaper for domestic consumers (Li et al., 2015). Conversely, when REER decreases, it means that real depreciation occurs, and the domestic currency becomes cheaper. As a result, domestic products become more competitive in the global market and open access for improvement in the trade balance (N. Chen & Juvenal, 2016).

2.4 Trade Balance and External Adjustments

The trade balance can be interpreted as the difference between the value of exports, namely export prices multiplied by volume, and the value of imports, namely import prices multiplied by volume, in a country (Gaulier et al., 2020). The trade balance is one of the main indicators in the external sector, whose existence reflects the balance position between domestic production and national absorption, such as consumption and investment, toward the international market (Qiao, 2007). Changes in the exchange rate will affect the price of export goods in the global market, as well as the price of imports in the domestic market. This shows the strong relationship between the trade balance and REER.

In the process of external adjustment, when a currency depreciates, it is theoretically expected to improve the trade balance through increased export price competitiveness. However, based on the Marshall-Lerner Condition, depreciation will only be effective if the price elasticity of demand for exports and imports is greater than one. The *J-curve* effect also needs to be considered. In the short run, the trade balance may worsen after depreciation before eventually improving in the long run along with the adjustment of trade volume (Wilson & Tat, 2001). Basically, the dynamics of the trade balance are not only determined by primary commodity exports, but also by a much broader economic structure. For example, imported inputs, oil and gas components, industrial and sectoral structures, firms' market power, and global demand from trading partner countries (Gaulier et al., 2020).

2.5 Theoretical and Analytical Framework

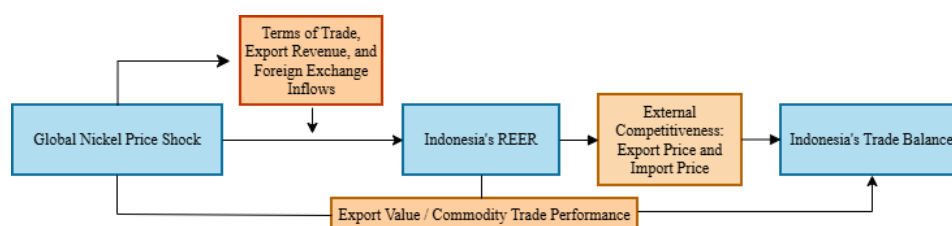


Figure 2.1 Theoretical Framework

Figur 2.1 illustrates theoretical framework, global nickel price shocks can affect Indonesia's REER through the terms of trade, export revenue, and foreign exchange inflows. In turn, Indonesia's REER can affect the country's trade balance through external competitiveness, export prices, import prices, and trade adjustment mechanisms. Additionally, nickel price shocks can also directly affect the trade balance through changes in export values and commodity trade performance.

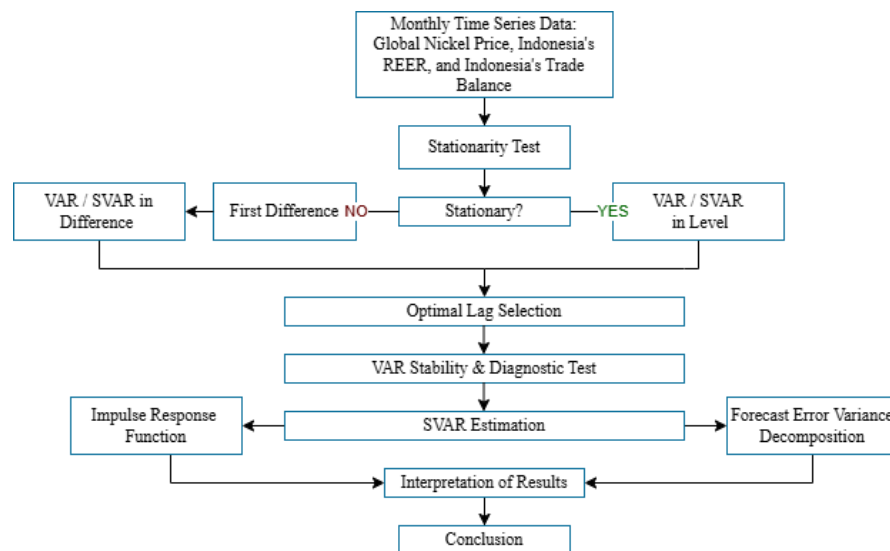


Figure 2.2 Analytical Framework

Figure 2.2 illustrates the analytical framework of this study. The analysis begins with the collection of monthly time-series data on global nickel prices, Indonesia's REER, and Indonesia's trade balance. The data are then tested for stationarity, followed by the selection of optimal lags, VAR stability testing, and SVAR estimation. Dynamic effects are then analyzed using IRF and FEVD to draw conclusions.

2.6 Hypothesis Development

Based on existing theory and prior research, global nickel price shocks affect the REER through terms of trade, export revenues, and foreign exchange flows. Furthermore, the REER influences the trade balance through the conditions and intensity of price competitiveness in exports and imports. In addition, nickel price shocks can also directly affect the trade balance through the performance of commodity exports. In this regard, the hypotheses formulated in this study are as follows:

H0₁: Indonesia's REER does not respond to Global nickel price shocks, 1994–2025

Ha₁: Indonesia's REER responds to Global nickel price shocks, 1994–2025.

H0₂: Indonesia's trade balance does not respond to Indonesia's REER, 1994–2025.

Ha₂: Indonesia's trade balance responds to Indonesia's REER, 1994–2025.

H0₃: Indonesia's trade balance does not respond to Global nickel price shocks, 1994–2025.

Ha₃: Indonesia's trade balance responds to Global nickel price shocks, 1994–2025.

3. METHODS

3.1 Research Desain, Data, Variables

This study aims to analyze how Indonesia's external sector performance relates to the dynamics or shocks of global nickel prices. Through indicators such as global nickel prices, Indonesia's REER, and Indonesia's trade balance, this study is expected to provide an overview of how global commodity price shocks, reflected in nickel prices, are transmitted into the domestic economy. This transmission can be observed through changes in real exchange rate competitiveness and the response of Indonesia's trade balance. Furthermore, this study is expected to explain the extent to which Indonesia's strategic position in the global nickel market is able to encourage the strengthening of overall external sector performance.

This study employs a quantitative approach using one of the econometric models, namely the *Structural Vector Autoregression* (SVAR) model, with Stata 17MP. The data used in this study consists of secondary data collected from the Federal Reserve Economic Data (FRED). The data consists of monthly time series, with the time period ranging from January 1994 to December 2025. Several variables used in this study are presented in Table 3.1.

Tabel 3.1 Research Variables and Data

No	Variables	Unit	Source
1	Global Nickel Price	U.S. Dollars per Metric Ton	FRED
2	Indonesia's REER	Index 2020=100	FRED
3	Indonesia's Trade Balance	US dollars	FRED

Sources: Processed by author, 2026

3.2 Model Spesification

This study is conducted using the *Structural Vector Autoregression* (SVAR) model. The SVAR method is a development of the *Vector Autoregressive* (VAR) method. The addition of the word "structural" refers to certain identification assumptions, in this case often modeled in the form of a lower triangular matrix, which is used to analyze the interaction of variables simultaneously (Ali & Vinh, 2020). SVAR is used because it is able to analyze dynamic relationships among macroeconomic variables and identify structural shocks or random disturbances based on the variable system and economic theory (Brahmasrene et al., 2014).

Unlike the VAR model, the SVAR model is able to provide a clearer structure in explaining how shocks in one variable are transmitted to other variables. In addition, the SVAR model is also able to treat each endogenous variable as a function of past values or lags (Brahmasrene et al., 2014). Not only from the variable itself in the previous period, but also from the past values of other variables in a system (Brahmasrene et al., 2014). The use of the SVAR method in this study is chosen because the main focus of this study is to examine the relationship among variables and to trace the structural response of Indonesia's REER and trade balance to global nickel price shocks.

The basic VAR model can be written as follows:

$$Y_t = \alpha_1 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \beta_3 Y_{t-3} + \varepsilon_t$$

With:

$$Y_t = \begin{bmatrix} dNickel_t \\ dREER_t \\ TradeBalance_t \end{bmatrix}$$

Description:

- Y_t : Vector of time series variables, consisting of:
 $dNickel_t$: Change in global nickel price
 $dREER_t$: Change in Indonesia's REER
 $TradeBalance_t$: Indonesia's Trade Balance
- α_1 : Vector of intercepts
 $\beta_1, \beta_2, \beta_3$: Coefficient matrices
 $\beta_1 Y_{t-1}$: The effect of variables at lag 1
 $\beta_2 Y_{t-2}$: The effect of variables at lag 2
 $\beta_3 Y_{t-3}$: The effect of variables at lag 3
 ε_t : Error term

Based on the optimal lag selection process and model diagnostic considerations, the model used in this study is lag 3. The following is the structural form of the SVAR model used:

$$A u_t = B \varepsilon_t$$

With:

$$u_t = \begin{bmatrix} u_{dNickel,t} \\ u_{dREER,t} \\ u_{TradeBalance,t} \end{bmatrix} \text{ and } \varepsilon_t = \begin{bmatrix} \varepsilon_{dNickel,t} \\ \varepsilon_{dREER,t} \\ \varepsilon_{TradeBalance,t} \end{bmatrix}$$

Description:

- A : Matrix that captures the direct relationships among variables at the same time period.
 B : Matrix that captures the magnitude structural shock variance in each variables.
 u_t : Vector of reduced-form residuals from the VAR model.
 ε_t : Vector of structural shocks.

In this study, the direct relationship retriCTION matrix can be written as follows:

$$A = \begin{bmatrix} 1 & 0 & 0 \\ \alpha_{21} & 1 & 0 \\ \alpha_{31} & \alpha_{32} & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} b_{11} & 0 & 0 \\ 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix}$$

Based on the lower triangular structure shown in matrix A, the structural ordering follows the theoretical order written as follows:

$$dNickel_t \rightarrow dREER_t \rightarrow TradeBalance_t$$

Global nickel price is positioned as the most exogenous shock because its price is determined in the global commodity market. This price shock can then directly and contemporaneously affect Indonesia's REER and Indonesia's trade balance. REER occupies the position of a transmission variable because of its role in responding to nickel price shocks and influencing the trade balance through changes in external competitiveness. Meanwhile, Indonesia's trade balance occupies the position of the final response variable because of its role in reflecting the outcome of the adjustment process in the external sector.

3.3 Data Analysis Technique

To ensure model suitability, this study is conducted through several steps. The stationarity test is the initial step carried out to determine whether each variable used is stationary at level or needs to be transformed into *first difference*. The stationarity test in this study transforms global nickel price and Indonesia's REER into *first difference* form. On the other hand, trade balance is not transformed because it is already stationary at level.

Furthermore, the use of macroeconomic variables in this study also requires the researcher to conduct optimal lag selection. The objective is to determine the most appropriate lag length in the VAR/SVAR model. This is important because the response of one variable to shocks from other variables generally has a certain time lag. The optimal lag selection in this study uses lag 3. After the optimal lag is determined, the model stability test is then conducted to ensure that the VAR system satisfies the stability condition. A stable VAR system will provide *Impulse Response Function* (IRF) and *Forecast Error Variance Decomposition* (FEVD) results that are appropriate and can be interpreted correctly.

Furthermore, the SVAR model is then estimated using short-run structural restrictions. The restriction structure used follows the theoretical ordering of variables, starting from global nickel price shocks, Indonesia's REER, and Indonesia's trade balance. The final step to examine the dynamic effects among variables is carried out through *Impulse Response Function* and *Forecast Error Variance Decomposition* analysis. IRF is used to see the direction and duration of the response of Indonesia's REER and Indonesia's trade balance to structural shocks, namely global nickel price shocks, over a twelve-month period. Meanwhile, FEVD is used to see and measure how far the contribution of each shock can explain fluctuations in each variable. In this case, it is used to see and measure the contribution of global nickel price shocks and Indonesia's REER shocks to Indonesia's trade balance. The IRF and FEVD results are then used as the basis for implicit hypothesis testing in this study.

4. RESULTS AND DISCUSSION

This study was conducted through several stages of analysis. Preliminary Test Results performed as an initial step, followed by impulse response function analysis and forecast error variance decomposition analysis. The following is an overview of the characteristics of the data used, presented in the form of descriptive statistics summarized in Table 4.1.

Table 4.1 Summary Descriptive Statistics

Variables	Obs	Mean	Min	Max	Std. dev
Global Nickel Price	384	14,406,34	3,865.76	51,783.33	7,670.65
Indonesia's REER	384	97,84	40.17	125.86	13.68
Indonesia's Trade Balance	384	1.62e+09	-2.33e+09	7.56e+09	1.50e+09

Sources: Processed by author, 2026

Based on the descriptive statistics summary in Table 4.1, this study has a total of 384 observations across the variables used. The significant gap in the global nickel price, as reflected by the difference between the minimum and maximum values, indicates that this variable exhibits relatively high volatility. Indonesia's REER shows a similar pattern but is relatively more stable. Meanwhile, Indonesia's trade balance exhibits considerable variation.

4.1 Preliminary Test Results

Stationarity tests, optimal lag selection, and model diagnostics were conducted as preliminary analyses prior to the IRF and FEVD analyses. The following are the results of the stationarity tests to ensure that the data used in this study are stationary, presented in Table 4.2.

Table 4.2 Stationarity Test Results

Variables	P-value at level	P-value at 1 st difference	Model Form
Global Nickel Price	0.2099	0.0000*	dNickel
Indonesia's REER	0.0605	0.0000*	dREER
Indonesia's Trade Balance	0.0000*	-	TradeBalance

Note: * Indicate stationarity at the 5% significance level.

Sources: Processed by author, 2026

Based on the results of the stationarity test in Table 4.2, global nickel prices and Indonesia's REER are non-stationary at the first order but become stationary after first-order differencing. On the other hand, Indonesia's trade balance is stationary at the first order. In this case, the SVAR model used includes dNickel, dREER, and Trade Balance. Next, the following are the results of the optimal lag selection test, to determine the optimal lag length for this study, as presented in Table 4.3.

Table 4.3 Lag Order Selection Criteria

Lag	LR	FPE	AIC	HQIC	SBIC
2	87.531	2.5e+25	67.0021	67.0902*	67.2238*
3	30.44	2.4e+25*	66.9686*	67.0944	67.2854
12	18.527*	2.6e+25	67.0432	67.5086	68.2149

Note: Only lags selected by at least one criterion are reported. * Indicate the optimal lag.

Sources: Processed by author, 2026

Based on the lag order selection criteria in Table 4.3, the optimal lag order according to the LR criterion is 12, while the FPE and AIC criteria indicate a lag order of 3, and the HQIC and

SBIC criteria indicate a lag order of 2. In this case, the study uses a 3-lag SVAR model because it is able to capture and produce a more accurate dynamic relationship, as supported by the FPE and AIC diagnostic criteria. Equally important, the following are the results of the model stability and diagnostic tests, to ensure the model is stable and meets the classical assumptions, as presented in Table 4.3.

Table 4.4 Stability and Model Diagnostic Test

Diagnostic Test	Results	Decision
VAR Stability Test	All eigenvalues lie inside the unit circle	Stable model
LM Autocorrelation Test	Most p-value > 0.05, except lag 5 and 12	No serious autocorrelation
Jarque-Bera Normality Test	P-value = 0.0000	Not normally distributed

Sources: Processed by author, 2026

Based on the results of model dignistic test in Table 4.2, The fact that all eigenvalues lie within the unit circle indicates that the stability condition is satisfied. The results of the LM autocorrelation test show that most lag orders exhibit values higher than the 5% significance level, although lag orders 5 and 12 show lower values. This does not affect the model's validity because the autocorrelation occurs beyond the optimal lag. Meanwhile, the probability from the Jarque-Bera test yields a value of 0.0000. This value is lower than the 5% significance level, meaning the residuals are not normally distributed. This occurs due to the use of macro time series data with high levels of volatility, particularly in the global nickel price variable.

4.2 Impuls Response Function Analysis

To determine the direction, magnitude, and lag required for the variable to respond to a shock over a 12-period horizon, the IRF graph shown in the figure 4.1, 4.2, and 4.3.

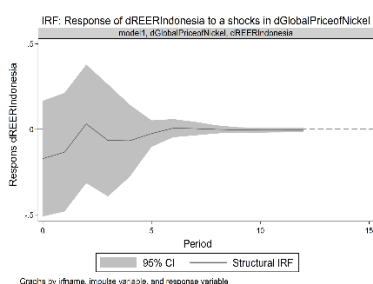


Figure 4.1 IRF-Indonesia's REER to Global Nickel Price Shock

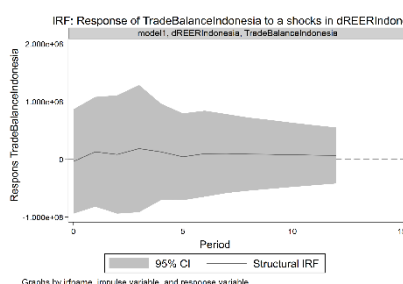


Figure 4.2 IRF-Indonesia's Trade Balance to Indonesia's REER

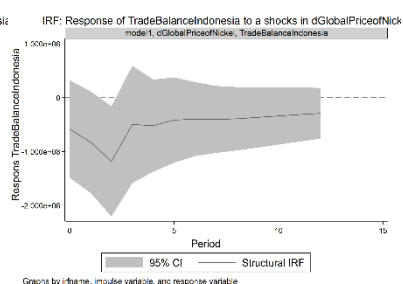


Figure 4.3 IRF-Indonesia's to Trade Balance to Global Nickel Price Shock

Sources: Processed by author, 2026

Based on the impulse response function in figure 4.1, Indonesia's REER has responded to the global nickel price shock. However, this response has been relatively weak and has even gradually faded over time. In Figure 4.2, Indonesia's trade balance also responds weakly to shocks to Indonesia's REER. Furthermore, in Figure 4.3, Indonesia's trade balance also responds to global nickel price shocks, but the response is relatively limited as it gradually returns toward equilibrium.

4.3 Forecast Error Variance Decomposition Analysis

In this context, FEVD serves to support the IRF results previously presented, FEVD is used to determine the extent to which each shock contributes to explaining the variance in Indonesia's trade balance. The results of the FEVD analysis are presented in the table 4.5.

Table 4.5 FEVD of Indonesia's Trade Balance Results

Horizon	Global Nickel Price Shock	Indonesia's REER Shocks	Indonesia's Trade Balance Own Shock
1 Month	0.42%	0.00%	97.58%
3 Month	2.25%	0.02%	97.73%
6 Month	2.09%	0.05%	97.86%
12 Month	2.04%	0.07%	97.89%

Sources: Processed by author, 2026

Based on the forecast error variance decomposition of Indonesia's Trade Balance result in Table 4.5, The variance in Indonesia's trade balance is explained primarily by domestic shocks, accounting for 97.89% over a 12-month horizon. Meanwhile, shocks to global nickel prices and Indonesia's REER contribute only 2.04% and 0.07%, respectively. Thus, in explaining the variance in Indonesia's trade balance, both factors remain relatively weak. The same holds true for a 3-month horizon, which is the optimal lag.

4.4 Discussion and Policy Implication

This study found that global nickel price shocks are transmitted to Indonesia's real effective exchange rate (REER) and trade balance, though the magnitude of this transmission is relatively limited. Global nickel price shocks account for only 2.04% of the fluctuations in Indonesia's trade balance over a twelve-month horizon. This finding also underscores that while Indonesia holds a strategic position and has significant influence in the global nickel market, this is insufficient to strengthen the aggregate performance of its external sector. The impact of such shocks is felt far more acutely at the sectoral and microeconomic levels than at the macroeconomic level, such as in Indonesia's trade balance.

The commodity currency theory also supports this study in explaining how rising commodity prices can improve terms of trade, export revenue, and demand for the domestic currency. The minimal contribution of global nickel price shocks to Indonesia's trade balance occurs because non-nickel exports, imports of input commodities, global demand, and the performance of the oil and gas sector also contribute and may even dominate the variance in Indonesia's trade balance. This is consistent with the concept that views the impact of commodity price increases or shocks on the external sector as highly dependent on a country's economic and trade structure (Lane & Milesi-ferretti, 2002; Brahmasrene et al., 2014).

Furthermore, changes in Indonesia's REER account for only 0.07% of the variance in Indonesia's trade balance over a twelve-month horizon. Changes in the REER are expected to influence export-import competitiveness through changes in the relative prices of domestic and foreign goods (N. Chen & Juvenal, 2016). However, this expected effect remains weak in Indonesia. This occurs because, trade responses to exchange rate changes often vary across

countries and in the short term, do not always satisfy the Marshall-Lerner condition. Therefore, changes in the real exchange rate do not necessarily lead to significant improvements in the trade balance (Skrooee & Ara, 2008). Similarly, in the context of global nickel price volatility, the relationship between Indonesia's REER and its trade balance is also heavily dependent on the structure of the economy (Brahmasrene et al., 2014).

The relationship between global nickel prices and Indonesia's REER also exhibits a high degree of complexity, which in turn weakens the REER's response to global nickel price shocks. This occurs because the relationship between commodity prices and exchange rates is not always stable due to changes in global economic conditions, market uncertainty, and country-specific characteristics (Brahmasrene et al., 2014). These findings are also consistent with the research by (Shang & Hamori, 2021) and (Umar & Bossman, 2023) who concluded that the relationship between commodity prices and financial markets tends to be dynamic and can change in accordance with global economic conditions.

Based on these findings, from a policy implications perspective, relying solely on the expansion or growth of strategic commodities as a strategy to strengthen Indonesia's external sector is not the right choice. Such a policy must be balanced with broader structural policies to achieve more effective and better results for the Indonesian economy. For example, this could be accompanied by an increase in domestic value added, the strengthening of downstream industries, a reduction in dependence on imported inputs, or the implementation of export product diversification. This is done to ensure a stable exchange rate and stronger external resilience. (Ali & Vinh, 2020) also emphasize that the effectiveness of exchange rate transmission on international trade is influenced by structural changes in the economy.

Furthermore, the findings of this study also indicate that evaluating the success of the nickel downstreaming policy is insufficient if one considers only Indonesia's trade balance. In essence, investment, processing capacity, and the export value of nickel and its derivatives have significant potential for growth as a result of the implementation of the nickel downstreaming policy. However, these positive impacts on Indonesia's aggregate trade balance do not materialize immediately and require a considerable amount of time to be felt. In fact, they may even decline due to the stronger performance of other sectors. The downstream processing policy is not solely focused on increasing processing capacity but also on strengthening the domestic supply chain, developing technology, and enhancing the competitiveness of the national industry. In this regard, leveraging Indonesia's strategic position as a key player in the global nickel market is far more effective, and the resilience of Indonesia's external sector is significantly stronger and more sustainable (Gaulier et al., 2020).

5. CONCLUSION AND LIMITATION

5.1 Conclusion

The primary objective of this study is to analyze the transmission of global nickel price shocks on Indonesia's REER and trade balance from 1994 to 2025 using the Structural Vector Autoregression (SVAR) approach. The findings indicate that global nickel price shocks affect Indonesia's REER. Furthermore, both global nickel price shocks and shocks to Indonesia's REER also influence Indonesia's trade balance. However, all the resulting responses are relatively weak and non-persistent; they even tend to subside in the short term. This finding is supported by FEVD results, which also indicate that the variance in Indonesia's trade balance is explained more by shocks originating from the trade balance itself than by shocks stemming from global nickel prices or Indonesia's REER. These findings further confirm the hypothesized relationship in the study and underscore that while Indonesia holds a strategic position on the global stage as one of the leading nickel producers, the resulting transmission mechanism is not yet strong enough to automatically improve external sector performance. Relying solely on strategic commodities is insufficient. There is a need to increase domestic value added, diversify exports, reduce dependence on imported inputs, and strengthen the industrial structure to optimize strategic mineral resources for economic benefits and a stronger external sector.

5.2 Limitation

In interpreting the research findings, there are several limitations to this study. The analysis period spans from January 1994 to December 2025; as such, the study does not include data for 2026 as the period following the end of the observation period, nor does it account for current economic developments that could potentially influence the relationships between variables. Furthermore, the research model uses only three variables, namely global nickel prices, Indonesia's REER, and Indonesia's trade balance. As a result, it does not account for other factors or variables that could also influence the dynamics of Indonesia's external sector, such as energy prices, domestic import conditions, global demand, or trade policies. Additionally, while the use of the SVAR approach in this study is fundamentally capable of representing dynamic relationships between variables within a specific identification framework, the possibility of nonlinear relationships or changes in the economic structure during the study period has not been fully captured. Given these limitations, future research is recommended to expand the scope of data, use a wider variety of economic variables, and combine the SVAR approach with other econometric methods to yield more comprehensive research results or findings in explaining the transmission mechanism of commodity shocks on Indonesia's external sector.

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