

ANALYSIS OF THE EFFECT OF INTERNATIONAL PRICES, EXCHANGE RATES, NON-TARIFF MEASURES, AND IMPORT VOLUME ON THE EXPORT VALUE OF INDONESIAN CLOVES (HS:0907) TO INDIA

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Abstract

This study aims to analyze the influence of international prices, the rupiah–rupee exchange rate, non-tariff measures, and India’s import volume on the export value of Indonesian cloves to India. The research utilizes secondary data for the period 2015–2024. The analytical method employed is the Autoregressive Distributed Lag (ARDL) model to examine both short-run and long-run relationships, complemented by stationarity tests, cointegration tests, ECM estimation, and diagnostic and stability tests. The results show that international prices have a positive and significant effect on Indonesia’s clove export value, consistent with export-supply theory which states that higher global prices increase export incentives. The rupiah–rupee exchange rate displays a positive but insignificant relationship, indicating that exchange rate volatility is not sufficiently strong to influence changes in export value. Non-tariff measures, including SPS and TBT standards, are found to have a significant effect, reflecting the role of regulations in increasing compliance costs while simultaneously enhancing Indian consumer confidence in the quality of Indonesian cloves. India’s import volume also has a significant influence, showing that India’s domestic demand remains a major driver of Indonesia’s export value during the study period. This study is expected to provide insights for policymakers and industry players in strengthening trade strategies, particularly in enhancing the competitiveness of Indonesian clove exports through quality improvements, exchange rate stability, and compliance with non-tariff standards.

Keywords: *International Prices, Exchange Rate, Non-Tariff Measures, Import Volume, Export Value, Cloves, Indonesia, India.*

1. INTRODUCTION

International trade is one of the main drivers of global economic growth. Through export and import activities, countries can leverage comparative advantages to improve production efficiency and meet domestic needs. This cross-border trade not only promotes a more optimal allocation of resources but also creates broader market access for a country's goods and services. In the context of the global economy, international trade becomes an important tool for developing countries like Indonesia to strengthen their national economic structure. Besides being a source of foreign exchange, international trade also fosters

industrialization, job creation, as well as technology and innovation transfer from developed countries. Despite its significant benefits, international trade faces various challenges, such as fluctuations in global commodity prices, exchange rate volatility, and trade barriers, both tariff and non-tariff (Pianti Lia et al., 2022).

Indonesia's exports are divided into oil and gas (migas) and non-oil and gas (non-migas) sectors, with the plantation subsector, including cloves, playing a significant role in non-oil and gas exports. According to the Central Statistics Agency (BPS), Indonesia's total export performance fluctuated significantly from 2007 to 2016, with the export value increasing from 114.10 billion USD in 2007 to 137.02 billion USD in 2008, but then decreasing again in 2009 to 116.51 billion USD (Nurhayati, 2018). Cloves are one of Indonesia's flagship plantation commodities with a strategic role in international trade. According to the Food and Agriculture Organization (FAO) data in 2020, Indonesia is the world's largest producer of cloves, with a production of 133,604 tons, far surpassing Madagascar (23,931 tons) and Tanzania (8,602 tons), its main competitors (Mellinia & Wijayanti, 2024). The high volume of production and global demand makes cloves one of the country's leading commodities, contributing significantly to foreign exchange and the national economy. In the context of the balance of payments, clove exports directly strengthen Indonesia's foreign exchange reserves, which positively impact the stability of the rupiah exchange rate and the ability to import capital goods. Additionally, the clove plantation sector supports labor absorption in producing areas such as Maluku and Nusa Tenggara, while also promoting the growth of downstream industries such as essential oils and other derivative products. Therefore, the development and optimization of clove exports are not only important for national income but also make a significant contribution to regional and national economic growth.

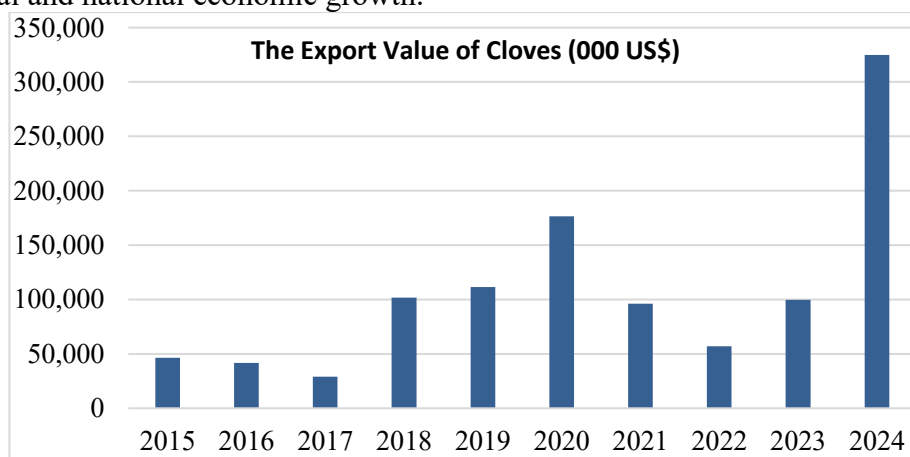


Figure 1. Value of Indonesia's Clove Exports to India 2015-2024

Source: Central Statistics Agency, processed by Pusdatin

Based on Figure 1. the value of Indonesia's clove exports in 2020 reached 176.56 million USD, an increase of nearly 84 percent from the previous year, making Indonesia the largest contributor to global clove exports (Agricultural Data and Information System Center, 2023). India, as one of the main export destinations, has a high demand for cloves for use in the food industry, traditional medicine, essential oils, and perfumes, driving the increase in the value of Indonesian clove exports. Despite this, clove exports have remained

relatively stable, with India as the primary market, followed by the United Arab Emirates, Singapore, and Bangladesh (Mellinia & Wijayanti, 2024). The plantation subsector contributed an average of 3.40% to Indonesia's Gross Domestic Product (GDP) during the 2015-2019 period, although it experienced a decline in growth of -7.22% (Hasibuan & Novianti, 2022).

India imported cloves from Indonesia worth 176.56 million USD in 2020, an 84 percent increase from the previous year, to meet the demands of the food, traditional medicine, and essential oil industries (Madaniyah et al., 2022). India's dependence on Indonesian cloves has grown due to economic growth, a large population, and domestic crop failures. As a result, India has become an attractive export destination (Hidayati & Ekaria, 2023). However, the realization of this potential may be affected by several variables, such as non-subsidy policies, exchange rates, and international price fluctuations. These factors can hinder Indonesia's competitiveness in the Indian clove market. International clove prices are a key factor influencing export value. According to international price theory, the price of commodities in global markets is determined by the dynamics of global supply and demand. When international clove prices rise, Indonesian exporters can achieve higher profit margins, driving an increase in exports to India.

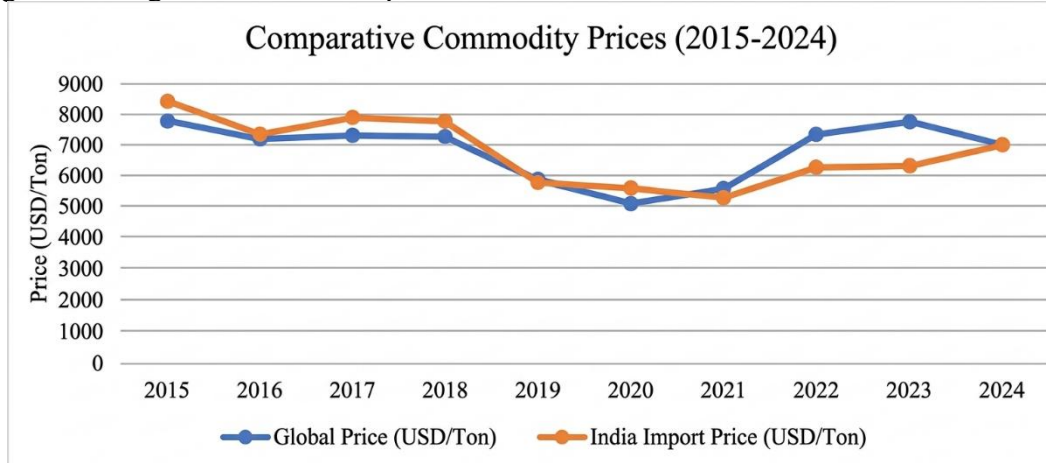


Figure 2: International Clove Price and India's Clove Import Price 2015-2024
 Source: ITC Trade Map (Accessed May 2025)

Figure 2 shows the trends in global clove prices and India's clove import prices from 2015 to 2024. Global prices experienced a significant decline from 2019 (5881 USD/Ton) to 2020 (5072 USD/Ton), followed by a sharp increase through 2023 (7746 USD/Ton). In contrast, India's import prices remained more stable, with the lowest point in 2021 (5241 USD/Ton), showing a gradual increase through 2024 (6991 USD/Ton). This difference in trends reflects the varying market dynamics between global prices and India's imports during the period. However, the unpredictable price fluctuations, as is typical with agricultural commodities, can create uncertainty for exporters (Madaniyah, 2024). This issue becomes more complex with competition from countries like Madagascar and Sri Lanka, which also export cloves to the global market (Hidayati & Ekaria, 2023).

The exchange rate between the Indonesian rupiah (IDR) and the Indian rupee (INR) plays a vital role in the competitiveness of Indonesian clove exports. A weaker rupiah makes cloves cheaper in the Indian market, boosting exports, while a stronger rupiah increases prices, reducing competitiveness. Historical exchange rate data from XE.com and the Reserve Bank of India (RBI) from 2019 to 2021 shows similar trends, with significant fluctuations during the second quarter of 2020, coinciding with the COVID-19 pandemic, which caused global exchange rate volatility.

In addition to tariff policies, Non-Tariff Measures (NTMs), including Sanitary and Phytosanitary Measures (SPS) and Technical Barriers to Trade (TBT), also impact international trade. These regulations, designed to protect health and the environment, often present challenges for exporters, especially from developing countries like Indonesia. In the context of Indonesia's clove exports to India, compliance with SPS and TBT policies is crucial, as these measures can either help or hinder export values depending on Indonesia's ability to meet these requirements. Understanding the impact of NTMs is essential to grasp the complexities of Indonesia's clove trade with India.

The volume of clove imports by India is another factor affecting Indonesia's export values. India, with its large population and rapid economic growth, has high demand for cloves for its food, cosmetics, and traditional medicine industries (Madaniyah, 2024). India's dependence on clove imports, due to domestic crop failures caused by extreme weather, creates significant opportunities for Indonesia (Wahdiana et al., 2023). However, India's import volume can be influenced by trade policies such as import tariffs, import quotas, and non-tariff measures that may limit the demand for Indonesian cloves.

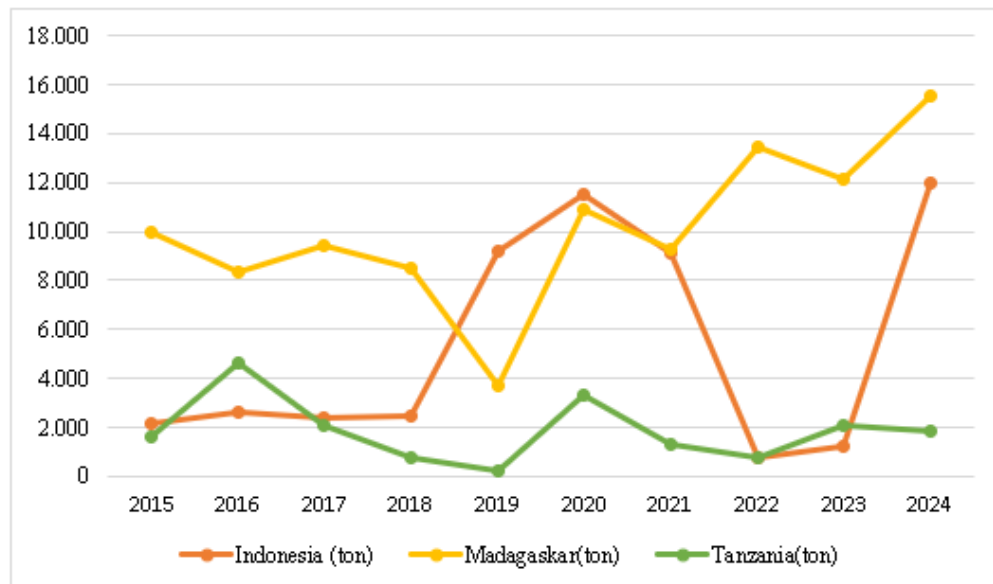


Figure 3. Volume of Clove Imports to India from Exporting Countries 2015-2024

Source: ITC Trade Map (Accessed June 2025)

Figure 3. shows the dynamics of India's clove imports from Indonesia and competitors such as Madagascar and Tanzania. From 2015 to 2024, Indonesia's clove exports to India grew from 2,121 tons to 11,981 tons, while Madagascar saw a sharper

increase from 9,996 tons to 15,662 tons, and Tanzania remained low at 1,828 tons. The fluctuation, especially after 2020, reflects India's strong reliance on imported cloves, with the Indian market offering significant opportunities for Indonesian exporters.

The COVID-19 pandemic disrupted Indonesian clove exports in 2019 due to supply chain disruptions and trade restrictions, though agricultural exports increased by 14.02% in 2020 (Wahdiana et al., 2023). Despite the pandemic, Indonesian clove exports remained resilient, with pandemic-related factors positively influencing export values. Key factors like Indonesia's GDP, the GDP of destination countries, population, and production capacity played a significant role in boosting exports, while initial disruptions were mitigated by stable demand from partner countries. However, challenges such as international price fluctuations, exchange rate volatility, and non-tariff policies worsened export vulnerability to India, revealing a gap between the potential of cloves as a key commodity and its actual global market performance.

This study offers a novel perspective by holistically integrating international prices, exchange rates, non-tariff policies, and India's import volume to analyze Indonesia's clove exports, an approach not previously addressed simultaneously in other studies. By focusing on the bilateral relationship between Indonesia and India from 2015 to 2024, including the impact of the pandemic, this research provides fresh insights into export challenges. The use of ARDL models allows for both short- and long-term analysis, enriching our understanding of variable interactions, and contributes to the development of strategies for bilateral trade and international trade literature.

2. RESEARCH METHOD

This study employs a quantitative approach, designed to measure the impact or relationship between variables. Rooted in positivist philosophy, this method is ideal for analyzing phenomena within specific populations or samples. Data is collected using standard research instruments, generating numerical or statistical information (Sugiyono, 2019). The aim is to test the hypotheses formulated beforehand. The data sources for this research are from several credible official institutions: the Central Statistics Agency (BPS) of Indonesia, the Ministry of Trade of Indonesia, Bank Indonesia (BI), and international trade databases such as United Nations Comtrade and the Food and Agriculture Organization (FAO) of the United Nations. The study specifically analyzes the impact of international clove prices, the exchange rate of the rupiah to the Indian rupee, non-subsidy policies in the clove sector, and clove import volumes by India on the export value of Indonesian cloves to India. Data processing utilizes statistical techniques implemented through Eviews 12 software.

This research focuses on Indonesia's clove exports to India, the largest market for Indonesian cloves, while also considering exports to China and the United Arab Emirates, the second and third largest destinations. The study uses data from 2015 to 2024 to capture long-term fluctuations in macroeconomic variables, trade policies, and trends in prices and volumes, providing a comprehensive analysis of the global factors influencing Indonesia's clove exports.

The population for this study includes all time-series data on the total value of Indonesian clove exports to major destinations, specifically India, China, the United Arab

Emirates, Saudi Arabia, and Bangladesh, from 2015 to 2024. This data represents the total export value of cloves over the specified period, totaling USD 1,084,312. The sample is drawn from this population using purposive sampling, focusing on data from India as the primary destination for Indonesian cloves. The study uses quarterly data from 2015 to 2024, amounting to 40 observations, ensuring a comprehensive analysis of clove export dynamics. This selection is based on the economic significance of India in the export market, the accessibility of reliable data, and the specific research objectives related to export determinants.

This study uses a quantitative analysis approach with the Autoregressive Distributed Lag (ARDL) model for time series econometric analysis, as developed by Pesaran et al. (2001). The ARDL model is designed to analyze both short- and long-term dynamic relationships between economic variables. It includes lagged values of the dependent variable along with the current and lagged values of independent variables to explain the dependent variable's behavior. The choice of ARDL is based on its methodological advantages: it can handle variables with different integration orders (I(0) or I(1)), estimates both short- and long-term relationships, and provides flexibility in selecting lags for each variable. Additionally, ARDL's bounds testing for cointegration doesn't require uniform integration orders, unlike other methods.

However, the use of time series data, which often involves nominal values, may lead to heteroscedasticity, i.e., non-constant variance across periods. To mitigate this, natural logarithm transformations are applied to all variables (except dummy indicators). This process stabilizes variance, reduces the impact of outliers, and linearizes the model's functional form. The empirical model is estimated using log-transformed specifications, which makes the coefficients interpretable as elasticities, quantifying the percentage response of the dependent variable to a 1% change in explanatory variables. Additionally, stationarity tests, lag length determination, and cointegration tests are applied to ensure the model's validity.

Cointegration testing is essential for verifying long-term equilibrium relationships among variables. In this study, the Bounds Testing approach is used, where the F-statistic is compared against upper and lower critical values to determine the presence of cointegration. If the F-statistic exceeds the upper bound, cointegration is confirmed, and long-term relationships are estimated. Following this, the Error Correction Model (ECM) is derived from the ARDL model to analyze short-term dynamics and the speed at which variables return to equilibrium after a shock. The ECM includes both differentiated variables for short-term effects and an error correction term (ECT) that represents the residual from the long-term cointegration relationship. A negative and significant ECT coefficient indicates the speed of adjustment towards long-term equilibrium, reflecting how deviations from equilibrium are corrected over time.

3. RESULTS AND DISCUSSION

The application of the ARDL data testing model in this study relies on the completion of several prerequisite tests. These tests are detailed as follows:

Stationarity Test (Unit Root Test)

Before estimating the ARDL model, the first step is to test the data for stationarity. The stationarity test aims to determine whether a variable has a unit root, allowing the order

of integration of each variable to be determined. This is important because the ARDL model can only be used if the data is a mixture of I(0) and I(1), but no variables can be integrated in I(2). Therefore, the test is performed using the Augmented Dickey-Fuller (ADF) method.

Table 1. 1Test with Augmented Dickey Fuller (ADF)

| Variables | Uni root Test | ADF Test Statistic | Critical Value 5% | ADF Prob. | Information |
|---------------------|------------------|--------------------|-------------------|-----------|----------------|
| International Price | Level | -2.418615 | -2.938987 | 0,1434 | Non-Stationary |
| | First Difference | -5.584104 | -2.941145 | 0,000 | Stationary |
| Mark Swap | Level | -1.128178 | -2.938987 | 0.6949 | Non-Stationary |
| | First Difference | -5.590649 | -2.941145 | 0,000 | Stationary |
| Policy Non-Tariff | Level | -1.414704 | -2.938987 | 0.5653 | Non-Stationary |
| | First Difference | -6,000,000 | -2.941145 | 0,000 | Stationary |
| Volume Import | Level | -1.682345 | -2.943427 | 0.4316 | Stationary |
| | First Difference | -8.673734 | -2.943427 | 0,000 | Stationary |
| Mark Export | Level | -4.843542 | -2.938987 | 0.0003 | Stationary |
| | First Difference | - | - | - | - |

Source: processed data, 2025

Based on the results of the stationarity test using the Augmented Dickey-Fuller (ADF) method in Table 1., it can be seen that most of the variables in this study are not stationary at the level level, but become stationary after *the first difference is performed*. The variables of international prices, exchange rates, non-tariff policies, and import volume at the level level have a probability value greater than 0.05 so they are not stationary, but after *the first difference is performed* all become stationary with a probability value below 0.05. Meanwhile, the export value variable as the dependent variable has been stationary since the level level with a probability value of $0.0003 < 0.05$. These results indicate that the research data has a combination of variables that are stationary at the level (I(0)) and at *the first difference* (I(1)), so they meet the requirements for use in the Autoregressive Distributed Lag (ARDL) model analysis which allows testing short-term and long-term relationships between variables with different degrees of integration.

Determining Optimum Lag

Once the level of variable integration is known, the next step is to determine the optimal lag length. Selecting the optimal lag length is crucial to ensure the ARDL model accurately captures both short-term and long-term dynamics. Lag determination is performed using information criteria such as *the Akaike Information Criterion (AIC)*. The model with the smallest information criterion value is selected as the optimal lag.

Table 2. Results of the Optimum Lag Determination Test

| Model | LogL | AIC* | BIC | HQ | Adj. R-sq | Specification |
|-------|------------|----------|----------|----------|-----------|---------------------|
| 294 | -54.327535 | 3.747434 | 4.400509 | 3.977674 | 0.618052 | ARDL(2, 3, 1, 2, 2) |
| 278 | -53.698256 | 3.767473 | 4.464086 | 4.013062 | 0.613245 | ARDL(2, 3, 2, 2, 2) |
| 292 | -55.914282 | 3.779150 | 4.388687 | 3.994041 | 0.601940 | ARDL(2, 3, 1, 3, 0) |
| 296 | -56.985305 | 3.782989 | 4.348988 | 3.982530 | 0.595789 | ARDL(2, 3, 1, 2, 0) |
| 280 | -56.030745 | 3.785446 | 4.394982 | 4.000336 | 0.599426 | ARDL(2, 3, 2, 2, 0) |
| 38 | -54.048325 | 3.786396 | 4.483009 | 4.031985 | 0.605857 | ARDL(3, 3, 1, 2, 2) |

Source: processed data, 2025

Referring to Table 4.3, the ARDL(2,3,1,2,2) model was determined as the most appropriate specification for this study. This conclusion was reached after comparing six alternative models, where the selected model showed the most optimal statistics: a minimum *Akaike Information Criterion* (AIC) value of 3.747434, a maximum *log-likelihood* of -54.327535 and an *Adjusted R-squared* of 0.618052 . The selection based on the lowest AIC ensures model efficiency by balancing its suitability and complexity. Thus, this optimal ARDL(2,3,1,2,2) framework will be applied for subsequent short-term and long-term dynamic analyses.

Cointegration Test

The next step is to conduct a cointegration test using the Bounds Test method. This test aims to determine whether there is a long-term relationship between the dependent and independent variables. In the Bounds Test, the F-statistic value is compared with the critical values at the lower (I(0)) and upper (I(1)) limits. If the F-statistic is greater than the upper limit, cointegration can be concluded. Conversely, if it is less than the lower limit, cointegration does not exist. The results of the bound test cointegration test on the ARDL (3,4,4,3,2) model are as follows:

Table 3. Cointegration Test Results (Bounds Test)

F -Bound Test Null Hypothesis: No levels relationship

| Test Statistics | Value | Significant. | I(0) | I(1) |
|--------------------|-----------|--------------|---------------------|-------|
| <i>F-statistic</i> | 14.186374 | 10% | Finite Sample: n-35 | |
| | | | 2.46 | 3.46 |
| | | | 2,947 | 4,088 |
| | | | 4,093 | 5,532 |

Source: processed data, 2025

Based on the results of the Bound Test cointegration test in Table 4.4, d, the F-statistic value The obtained value is 14.18637, with the number of independent variables (k) as many as 4. This value is then compared with the critical value at the significance level of 10%, 5%, and 1%. Based on the test results, the F-statistic value (14.18637) is greater than the upper limit value (I(1)) at all significance levels, namely 3.46 (10%), 4.088 (5%), and 5.532 (1%). Thus, it can be concluded that there is a long-term relationship (cointegration) between the dependent variable and all independent variables in the ARDL model. These results indicate that short-term changes in independent variables, such as international prices, exchange rates, non-tariff policies, and import volume, in the long term will affect the export value variable, so that the ARDL model used is worthy of further analysis into estimating long-term and short-term relationships.

ARDL Model Estimation

Once cointegration is detected, the next step is to estimate the long-run ARDL model. This estimation is used to determine the extent of the influence of the independent variables on the dependent variable in the long run. The coefficients obtained from the long-run estimation *will* explain the direction and magnitude of the relationship between the variables when the system has reached equilibrium.

Table 4. Long-Term ARDL Estimation Results

| Levels Equation Case 2: Restricted Constant and No Trend | | | | |
|---|-------------|------------|-------------|--------|
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| LOGHI | -6.861295 | 1.440815 | -4.762094 | 0.0001 |
| LOGKURS | 39.78161 | 6.450489 | 6.167224 | 0.0000 |
| NTM | -5.328932 | 0.964754 | -5.523619 | 0.0000 |
| LOGVIMPOR | 0.034314 | 0.118658 | 0.289184 | 0.7751 |
| C | -193.0519 | 32.67497 | -5.908249 | 0.0000 |

EC = LOGNEKSPOR - (-6.8613*LOGHI + 39.7816*LOGKURS - 5.3289*NTM + 0.0343*LOGVIMPOR - 193.0519)

Source: processed data, 2025

Based on the results of the long-term ARDL model estimation in the table above, the long-term equation can be formulated as follows:

$$\Delta \log \text{NEKSPOR} = -193.0519 - 6.8613 \Delta \log \text{HI}_t + 39.7816 \Delta \log \text{KURS}_t - 5.3289 \Delta \text{NTM}_t + 0.0343 \Delta \log \text{VIMPOR}_t$$

The constant value of -193.0519 indicates that if the export price (LOGHI), exchange rate (LOGKURS), non-tariff trade barriers (NTM), and import volume (LOGVIMPOR) variables do not change in the long run, then the logarithm value of non-oil and gas exports will be at a constant level of -193.0519. This constant coefficient is proven to be statistically significant, as indicated by the probability value of 0.0000 which is far below the significance limit of 0.01, thus confirming its relevance in forming a long-term equilibrium relationship in the model.

The international price of cloves has a negative and significant effect on Indonesia's export value in the long term. This is evident from the coefficient value of -6.8613 with a probability value of 0.0000 < 0.01. This means that if the international

price of cloves increases by 1% in the long term, Indonesia's export value will decrease by 6.8613 percent.

The rupee exchange rate has a positive and significant effect on Indonesia's export value in the long term. This is evident from the coefficient value of 39.7816, with a probability value of $0.0000 < 0.01$. This means that if the rupee exchange rate increases by 1% in the long term, Indonesia's export value will increase by 39.7816 percent.

The non-tariff policy variable has a negative and significant effect on the value of clove exports in Indonesia in the long term. This can be seen from the coefficient value of -5.3289 with a probability value of $0.0000 < 0.01$. This means that if non-tariff policies are implemented in the long term, the value of clove exports in Indonesia will decrease by 5.3289 percent.

India's import volume variable has a positive but insignificant effect on Indonesia's export value in the long run. This is evident from the coefficient value of 0.0343, with a probability value of $0.7751 < 0.01$. This means that if India's import volume increases by 1% in the long run, Indonesia's export value will increase by 0.0343 percent.

ECM Model Estimation

In addition to long-term analysis, the ARDL model can also be used to estimate short-term relationships through the Error Correction Model (ECM). An important component of the ECM is the Error Correction Term (ECT).

Table 5. Short-Term ECM Estimation Results

| ECM Regression | | | | |
|--|-------------|------------|-------------|--------|
| Case 2: Restricted Constant and No Trend | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| D(LOGNEKSPOR(-1)) | 0.577910 | 0.109183 | 5.293029 | 0.0000 |
| D(LOGHI) | -0.707347 | 1.122617 | -0.630088 | 0.5351 |
| D(LOGHI(-1)) | 8.609219 | 1.422997 | 6.050060 | 0.0000 |
| D(LOGHI(-2)) | 4.770963 | 1.114092 | 4.282379 | 0.0003 |
| D(LOGKURS) | 16.01342 | 14.14652 | 1.131969 | 0.2698 |
| D(NTM) | -3.327418 | 1.037857 | -3.206046 | 0.0041 |
| D(NTM(-1)) | 6.280207 | 1.178052 | 5.331009 | 0.0000 |
| D(LOGVIMPOR) | 0.131039 | 0.108339 | 1.209531 | 0.2393 |
| D(LOGVIMPOR(-1)) | 0.217718 | 0.089693 | 2.427372 | 0.0238 |
| CointEq(-1)* | -1.578907 | 0.154481 | -10.22073 | 0.0000 |

Source: processed data, 2025

Based on the results of the short-term ECM model estimation in table 4.6 above, the long-term equation can be formulated as follows :

$$\begin{aligned}
 D(\text{LOGNEKSPOR}_t) = & 0.577910D(\text{LOGNEKSPOR}_{t-1}) - \\
 & 0.707347 D(\text{LOGHI}_t) \\
 & + 8.609219D(\text{LOGHI}_{t-1}) + 4.770963 D(\text{LOGHI}_{t-2}) \\
 & + 16.01342 D(\text{LOGKURS}_t) - 3.327418 D(\text{NTM}_t) \\
 & + 6.280207 D(\text{NTM}_{t-1}) \\
 & + 0.131039 D(\text{LOGVIMPOR}_t) \\
 & + 0.217718 D(\text{LOGVIMPOR}_{t-1}) \\
 & - 1.578907 \text{CointEq}_{(t-1)} + \varepsilon_t
 \end{aligned}$$

The ECM results show a CointEq(-1) value of -1.578907 (p-value = 0.0000), indicating long-term cointegration between Indonesian exports to India and its explanatory variables. The negative coefficient suggests that 157.89% of the imbalance from the previous period will be corrected towards long-term equilibrium.

In the short term, the international price variable (D(LOGHI)) has a negative but insignificant effect (coefficient = -0.707347 , p-value = 0.5351). However, the first and second lags show a positive and significant impact on exports, with coefficients of 8.609219 and 4.770963, and p-values < 0.005 , indicating that higher international prices in previous periods led to increased exports.

The rupee exchange rate variable (D(LOGKURS)) has a positive but insignificant effect on exports in the short term (coefficient = 16.01342, p-value = 0.2698). While the appreciation of the rupiah reduces price competitiveness, the effect is not significant.

The non-tariff policy variable (D(NTM)) has a negative and significant effect on exports (coefficient = -3.327418 , p-value = 0.0096), but the next period shows a positive and significant effect (coefficient = 6.280207, p-value = 0.0001), as exporters adapt to regulations.

The import volume variable (D(LOGVIMPOR)) has a positive but insignificant effect on exports in both the short term and the first lag (coefficients = 0.131039 and 0.217718, p-values > 0.005).

Model Diagnostic Test

After estimating the ARDL model, diagnostic tests are performed to ensure the model meets classical assumptions and is reliable. These tests help confirm that the estimation results are unbiased and valid for drawing conclusions. Based on (Pesaran et al., 2001), the main diagnostic tests include autocorrelation, heteroscedasticity, and normality.

1. Autocorrelation Test

The autocorrelation test checks if there is a relationship between the residuals in the current and previous periods. Autocorrelation can lead to biased and inefficient results. Using the Serial Correlation LM Test, if the test probability is greater than 0.05, it indicates no autocorrelation, meaning the model is reliable and the estimation results are valid.

Table 6. Results of the *Serial Correlation Autocorrelation Test (LM Test)*

| <i>Breusch–Godfrey Serial Correlation LM Test</i> | |
|---|----------------------------|
| F-Statistic 2.983335 | Prob. F(2,20) 0.0735 |
| Obs*R-Squared 8.501930 | Chi-Square Prob.(2) 0.0143 |

Source: processed data, 2025

The *Breusch–Godfrey Serial Correlation LM Test* results in Table 4.7, the F-statistic value is 2.983335 with a probability of 0.0735, which is greater than 0.05. This indicates that the model does not experience significant autocorrelation. Although the Obs*R-squared value indicates a weak indication of autocorrelation, because the F-statistic value is not significant and the model is declared stable based on the CUSUM test, this model can still be used. Thus, the estimated ARDL model has met the assumption of being free from autocorrelation according to the approach.(Pesaran et al., 2001).

2. Heteroscedasticity Test

The heteroscedasticity test is performed to determine whether the variance of the residuals in a regression model is constant (*homoscedastic*) or fluctuating (*heteroscedastic*). This test is important because heteroscedasticity can cause coefficient estimates to be inefficient, although still unbiased. In ARDL models, this test is generally performed using the *Breusch–Pagan–Godfrey method* to ensure that the error distribution is constant across all observations .

Table 7. Heteroscedasticity Test Results
Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

| | | | |
|---------------------|----------|----------------------|--------|
| F-statistic | 0.935742 | Prob. F(14,22) | 0.5394 |
| Obs*R-squared | 13.80938 | Prob. Chi-Square(14) | 0.4640 |
| Scaled explained SS | 4.353234 | Prob. Chi-Square(14) | 0.9929 |

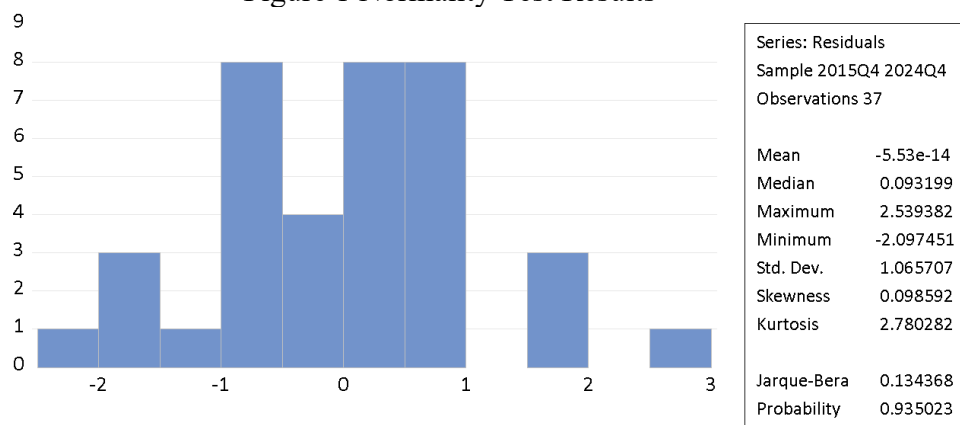
Source: processed data, 2025

Based on table 7, the results of the heteroscedasticity test using the *Breusch–Pagan–Godfrey method* show an F -statistic value of 0.935742 with a probability of 0.5394 , and an Obs*R -squared value of 13.80938 with a probability of 0.4640 . Since all probability values are greater than the 5% significance level, it can be concluded that there is no heteroscedasticity in the model . Thus, the residual variance is constant (*homoscedastic*), so the estimated ARDL model has met the classical assumptions and the estimation results can be considered efficient.

3. Normality Test

A normality test was conducted to ensure that the model residuals were normally distributed, thus ensuring reliable estimation results. This test used the *Jarque–Bera Test* , where the model is deemed to meet the normality assumption if the probability value is greater than 0.05. Thus, the ARDL model can be considered statistically valid.

Figure 1 Normality Test Results



Source: processed data, 2025

Based on Figure 4.5, it can be seen that the Jarque-Bera value is 0.134368 , which is smaller than the Chi-Square value with *df* (3) at $\alpha = 5\%$, which is 7.81 . In addition, the

Jarque-Bera probability value is $0.935023 > 0.05$, so it can be concluded that this research model has been normally distributed, and fulfill the classical assumptions of normality.

Model Stability Test

The model stability test was conducted to ensure that the coefficients in the ARDL model were constant throughout the study period. This test used CUSUM and CUSUM of Squares, where CUSUM assesses short-term parameter stability and CUSUM of Squares assesses long-term stability. The model is declared stable if the test line is within the critical limits at the 5% significance level, so that the estimated parameters can be considered consistent and valid. The results of the CUSUM and CUSUM Q tests are as follows:

Figure 2 CUSUM Test Results

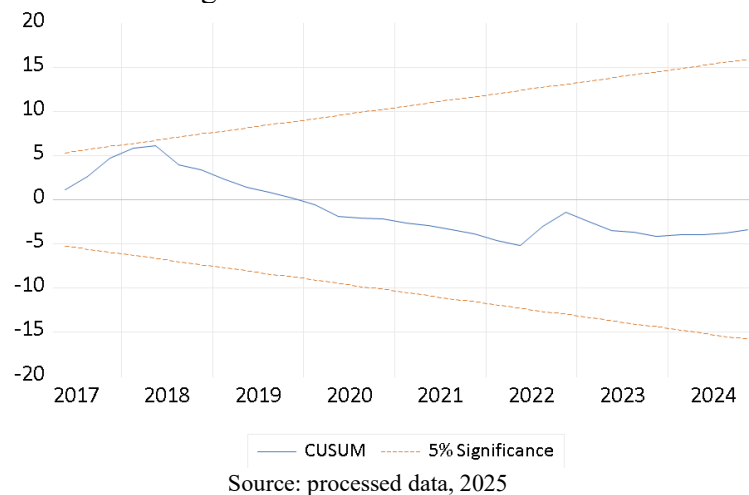
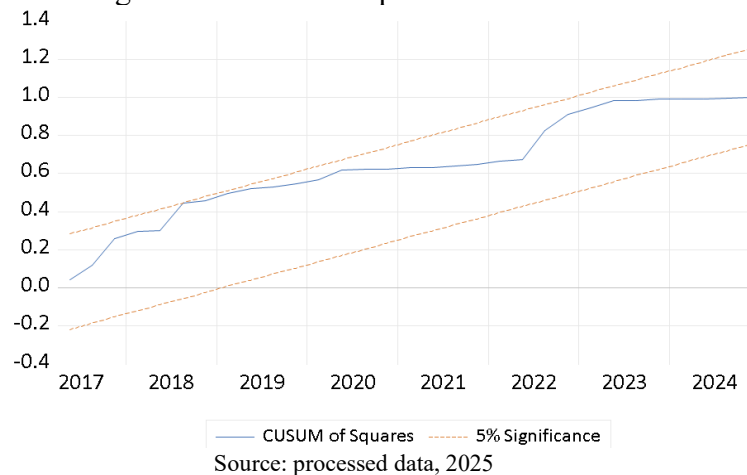


Figure 3 CUSUM of Squares Test Results



Based on Figures 5 and 6 the results of the stability test of the ARDL (2, 3, 1, 2, 2) model through the CUSUM test and CUSUM of Squares show that the lines on both graphs are within the 5% significance limit (neither crossing the upper nor lower yellow limits).

Thus, it can be concluded that the model used is stable and its estimated parameters are consistent throughout the study period

Discussion

The Impact of International Clove Prices on Indonesia's Clove Export Value

The ARDL model estimation indicates that international clove prices have a negative and significant impact on Indonesia's clove exports to India in the long term, with a coefficient of -6.8613 and a significance level of 0.01 (< 0.05). This suggests that a 1% increase in international clove prices will reduce export value by 6.8613%, as higher global prices reduce India's demand for clove imports. However, in the short term, the effect is negative but insignificant, with a coefficient of -0.707347 and a significance level of 0.5351. In the first and second years, there is a positive and significant effect with coefficients of 8.609219 (lag 1) and 4.770963 (lag 2) at significance levels of 0.0000 and 0.0003 (< 0.05). These results suggest that in the short term, an increase in international prices encourages clove exports as exporters attempt to capitalize on price hikes to increase sales.

Thus, the study shows that the impact of international prices on Indonesia's clove exports to India is not constant but changes between the short and long term. In the short term, rising prices boost export value as exporters respond quickly to global price increases, seeking to maximize profits. However, in the long term, the relationship turns negative, as continuous price hikes reduce India's import demand. This can be explained by the fact that industries using cloves face higher production costs, making demand more sensitive to price changes. Additionally, excessively high prices can erode Indonesia's price competitiveness against other suppliers, leading importers to reduce purchases or seek alternative sources. The differing effects in the short and long term highlight the market adjustment process, where short-term responses are driven by profit incentives, while long-term decisions are influenced by cost efficiency, demand elasticity, and price competitiveness in global markets.

This finding aligns with Nuryanto et al. (2023), who showed that international prices have a negative and significant effect on the export volume of Indonesian palm oil to India. They found that a 1% increase in international prices reduces exports by about 2.4–2.6%, as higher prices reduce demand and competitiveness in the global market. However, this finding contrasts with Mane (2015), whose research showed a positive and significant effect of international prices on clove exports in the short term, suggesting that price increases boost exports as producers take advantage of higher prices. Similarly, the study by Madaniyah et al. (2022) found a positive and significant short-term effect of international clove prices on Indonesian exports. Theoretically, these results can be explained through Ricardo's Comparative Advantage Theory. According to Ricardo, a country will export goods in which it has a relative cost advantage. When international clove prices sharply increase and erode Indonesia's price competitiveness in the global market, exports decline as the comparative advantage weakens. Therefore, the stability of international prices is a strategic factor in maintaining Indonesia's clove export competitiveness to India, suggesting the need for policies that enhance production efficiency and market diversification.

The Impact of the Rupee-Rupiah Exchange Rate on Indonesia's Clove Export Value

The ARDL model estimation shows that the exchange rate of the Indian rupee to the Indonesian rupiah has a positive and significant impact on Indonesia's clove exports to India in the long term, with a coefficient of 39.7816 and a probability value of 0.0000 (< 0.01). This indicates that a 1% increase in the rupee's value relative to the rupiah leads to a 39.78% increase in the export value of Indonesian cloves to India, as a stronger rupee makes Indonesian products relatively cheaper and more competitive in the Indian market. In contrast, in the short term, the exchange rate has a positive but insignificant impact, with a coefficient of 16.01342 and a probability value of 0.2698 (> 0.05), suggesting that short-term fluctuations in the exchange rate do not significantly influence exports. While appreciation of the rupee may potentially boost exports, the effect is not strong enough to impact trade decisions directly.

The findings indicate that the effect of exchange rates on Indonesia's clove exports is not immediate but occurs through an adjustment process. In the short term, exchange rate changes have no significant impact because international trade mechanisms take time to adjust prices and transaction volumes. However, in the long term, as exchange rate movements stabilize and become more sustained, the impact on export value becomes more noticeable. These results are consistent with Ricardo's theory of comparative advantage, which posits that a country will export goods that have a lower relative price in the international market. The appreciation of the rupee makes Indonesian cloves cheaper, thus enhancing competitiveness and driving export growth in the long run. This also aligns with international trade theory, which explains that exchange rate changes affect the relative price position between countries and export-import flows. Therefore, the study emphasizes that a stable and favorable exchange rate can enhance Indonesia's export competitiveness, in line with the principle of comparative advantage in international trade relations.

The Impact of Non-Tariff Policies on Indonesia's Clove Export Value

The ARDL model estimation reveals that non-tariff policies (D(NTM)) have a negative and significant impact on Indonesia's clove exports to India in the short term, with a coefficient of -3.327418 and a probability value of 0.0041 (< 0.05). This suggests that, in the short term, stricter import regulations and compliance costs hinder export activities. However, in the first lag (D(NTM(-1))), the impact becomes positive and significant, with a coefficient of 6.280207 and a probability value of 0.0000 (< 0.01), indicating that exporters eventually adapt to these regulations, leading to an increase in exports. In the long term, non-tariff policies continue to have a negative and significant effect, with a coefficient of -5.3289 and a probability value of 0.0000 (< 0.01), implying that sustained non-tariff measures lead to a long-term decline in export performance due to stricter quality standards and technical regulations.

These findings align with the research of Ardiyanti & Sinta (2018) and Handoyo & Permata (2019), which showed that non-tariff policies, such as SPS and TBT, negatively affect Indonesia's exports by increasing compliance costs. However, this study contrasts with the work of Maharani Tristi et al. (2021), which found that non-tariff policies initially had a positive impact on exports as exporters adapted to the new regulations. In the long run, though, the increased costs of compliance and regulatory complexity became a barrier. This

is in line with Ricardo's theory of comparative advantage, which suggests that while countries may initially benefit from adapting to regulatory changes, the long-term impact of non-tariff measures reduces competitiveness as compliance costs increase.

The Impact of India's Clove Import Volume on Indonesia's Clove Export Value

The ARDL model estimation shows that India's import volume has a positive but statistically insignificant effect on Indonesia's clove export value in the short term, with a coefficient of 0.131039 and a probability value of 0.2923 (> 0.05). This indicates that in the short term, an increase in India's import volume does not have a significant impact on Indonesia's exports. However, in the first lag ($D(\text{LOGVIM}(-1))$), the impact remains positive and statistically significant, with a coefficient of 0.217718 and a probability value of 0.0238 (< 0.05), suggesting a continuation of trade activity and strong demand, as well as established distribution networks.

In the long term, India's import volume has a positive but insignificant effect on Indonesia's clove export value, with a coefficient of 0.0343 and a probability value of 0.7751 (> 0.05). This means that a 1% increase in India's import volume would only result in a 0.03% increase in Indonesia's clove exports, indicating that the impact is minimal. While India's import demand rises, Indonesia does not automatically become the primary supplier of this increased demand. These findings contradict previous research, which showed that import volumes positively influenced export performance due to technological improvements and better product quality. Additionally, the results align with the theory of comparative advantage, suggesting that India's increasing imports reflect high demand for goods inefficiently produced domestically, but this does not significantly boost Indonesia's exports due to limited specialization or cost competitiveness.

4. CONCLUSION

Based on the analysis of the impact of international prices, the exchange rate of the rupiah to the Indian rupee, non-tariff policies, and India's import volume on the value of Indonesian clove exports to India from 2015 to 2024, the following conclusions can be drawn:

- a) International clove prices have a significant negative impact on Indonesia's clove exports to India in the long term, but no significant effect in the short term. This indicates that higher prices lead importers to reduce demand or shift to other suppliers with more competitive prices, while short-term impacts are less evident due to trade contracts, market adjustments, and administrative factors.
- b) The exchange rate of the Indian Rupee to the Indonesian Rupiah has a significant positive impact on export value in the long term, but only a small positive and insignificant impact in the short term. In the long run, a stronger Rupee or a weaker Rupiah increases India's purchasing power, boosting clove exports, but short-term effects are minimal due to trade contract adjustments and market rigidity.
- c) Non-tariff policies (quality standards and import regulations in India) have a significant negative impact on clove exports in the long term, and an insignificant negative impact in the short term. In the long term, stricter quality standards and regulations can hinder exports through increased compliance costs, more complex administration, and market access restrictions. Short-term effects are less significant as exporters adjust to the regulations or continue with existing trade contracts.

- d) India's clove import volume has a positive but statistically insignificant impact on Indonesia's clove export value in both the long and short term. This indicates that while higher import volumes from India are generally followed by increased exports from Indonesia, the effect is not strong enough to significantly explain export changes. This suggests that India's rising import demand does not automatically lead to higher exports from Indonesia due to competition, product quality differences, and price competitiveness.

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