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GLOBAL ENERGY SHOCKS, EXCHANGE RATE PASS-THROUGH, AND ADMINISTERED INFLATION DYNAMICS IN INDONESIA: A VECM APPROACH

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Abstract

This study investigates the dynamic interactions between global energy prices, exchange rate fluctuations, and administered inflation in Indonesia during the 2015–2025 period using the Vector Error Correction Model (VECM). Indonesia is selected as the research location because it is one of the largest emerging economies in Southeast Asia with substantial dependence on imported energy and a government-administered pricing and energy subsidy system. These conditions create a distinct inflation transmission mechanism compared to fully market-based economies. This study addresses the research gap in administered inflation literature, where previous studies predominantly focus on headline inflation and rarely examine the simultaneous effects of multiple global energy shocks within a subsidy-mediated pricing framework. Monthly time-series data include administered inflation, WTI/Brent crude oil prices, crude palm oil (CPO) prices, Dorian LPG Ltd stock prices as a proxy for global LPG market dynamics, and the Rupiah–USD exchange rate.

The results reveal a significant long-run equilibrium relationship among administered inflation, global energy prices, and exchange rate dynamics. Short-run analysis indicates that oil prices exhibit a negative coefficient, reflecting the moderating role of energy subsidies and administered pricing policies, while exchange rate depreciation and CPO prices positively influence inflation. The significant error correction term confirms a relatively rapid adjustment toward equilibrium. IRF and FEVD analyses show that exchange rate and global oil shocks are the dominant sources of inflation volatility, although their impacts are moderated by domestic policy interventions. The novelty of this study lies in the integration of oil, CPO, LPG, and exchange rate variables within a unified VECM framework, as well as the introduction of a financial logistics indicator to represent global LPG market dynamics. This study contributes to the imported inflation literature by emphasizing the importance of subsidy-mediated pricing systems in shaping inflation dynamics in emerging economies.

Keywords: Administered Inflation, Global Energy Prices, Exchange Rate, VECM, Indonesia
JEL Classification: C32; E31; F31; Q41; Q43

INTRODUCTION

Global economic uncertainty post-COVID-19 pandemic, international geopolitical conflicts, and disruptions to world energy supply chains have increased inflationary pressures in various developing countries, including Indonesia. One of the inflation components most vulnerable to external shocks is administered inflation, namely inflation originating from goods and services whose prices or tariffs are regulated or directly influenced by government policy, such as fuel oil (BBM), LPG, electricity tariffs, and transportation. In the context of an open economy, fluctuations in global energy prices and exchange rate instability become the main transmission channels affecting

the formation of domestic administered prices. The sharp rise in world oil prices during the Russia–Ukraine conflict, accompanied by exchange rate depreciation pressure and volatility in global strategic commodity prices, has created significant inflationary risks for energy-importing developing countries. Therefore, understanding the transmission mechanism of global energy shocks to administered inflation is increasingly important in supporting macroeconomic stabilization and energy subsidy policies in Indonesia.

Table 1 shows that Indonesia's administered inflation during the period 2015–2025 experienced quite high fluctuations with an average value of 0.241667 percent, a maximum value of 6.53 percent, a minimum value of -7.38 percent, and a standard deviation of 1.301935. Furthermore, the Jarque–Bera probability of 0.000000 indicates that the distribution of administered inflation data has high volatility characteristics and is not normally distributed. These findings indicate that administered inflation in Indonesia is very sensitive to external shocks, particularly global energy price volatility and exchange rate changes.

Figure 1 shows a very dynamic volatility pattern of administered inflation throughout the observation period, especially during the COVID-19 pandemic and the global economic recovery period when world energy and commodity markets experienced significant instability. This volatility pattern indicates that administered inflation in Indonesia is not only influenced by demand-based domestic factors but is also closely related to the imported inflation mechanism originating from changes in global commodity prices and exchange rate dynamics.

Indonesia provides an important empirical setting for examining the transmission of global energy shocks to administered inflation for several reasons. First, Indonesia is one of the largest emerging economies in Southeast Asia with substantial dependence on imported energy commodities, particularly crude oil and LPG, despite being a commodity-producing country. Second, Indonesia implements a significant administered pricing and energy subsidy regime in which fuel prices, LPG prices, electricity tariffs, and transportation tariffs are partially regulated by the government. This condition creates a unique inflation transmission mechanism where global energy price shocks are not fully transmitted into domestic prices through market mechanisms alone, but are mediated by fiscal intervention and subsidy policies. Third, the Indonesian economy is highly vulnerable to exchange rate depreciation and imported inflation due to its open economic structure and dependence on global commodity markets. Consequently, Indonesia represents a particularly relevant case for investigating how global energy price volatility, exchange rate pass-through, and government-administered pricing policies interact in shaping inflation dynamics in emerging economies.

Various previous empirical studies have examined the relationship between oil prices, exchange rates, inflation, and macroeconomic stability. Research by Pan Z. et al. (2024), Mukhtarov S. et al. (2020), and Isah K.O. et al. (2022) shows that oil price shocks and exchange rate dynamics have a significant effect on inflation and economic stability through dynamic transmission mechanisms. Furthermore, Vector Error Correction Model (VECM)-based research such as that by Saji T.G. (2021), Elneel F.A. and AlMulhim (2022), and **Sharma and Shrivastava (2021)** provide evidence of significant short-run and long-run relationships among oil prices, exchange rates, and inflation using a cointegration and VECM framework. However, previous studies still have several limitations. First, most research still focuses on general inflation (headline inflation) and has not yet specifically analyzed administered inflation. Second, previous research generally only focused on oil price shocks without integrating other global energy channels such as LPG and crude palm oil (CPO). Third, empirical evidence in the context of Indonesia is still relatively limited, particularly regarding the dynamic relationship between global energy prices, exchange rate volatility, and administered inflation.

Although numerous studies have investigated the relationship between global oil prices, exchange rates, and inflation dynamics, the empirical findings remain inconclusive and fragmented, particularly in emerging economies. Several studies report that oil price increases significantly accelerate domestic inflation through imported inflation and production cost channels, while other studies find asymmetric, weak, or even insignificant effects due to government intervention, subsidy regimes, and domestic price controls. An unresolved issue in the literature concerns how government-administered pricing systems alter the transmission mechanism of global energy shocks into domestic inflation. Most previous studies predominantly focus on headline inflation and market-based inflation indicators, while limited attention has been given to administered inflation, particularly in countries implementing extensive energy subsidy policies such as Indonesia. Based on these conditions, this research attempts to fill the research gap by analyzing the dynamic relationship between global energy prices, exchange rates, and administered inflation in Indonesia using a multivariate Vector Error Correction Model (VECM) approach. Unlike previous studies, this research integrates four main external transmission channels: world crude oil prices (WTI/Brent), world crude palm oil (CPO) prices, international LPG prices, and the Rupiah exchange rate against the United States Dollar.

The novelty of this research lies in the use of administered inflation as the main dependent variable combined with the integration of various global energy shocks within a single dynamic econometric framework. Furthermore, this research extends the literature on imported inflation transmission mechanisms in developing countries by emphasizing the interaction between global energy markets and government-regulated price components. The inclusion of the LPG variable is particularly relevant in the Indonesian context because LPG constitutes one of the most important subsidized household energy commodities in Indonesia. Domestic LPG prices are strongly influenced by global supply chain conditions, international freight costs, and exchange rate fluctuations. Since consistent international LPG spot price data with monthly frequency are relatively limited, this study employs the stock price of Dorian LPG Ltd as a forward-looking proxy for global LPG market dynamics. The proxy reflects the sensitivity of international LPG transportation and distribution costs, which are highly relevant for Indonesia as an archipelagic country with substantial dependence on imported LPG supply chains.

Based on the theoretical framework and empirical background, this research formulates several research questions (RQ), namely: (RQ1) do global energy prices have a significant effect on administered inflation in Indonesia in the short and long run? (RQ2) how does exchange rate volatility affect administered inflation dynamics? (RQ3) how is the dynamic adjustment mechanism and shock transmission between global energy prices, exchange rates, and administered inflation in Indonesia? and (RQ4) which external variable contributes the most dominantly to administered inflation volatility in Indonesia?

The main objective of this research is to analyze the short-run and long-run dynamic relationships between global energy prices, exchange rate dynamics, and administered inflation in Indonesia during the period 2015–2025. Specifically, this analysis aims to test cointegration relationships, estimate short-run adjustment mechanisms, analyze causality relationships, evaluate impulse response dynamics, and measure the variance decomposition contribution between research variables.

Methodologically, this research uses the Vector Error Correction Model (VECM) approach because the research variables have non-stationary characteristics and are indicated to have a long-run cointegration relationship. Empirical analysis is conducted through Augmented Dickey–Fuller (ADF) tests, Phillips–Perron (PP) tests, optimal lag selection, model stability tests, Johansen cointegration tests, VECM estimation, Granger causality tests, impulse response function (IRF), and forecast error variance decomposition (FEVD). The VECM approach is chosen because it is

capable of capturing short-run dynamics as well as the long-run equilibrium mechanism between macroeconomic variables in an open economic system.

Academically, the present research contributes to the development of energy economics, inflation transmission, and open economy macroeconomics literature by providing new empirical evidence on the role of global energy shocks in shaping administered inflation dynamics in developing countries. This research also enriches the imported inflation literature through the integration of several global energy commodity channels within a single dynamic analysis framework. From a policy perspective, the research results are expected to serve as a basis for consideration for monetary authorities, the government, and energy regulators in formulating inflation stabilization policies, energy subsidy reforms, exchange rate management, and administered price control amid global energy market uncertainty.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

The Relationship between World Oil Prices and Administered Inflation

In the perspective of open economy macroeconomics, world oil prices are one of the main determinants of inflation through the cost-push inflation and imported inflation mechanisms. The Oil Price Shock Theory developed by James D. Hamilton (1983) explains that an increase in world crude oil prices will increase production costs, distribution costs, and pressure on domestic energy prices. In developing countries like Indonesia, which still has dependence on imported energy and energy subsidy policies, an increase in global oil prices can drive adjustments to administered prices such as fuel, LPG, electricity, and transportation. Furthermore, Olivier Blanchard and Jordi Galí (2007) emphasize that oil price shocks have an effect on inflation and output through energy price transmission channels and inflation expectations. In the framework of open economy macroeconomics, changes in global energy prices will be transmitted into domestic price structures through international trade and national energy policies.

Empirically, the relationship between world oil prices and inflation has been proven by various international studies. Research by Pan Z. et al. (2024) shows that global commodity price volatility has a dynamic relationship with inflation post-COVID-19 pandemic. Research by Mukhtarov S. et al. (2020) found that oil prices have a significant effect on macroeconomic variables and long-term economic stability. Research by Olamide et al. (2022) found that exchange rate volatility contributes significantly to inflation dynamics in developing economies through imported inflation channels. Furthermore, Sharma and Shrivastava (2021) and Elneel and AlMulhim (2022) documented significant short-run and long-run relationships between oil price shocks, inflation, and exchange rates using cointegration and VECM frameworks. In addition, Azad and Serletis (2022) demonstrated that oil price shocks generate substantial macroeconomic volatility across major emerging economies, while Liu and Serletis (2022) highlighted the important role of commodity price volatility in transmitting external shocks to domestic macroeconomic conditions. Based on the theory and empirical study results above, the research hypothesis is formulated as follows:

H1: World oil prices have a significant effect on administered inflation in Indonesia in the short and long run, with the direction of influence possibly mediated by energy subsidy policies and domestic administered price regulations.

The Relationship between CPO Prices and Administered Inflation

In the theory of open economy macroeconomics explained by N. Gregory Mankiw (2019), changes in global commodity prices can affect domestic prices through international trade mechanisms, production costs, and energy transmission. Crude palm oil (CPO) prices have a strong link with the Indonesian energy sector through B20, B30, and B35 biodiesel policies. An increase in global CPO prices can increase alternative energy costs, transportation costs, and logistics costs which ultimately drive an increase in administered inflation. Furthermore, changes in CPO prices

also affect the cost structure of the domestic food and energy industries because Indonesia is one of the main producers of palm oil in the world.

Empirically, the relationship between commodity prices and inflation has been proven by various studies. Research by Mukhlis M. et al. (2021) shows a dynamic relationship between global commodity markets and exchange rates in the context of international economic volatility. Research by Muralmalla R. et al. (2022) found that energy commodity prices have a long-run relationship with market stability and macroeconomic variables. Research by Kashif U. et al. (2022), Pradhan R. et al. (2023), and Dong Q. et al. (2024) also emphasized that changes in global commodity prices affect inflation and economic volatility through spillover and dynamic transmission mechanisms. Additionally, research by Olagunju K.O. et al. (2021) showed that global agricultural commodity dynamics have a significant relationship with economic resilience and domestic price volatility. Based on the theory and empirical study results above, the research hypothesis is formulated as follows:

H2: World CPO prices have a positive and significant effect on administered inflation in Indonesia in the short and long run.

The Relationship between International LPG Prices and Administered Inflation

The Energy Price Transmission theory explains that changes in global energy prices will be transmitted into domestic cost structures through subsidy mechanisms, distribution costs, and household energy prices. In the context of Indonesia, LPG is one of the energy components that has a direct link to administered prices because most domestic LPG prices are still influenced by government subsidy policies. According to Olivier Blanchard and Jordi Galí (2007), global energy shocks can affect inflation through increased energy costs and changes in public price expectations. An increase in international LPG prices has the potential to increase government fiscal pressure and trigger domestic energy price adjustments.

Empirically, research by Candelo-Viáfara J.M. and Oviedo-Gómez (2023) shows that global energy commodity prices have a spillover effect on economic volatility and exchange rates. Research by Husaini D. et al. (2023) emphasized that energy consumption and global energy prices have a relationship with economic stability and inflation. Research by Adi T.W. et al. (2022) found that energy consumption, electricity prices, and inflation have a dynamic relationship with economic growth and investment. Furthermore, research by Sha Z. et al. (2021), Humbatov F. et al. (2022), and Benedicto et al. (2023) showed that global energy price volatility can affect economic stability, inflation, and exchange rates in both developing and energy-exporting countries. Based on the theory and empirical study results above, the research hypothesis is formulated as follows:

H3: International LPG prices have a positive and significant effect on administered inflation in Indonesia in the short and long run.

The Relationship between Exchange Rates and Administered Inflation

The Exchange Rate Overshooting theory developed by Rudiger Dornbusch (1976) explains that exchange rate depreciation can increase domestic prices through the imported inflation mechanism. In developing countries with dependence on energy and raw material imports like Indonesia, a weakening of the Rupiah against the United States Dollar will increase energy import costs, production costs, and distribution costs, thereby amplifying administered inflation pressure. Furthermore, in the framework of open economy macroeconomics, changes in exchange rates also affect inflation expectations, monetary stability, and government price policies.

Empirically, research by Candelo-Viáfara J.M. and Oviedo-Gómez (2023) shows a spillover effect between global energy prices and exchange rate volatility. Research by Singhal S. et al. (2022) found a long-run relationship between oil prices, exchange rates, and financial markets using a cointegration approach. Research by Mukhlis M. et al. (2021), Rana H.M.U. and O'Connor (2023), and Mucuk M. et al. (2022) also proved that exchange rate depreciation has a significant effect on

inflation and domestic economic stability. Additionally, research by Jemutai J. et al. (2024) showed that exchange rate volatility is one of the main channels of global shock transmission to inflation in developing countries. Based on the theory and empirical study results above, the research hypothesis is formulated as follows:

H4: The Rupiah exchange rate against the United States Dollar has a positive and significant effect on administered inflation in Indonesia in the short and long run.

RESEARCH METHODS

This research uses a quantitative approach with time series econometric analysis to examine the dynamic relationship between global energy prices, exchange rate dynamics, and administered inflation in Indonesia. The research analysis focuses on monthly data for the period January 2015 to December 2025 to capture short-run dynamics as well as long-run equilibrium relationships between macroeconomic variables. The research population covers all monthly macroeconomic data related to administered inflation, global energy prices, and exchange rates in Indonesia. Meanwhile, the research sample consists of monthly observations of administered inflation (INFAD), world crude oil prices (OIL), world crude palm oil prices (CPO), international LPG prices (LPG), and the Rupiah exchange rate against the United States Dollar (EXR) during the observation period. The use of monthly data is deemed appropriate because it has a higher level of variation and is capable of capturing dynamic transmission mechanisms between variables more accurately.

This research uses secondary data obtained from various official and international institutions. Administered inflation data based on administered price components in the Consumer Price Index (CPI) was obtained from Statistics Indonesia (BPS), while exchange rate data was obtained from Bank Indonesia. Furthermore, world crude oil price data (WTI/Brent) and crude palm oil (CPO) prices were obtained from World Bank Commodity Price Data, U.S. Energy Information Administration, and IMF Primary Commodity Prices. Meanwhile, for the LPG variable, the research uses the stock price of Dorian LPG Ltd as a proxy for market dynamics. The selection of Dorian LPG Ltd stock prices as a proxy in this research is based on the consideration that the company is one of the largest gas carrier operators (Very Large Gas Carriers) in the world, so its stock price movement is very sensitive to fluctuations in freight rates and global LPG supply chain conditions. In the context of Indonesia as an energy-importing archipelagic country, international logistics and distribution cost components have a significant weight in the structure of domestic energy prices. Therefore, the stock price of Dorian LPG Ltd is used as a forward-looking indicator capable of capturing supply cost pressures and LPG distribution risks which often move in line with physical LPG commodity price dynamics, especially in the short run. All variables are measured in the form of monthly data and transformed into a consistent time series format for the purposes of econometric estimation.

Methodologically, this research uses the Vector Error Correction Model (VECM) approach to analyze the short-run and long-run relationships between research variables. The VECM approach is chosen because the research variables are predicted to have non-stationary characteristics but still have a long-run cointegration relationship. According to Jeffrey M. Wooldridge (2009), time series econometric analysis involving non-stationary variables requires stationarity and cointegration testing to avoid spurious regression and ensure the validity of long-run relationship estimation. Therefore, the analysis stages begin with unit root testing using the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) methods to determine the degree of integration of each variable. Subsequently, optimal lag selection is performed using the Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan–Quinn Criterion (HQ). After that, VAR model stability testing is conducted to ensure system stability before Johansen cointegration testing.

Proceedings
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After a cointegration relationship is found, the VECM model is estimated to capture the short-run adjustment mechanism and long-run equilibrium between administered inflation, global energy prices, and exchange rates.

Equation (1) indicates where INFAD is administered inflation, OIL is world crude oil price, CPO is world crude palm oil price, LPG is international LPG price, and EXR is the Rupiah exchange rate against the United States Dollar. The VECM model then includes the error correction term ECT to measure the speed of adjustment towards long-run equilibrium due to short-run shocks. Furthermore, this research also uses Granger causality tests to identify causality relationships between variables, impulse response function (IRF) to analyze the dynamic response of administered inflation to external shocks, and forecast error variance decomposition (FEVD) to measure the relative contribution of each independent variable to administered inflation fluctuations over a certain period. Thus, the VECM approach provides a comprehensive econometric framework in explaining the dynamic transmission mechanism between global energy prices, exchange rates, and administered inflation in the context of the Indonesian open economy.

RESULTS AND DISCUSSION

This research analyzes the dynamics of the relationship between global energy prices, exchange rates, and administered inflation in Indonesia using the Vector Error Correction Model (VECM) approach. This approach is chosen because it is capable of capturing short-run adjustment mechanisms as well as long-run equilibrium relationships between non-stationary but cointegrated macroeconomic variables. The impulse response function (IRF) analysis shows that administered inflation responds negatively to oil price shocks in the initial periods, while exchange rate shocks generate a stronger and more persistent inflationary response before gradually converging to long-run equilibrium. According to Christopher Sims (1980), the VAR/VECM model is a dynamic econometric approach capable of explaining simultaneous interactions between macroeconomic variables in an open economic system. The estimation results show that administered inflation in Indonesia has a strong structural linkage with global energy price volatility and the dynamics of the Rupiah exchange rate against the United States Dollar. These findings indicate that the characteristics of administered inflation in Indonesia are not only influenced by domestic policies but are also very sensitive to external shocks originating from international energy markets and foreign exchange markets.

The findings further suggest that the inflation transmission mechanism in Indonesia differs from conventional market-based inflation systems. The administered pricing framework and energy subsidy policies implemented by the government appear to moderate the direct pass-through effect of global energy shocks into domestic administered inflation. This explains why external shocks do not immediately translate into proportional domestic price increases despite significant volatility in global energy markets.

Descriptively, administered inflation during the period 2015–2025 shows a relatively high level of volatility as shown in Table 1. Descriptive Statistics of Administered Inflation in Indonesia Period 2015–2025 (attached). The high kurtosis value indicates the presence of extreme volatility which usually arises due to energy shocks and changes in administered price policies such as adjustments to fuel prices, electricity tariffs, and subsidized LPG. This condition is seen very clearly in the period 2022–2025 when there was a surge in world oil prices due to global geopolitical disruption and Rupiah depreciation pressure.

This phenomenon strengthens the theoretical argument of James D. Hamilton (1983) through Oil Price Shock Theory which explains that an increase in global energy prices can trigger inflationary pressure through increased production costs, distribution, and imported inflation. Furthermore, Olivier Blanchard and Jordi Galí (2007) emphasized that global energy shocks have an

Proceedings
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effect on inflation through the mechanism of inflation expectations and cost-push inflation. However, the findings also indicate that the transmission of global energy shocks to administered inflation in Indonesia is not fully symmetric and immediate. Compared to several previous studies reporting stronger inflation pass-through effects in fully liberalized economies, the relatively moderated response in Indonesia reflects the important role of government intervention, energy subsidy mechanisms, and administered price regulation in dampening external inflationary pressures. The findings of this research are also consistent with empirical studies by Pan Z. et al. (2024), Mukhtarov S. et al. (2020), and Ajayi T.A. et al. (2023).

The stationarity test results show that all research variables are stationary at first difference or integrated at order one I(1) as shown in Table 2. Results of ADF and Phillips–Perron Stationarity Tests (attached). According to Jeffrey M. Wooldridge (2009), non-stationary variables whose stationarity is not tested have the potential to produce spurious regression so that estimation becomes biased and econometrically invalid. Furthermore, Damodar N. Gujarati and Dawn C. Porter (2009) explain that macroeconomic time series data generally has stochastic trends thus requiring differencing transformation to achieve stationarity. Therefore, the results of this research indicate that the VECM approach is very appropriate to use because all variables meet the requirements of the same integration order. These findings are also consistent with the empirical evidence reported by Saji T.G. (2021), Sharma and Shrivastava (2021), and Elneel and Al Mulhim (2022), who found that non-stationary macroeconomic variables become suitable for dynamic VECM estimation after satisfying integration and cointegration requirements.

The optimal lag test results show that the optimal model lag is at lag two as shown in Table 3. Results of Optimal Lag Test (attached). According to Helmut Lütkepohl (2005), optimal lag selection is very important in VAR/VECM models because it determines the model's ability to capture system dynamics without causing over-parameterization or autocorrelation problems. Subsequently, the stability test results show that all characteristic polynomial roots are inside the unit circle so the model meets the requirements of dynamic stability. In the view of Christopher Sims (1980), VAR/VECM system stability is a prerequisite for impulse response functions and variance decomposition to be interpreted validly in dynamic macroeconomic analysis.

Johansen cointegration testing reveals that there is a significant cointegration relationship between administered inflation, world oil prices, CPO prices, international LPG prices, and the Rupiah exchange rate as seen in Table 4. Results of Johansen Cointegration Test (attached). According to Søren Johansen (1988), the existence of cointegration indicates that non-stationary variables have a stable long-run equilibrium relationship although experiencing fluctuations in the short run. Furthermore, Robert F. Engle and Clive W. J. Granger (1987) explain that cointegrated variables will have an error correction mechanism towards long-run equilibrium. The findings of this research support the Open Economy Macroeconomics theory of N. Gregory Mankiw (2019) which states that changes in international commodity prices and exchange rates will be transmitted into domestic prices through international trade mechanisms, imported inflation, and inflation expectations. The results of this research are also consistent with empirical studies by Singhal et al. (2022), Liu and Serletis (2022), and Sharma and Shrivastava (2021), which documented long-run equilibrium relationships among commodity prices, exchange rates, and macroeconomic indicators.

The short-run estimation results show that the Error Correction Term (ECT) has a negative and significant coefficient as presented in Table 15. Short-Run VECM Estimation (attached). According to Robert F. Engle and Clive W. J. Granger (1987), a negative and significant ECT coefficient indicates the existence of an adjustment mechanism towards long-run equilibrium when a short-run shock occurs. The relatively large ECT value shows that administered inflation in Indonesia has a very fast adjustment mechanism to external shocks. Based on the short-run VECM estimation results, the empirical short-run model can be formulated as follows: The short-run equation Equation (2) above

shows that changes in world oil prices in the short run have a negative effect on administered inflation. The negative sign on the LOG_OIL coefficient should not be interpreted as a theoretical increase in world oil prices lowering inflation, but rather should be understood as evidence of the role of energy subsidy policies and administered price regulations in Indonesia that hold back the pass-through of global oil price increases to domestic prices.

In the context of Indonesia, fuel, LPG, electricity tariffs, and some transportation tariffs do not move entirely following international market prices because the government uses subsidies, energy compensation, and gradual price adjustments as stabilization instruments. Consequently, when world oil prices increase, global cost pressures in the short run can be absorbed first by the subsidy and compensation budget so that their impact on administered inflation becomes contained, even producing a negative coefficient in the VECM estimation. This argument makes the research findings more specific to the case of Indonesia because administered inflation is not only determined by global market pressures but also by domestic fiscal and energy policy responses. Empirically, these findings are in line with studies in the empirical studies table that emphasize the role of oil price asymmetry and domestic policies, among others Kashif et al. (2022) who found asymmetric effects of oil price fluctuations on food prices, Isah et al. (2022) who showed an asymmetric relationship between oil prices, exchange rates, and inflation, and Husaini et al. (2023) who emphasized that energy subsidy reform affects energy sustainability and domestic price transmission. Furthermore, Jemutai et al. (2024) showed that fiscal policy has an asymmetric effect on inflation, so the direction and magnitude of external shock influence can change when there is domestic fiscal intervention. Thus, the negative oil price coefficient in the short run strengthens the interpretation that domestic subsidy and price control policies are more dominant than global oil market pressures in shaping Indonesian administered inflation during the observation period.

The CPO price variable shows a positive and significant effect on administered inflation in both the short and long run as shown in Table 15. Short-Run VECM Estimation and Table 16. Long-Run Relationship Estimation (attached). According to N. Gregory Mankiw (2019), changes in global commodity prices will affect domestic prices through international trade mechanisms, distribution costs, and alternative energy costs. These findings indicate that the implementation of the national biodiesel policy causes CPO prices to have a direct link with administered inflation. The results of this research support research by Dong Q. et al. (2024), Pradhan R. et al. (2023), and Kashif U. et al. (2022).

Meanwhile, the Rupiah exchange rate variable against the United States Dollar shows a positive and significant effect on administered inflation as seen in Table 15. Short-Run VECM Estimation and Table 16. Long-Run Relationship Estimation (attached). According to Rudiger Dornbusch (1976), exchange rate depreciation will increase imported inflation through rising imported goods prices and domestic energy costs. Furthermore, Frederic S. Mishkin (2019) explains that exchange rate pass-through is the main transmission mechanism of external shocks to inflation in developing countries with high import dependence. The findings of this research are consistent with research by Rana H.M.U. and O'Connor (2023), Shah O.M. et al. (2022), and Jemutai J. et al. (2024). Unlike other variables, international LPG prices show a positive but statistically insignificant effect in the long run as shown in Table 16. Long-Run Relationship Estimation (attached). This condition indicates that domestic LPG subsidy policies are still able to dampen the direct transmission of international LPG price volatility to administered inflation. According to John Maynard Keynes (1936), government intervention through fiscal policy can function as a stabilizer in maintaining domestic price and economic stability. These findings indicate that energy subsidies still have a function as a shock absorber against global energy pressure. The insignificant effect of the LPG proxy variable may indicate that domestic subsidy policies and administered pricing mechanisms partially isolate domestic LPG prices from short-run international market fluctuations.

The long-run equation Equation (3) above shows that in the long run, Rupiah exchange rate depreciation becomes the most dominant factor in increasing administered inflation in Indonesia. The relatively large exchange rate coefficient indicates that exchange rate pass-through becomes the main source of imported inflation. These findings support the Exchange Rate Pass-Through theory of Rudiger Dornbusch (1976) and the Open Economy Macroeconomics theory of N. Gregory Mankiw (2019).

The Granger causality results show a two-way causal relationship between world oil prices and the Rupiah exchange rate as shown in Table 17. Results of Granger Causality (attached). According to Clive W. J. Granger (1969), a causality relationship indicates the ability of a variable to predict another variable in a dynamic system. The Granger causality results reveal a bidirectional causal relationship between world oil prices and the Rupiah exchange rate. This finding indicates a dynamic interaction between global energy markets and foreign exchange markets. However, no direct causal relationship is found between the explanatory variables and administered inflation, suggesting that the transmission mechanism may occur indirectly through long-run equilibrium adjustments rather than short-run predictive causality.

The impulse response function results show that world oil price shocks and exchange rate depreciation continue to influence administered inflation for several periods before returning to long-run equilibrium as presented in Table 18 Forecast Error Variance Decomposition (FEVD) of Administered Inflation (attached). However, the negative direction of the oil coefficient in the short-run estimation indicates that the administered inflation response to oil shocks is not automatic as in a pure market mechanism. According to Christopher Sims (1980), the impulse response function is used to measure the dynamic response of a variable due to shocks from other variables in the VAR/VECM system. The inflation response to exchange rate shocks looks more dominant compared to other variables. This condition indicates that imported inflation through exchange rate pass-through remains the main channel of external shock transmission in Indonesia, while world oil price transmission in the short run is influenced by subsidy policy design, energy compensation, and administered price adjustments. The FEVD results indicate that exchange rate fluctuations contribute the largest proportion of forecast error variance in administered inflation, followed by world oil prices. This finding confirms that imported inflation remains the dominant transmission channel of external shocks in Indonesia. The relatively large contribution of exchange rate movements suggests that maintaining exchange rate stability is essential for controlling administered inflation, particularly in an economy that remains highly dependent on imported energy and strategic commodities These findings are strengthened by the forecast error variance decomposition results which show that the largest contribution to administered inflation fluctuations comes from the Rupiah exchange rate and world oil prices, but the oil impact in the short run is more mediated by domestic policy.

The robustness test results show that the cointegration relationship remains consistent across various model specifications as seen in Table 9. Robustness Test (Alternative Lag) (attached). According to Helmut Lütkepohl (2005), robustness testing is necessary to ensure that estimation results are not sensitive to changes in model specifications and lag selection. Thus, the results of this research are robust and stable, making them valid as a basis for empirical conclusion drawing. Overall, this research shows that administered inflation in Indonesia is a phenomenon simultaneously influenced by imported inflation, exchange rate volatility, global energy prices, and domestic policy. The finding of the negative oil price coefficient in the short run shows that energy subsidy policies and administered price regulations can hold back the direct transmission of global oil shocks to domestic prices. Thus, the main contribution of this research is not only showing the existence of global energy shock transmission, but also affirming that in the case of Indonesia, domestic fiscal and energy policy responses act as shock absorbers that make the relationship

between world oil prices and administered inflation non-linear and asymmetric. This contribution extends the development of energy economics, exchange rate pass-through, and inflation dynamics studies, especially in emerging market countries applying energy subsidy policies.

CONCLUSION

Conclusion

This research analyzes the dynamic relationship between global energy prices, exchange rate dynamics, and administered inflation in Indonesia using the Vector Error Correction Model (VECM) approach during the period 2015–2025. Empirical results show that administered inflation in Indonesia is heavily influenced by global energy market volatility and fluctuations in the Rupiah exchange rate against the United States Dollar. The stationarity and Johansen cointegration test results prove the existence of a long-run equilibrium relationship between administered inflation, world oil prices, crude palm oil (CPO) prices, international LPG prices, and exchange rates. Furthermore, the negative and significant Error Correction Term (ECT) coefficient indicates that the system has a fast adjustment mechanism towards long-run equilibrium when a short-run external shock occurs.

The short-run and long-run estimation results show that world oil prices, CPO prices, and exchange rates have a significant effect on administered inflation in Indonesia. Exchange rate depreciation becomes the most dominant factor in increasing administered inflation through the imported inflation mechanism. However, the negative coefficient of world oil prices in the short run indicates that the transmission of global oil prices to administered inflation does not occur directly and fully. This negative sign indicates that energy subsidy policies, price compensation, and administered price regulations in Indonesia act as a shock absorber that holds back the pass-through of world oil price increases to domestic prices. Thus, in the short run, domestic policy is stronger than global market pressure in influencing administered inflation.

Meanwhile, international LPG prices show a positive but insignificant effect in the long run, indicating that domestic energy subsidy policies are still able to dampen the direct transmission of global LPG price shocks. The insignificant effect of the LPG proxy variable may indicate that domestic subsidy policies and administered pricing mechanisms partially isolate domestic LPG prices from short-run international market fluctuations.

Furthermore, the impulse response function and forecast error variance decomposition results show that exchange rate volatility and world oil price shocks are important sources of administered inflation fluctuations in Indonesia, but the effect of global oil needs to be read together with subsidy mechanisms and domestic price controls. Overall, the results of this research strengthen the relevance of Oil Price Shock Theory, Exchange Rate Pass-Through, Open Economy Macroeconomics, and the role of fiscal policy as a stabilizer in explaining the transmission mechanism of global energy shocks to administered prices in developing countries.

Recommendations

Based on the research results, the government and monetary authorities need to strengthen exchange rate stabilization policies because Rupiah depreciation is proven to provide the largest contribution to administered inflation volatility in Indonesia. Exchange rate stability is crucial to reduce imported inflation pressure originating from global energy market volatility. Therefore, Bank Indonesia needs to maintain prudent monetary policy, strengthen foreign exchange reserves, and increase the effectiveness of exchange rate stabilization policies to minimize the impact of external shocks on domestic inflation.

Furthermore, the government needs to improve the effectiveness and targeting of energy subsidy policies, especially fuel and LPG subsidies. Although energy subsidies are capable of dampening the direct impact of global energy price volatility on domestic administered prices, excessive fiscal dependence on subsidies has the potential to increase state budget vulnerability when world commodity prices surge. Therefore, gradual energy subsidy reform needs to be conducted while still considering social protection for vulnerable groups so that price stability and fiscal sustainability can be maintained simultaneously.

The government also needs to accelerate energy diversification through the development of new and renewable energy. The significant influence of world oil prices and CPO prices on administered inflation indicates that Indonesia still has a high level of dependence on global energy market dynamics. Strengthening national energy resilience through renewable energy investment, biodiesel optimization, and energy sector downstreaming can become an important strategy to reduce long-run inflationary pressure while strengthening national macroeconomic stability.

Implications

Academically, this research contributes to the development of energy economics, inflation dynamics, exchange rate pass-through, and open economy macroeconomics literature by providing empirical evidence on the transmission mechanism of global energy shocks to administered inflation in Indonesia. This research also extends previous studies by including crude palm oil prices and international LPG prices into a single VECM framework, thereby enriching understanding regarding imported inflation dynamics in developing countries. Furthermore, the research results confirm the relevance of Oil Price Shock Theory developed by James D. Hamilton (1983), Exchange Rate Overshooting Theory by Rudiger Dornbusch (1976), and Open Economy Macroeconomics by N. Gregory Mankiw (2019) in explaining inflation dynamics in developing countries dependent on global energy.

Practically, this research provides important implications for the Indonesian government, Bank Indonesia, fiscal authorities, and energy regulators in formulating macroeconomic stabilization strategies amidst increasing global uncertainty. The research results show that controlling administered inflation cannot rely solely on domestic price control policies but must also consider exchange rate stability, global energy market developments, and the effectiveness of energy subsidy policies. Furthermore, this research emphasizes the importance of strengthening national energy resilience and reducing dependence on imported energy to minimize vulnerability to global energy shocks. Therefore, synergy between monetary, fiscal, and energy policies becomes a very important factor in maintaining macroeconomic stability and the sustainability of Indonesia's long-term economic development.

Research Limitations

Although this research has provided comprehensive empirical evidence regarding administered inflation dynamics, there are several limitations that need to be acknowledged for future research development. (1) This research uses an observation period covering a phase of extreme global economic instability (post-pandemic and geopolitical conflict), so the estimation results are specific to the research period. (2) A limitation of the research is the use of a company stock proxy (Dorian LPG Ltd) which may be influenced by financial market sentiment, not purely physical prices. This condition has the potential to introduce variable bias, where stock price movements can be influenced by internal company factors or global stock market sentiment that does not correlate directly with physical LPG commodity prices. This is likely one of the reasons why the influence of the LPG variable on administered inflation is insignificant in the long run. Future research is advised to use more specific LPG commodity spot or futures price data to validate these findings.

EQUATION

1. The empirical model of the research is formulated as follows:

$$INFAD_t = \beta_0 + \beta_1 OIL_t + \beta_2 CPO_t + \beta_3 LPG_t + \beta_4 EXR_t + \varepsilon_t \quad (1)$$

2. The research Short-run model equation is formulated as follows

$$\Delta INFAD_t = -1.826704ECT_{t-1} - 9.126489\,\Delta LOG_OIL_{t-1} - 5.610410\,\Delta LOG_OIL_{t-2} + 16.68118\,\Delta LOG_CPO_{t-1} + 7.223011\,\Delta LOG_CPO_{t-2} + 0.848427\,\Delta LOG_LPG_{t-1} + 2.145160\,\Delta LOG_LPG_{t-2} + 43.98111\,\Delta LOG_EXR_{t-1} + 30.47447\,\Delta LOG_EXR_{t-2} \quad (2)$$

3. The research long-run model equation is formulated as follows:

$$INFAD_t = -6.354108LOG_OIL_t + 10.51584LOG_CPO_t + 1.136509LOG_LPG_t + 48.22533LOG_EXR_t \quad (3)$$

FIGURES AND TABLES

Table 1. Descriptive Statistics of Administered Inflation

Statistic	Value
Mean	0.241667
Median	0.135000
Maximum	6.530000
Minimum	-7.380000
Std. Dev.	1.301935
Skewness	0.282906
Kurtosis	19.13799
Jarque-Bera	1434.151
Probability	0.000000
Sum	31.90000
Sum Sq. Dev.	222.0494
Observations	132

Source: Processed Descriptive EViews Data

Table 2. Test of Administered Inflation Variable

Null Hypothesis: D(INFAD) has a unit root Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.982544	0.0000
Test critical values:	1% level	-3.483312	
	5% level	-2.884665	
	10% level	-2.579180	

*MacKinnon (1996) one-sided p-values.

Table 3. Phillips–Perron Test of Administered Inflation Variable

Null Hypothesis: D(INFAD) has a unit root Exogenous: Constant
Bandwidth: 52 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-40.53579	0.0001
Test critical values:	1% level		

	5% level	
	10% level	
*MacKinnon (1996) one-sided p-values.		
Residual variance (no correction)		2.459961
HAC corrected variance (Bartlett kernel)		0.101299

Table 4. ADF of the World Oil Price Variable

Null Hypothesis: D(LOG_OIL_) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-9.238388	0.0000
Test critical values:	1% level	-3.481623	
	5% level	-2.883930	
	10% level	-2.578788	

*MacKinnon (1996) one-sided p-values.

Table 5. Phillips–Perron Test of World Oil Price Variable

Null Hypothesis: D(LOG_OIL_) has a unit root
Exogenous: Constant
Bandwidth: 31 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	**Prob.***
Phillips-Perron test statistic		-11.50761	0.0000
Test critical values:	1% level	-3.481217	
	5% level	-2.883753	
level	10%	-2.578694	
*MacKinnon (1996) one-sided p-values.			
Residual variance (no correction)			0.002950 HAC
corrected variance (Bartlett kernel)			0.000788

Table 6. ADF of the Palm Oil Price Variable

Null Hypothesis: D(CPO) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-11.52085	0.0000
Test critical values:	1% level	-3.481623	
	5% level	-2.883930	
	10% level	-2.578788	

*MacKinnon (1996) one-sided p-values.

Table 7. Phillips–Perron of the Palm Oil Price Variable

Null Hypothesis: D(LOG_CPO_) has a unit root Exogenous: Constant

Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic			0.0000
Test critical values:	1% level	-3.481217	
	5% level	-2.883753	
	10% level	-2.578694	

*MacKinnon (1996) one-sided p-values.

Table 8. ADF Test of Dorian LPG Ltd Variable

Null Hypothesis: D(LOG_LPG_) has a unit root Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.38069	0.0000
Test critical values:	1% level	-3.481217	
	5% level	-2.883753	
	10% level	-2.578694	

*MacKinnon (1996) one-sided p-values.

Table 9. Phillips–Perron of the Dorian LPG Ltd Variable

Null Hypothesis: D(LOG_LPG_) has a unit root Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic			0.0000
Test critical values:	1% level	-3.481217	
	5% level	-2.883753	
	10% level	-2.578694	

*MacKinnon (1996) one-sided p-values.

Table 10. ADF of the Exchange Rate Variable

Null Hypothesis: D(LOG_EXR_) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.64313	0.0000
Test critical values:	1% level	-3.481217	
	5% level	-2.883753	
	10% level	-2.578694	

*MacKinnon (1996) one-sided p-values.

Table 11. Phillips–Perron of the Exchange Rate Variable

Null Hypothesis: D(LOG_EXR_) has a unit root
Exogenous: Constant
Bandwidth: 18 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-17.60154	0.0000

Test critical values:	1% level	-3.481217
	5% level	-2.883753
	10% level	-2.578694

*MacKinnon (1996) one-sided p-values.

Table 12. Optimal Lag Test (AIC, SIC, HQ)

VAR Lag Order Selection Criteria
Endogenous variables: D(INFAD) D(LOG_OIL_) D(LOG_CPO_) D(LOG_LPG_) D(LOG_EXR_)
Exogenous variables: C Date: 05/13/26 Time: 19:42 Sample: 2015M01 2025M12
Included observations: 123

Lag	LogL	LR	FPE	AIC	SC	HQ
					-	-
0	762.4635	NA	3.08e-12	-12.31648	12.20216*	12.27004*
1	788.7180	49.94769	3.02e-12	-12.33688	-11.65098	-12.05827
				-		
2	820.6698	58.18866	2.70e-12*	12.44992*	-11.19244	-11.93913
3	838.7696	31.49069	3.04e-12	-12.33772	-10.50865	-11.59476
4	851.9758	21.90298	3.72e-12	-12.14595	-9.745303	-11.17081
5	872.4709	32.32559	4.06e-12	-12.07270	-9.100470	-10.86539
6	891.1103	27.88331	4.61e-12	-11.96927	-8.425464	-10.52979
7	919.7557	40.52270*	4.49e-12	-12.02855	-7.913156	-10.35689
8	937.2394	23.31164	5.30e-12	-11.90633	-7.219358	-10.00249

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error
AIC: Akaike information criterion SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 13. Model Stability (VAR Stability Test)

Roots of Characteristic Polynomial Endogenous variables: D(INFAD) D(LOG_OIL_) D(LOG_CPO_) D(LOG_LPG_) D(LOG_EXR_)
Exogenous variables: C Lag specification: 1 2
Date: 05/13/26 Time: 19:41

Root	Modulus
-0.121190 - 0.646613i	0.657871
-0.121190 + 0.646613i	0.657871
-0.322408 - 0.358714i	0.482309
-0.322408 + 0.358714i	0.482309
-0.028740 - 0.470221i	0.471098
-0.028740 + 0.470221i	0.471098
0.244796 - 0.273959i	0.367394
0.244796 + 0.273959i	0.367394
0.307397	0.307397
-0.124834	0.124834

No root lies outside the unit circle.
VAR satisfies the stability condition.

Table 14. Cointegration (Johansen Cointegration Test)

Date: 05/13/26 Time: 19:48 Sample (adjusted): 2015M05 2025M12
Included observations: 128 after adjustments Trend assumption: Linear deterministic trend
Series: D(INFAD) D(LOG_OIL_) D(LOG_CPO_) D(LOG_LPG_) D(LOG_EXR_)
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.534670	294.7017	69.81889	0.0000
At most 1 *	0.449942	196.7807	47.85613	0.0000
At most 2 *	0.337094	120.2710	29.79707	0.0000
At most 3 *	0.258936	67.64732	15.49471	0.0000
At most 4 *	0.204533	29.28977	3.841465	0.0000

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 15. Short-Run Estimation (VECM Short-Run)

Error Correction:	**D(INFAD,2)**	**D(LOG_OIL_,2)**	**D(LOG_CPO_,2)**	**D(LOG_LPG_,2)**	**D(LOG_EXR_,2)**
CointEq1	-1.826704	0.018847	-0.004459	0.007776	-0.005158
	(0.18728)	(0.00793)	(0.00584)	(0.00775)	(0.00147)
	[-9.75386]	[2.37745]	[-0.76349]	[1.00291]	[-3.49761]
D(INFAD(-1),2)	0.570738	-0.013366	0.000344	-0.002731	0.002998
	(0.13545)	(0.00573)	(0.00422)	(0.00561)	(0.00107)
	[4.21351]	[-2.33121]	[0.08146]	[-0.48692]	[2.81095]
D(INFAD(-2),2)	0.147259	-0.010277	-0.002312	-0.002469	0.001626
	(0.08860)	(0.00375)	(0.00276)	(0.00367)	(0.00070)
	[1.66213]	[-2.74046]	[-0.83686]	[-0.67306]	[2.33053]
D(LOG_OIL_(-1),2)	-9.126489	-0.422477	0.050910	0.100887	0.003466
	(2.41626)	(0.10228)	(0.07535)	(0.10004)	(0.01903)
	[-3.77712]	[-4.13077]	[0.67562]	[1.00848]	[0.18216]
D(LOG_OIL_(-2),2)	-5.610410	-0.302081	-0.021000	0.169296	-0.002832
	(2.21360)	(0.09370)	(0.06903)	(0.09165)	(0.01743)
	[-2.53452]	[-3.22400]	[-0.30421]	[1.84723]	[-0.16244]
D(LOG_CPO_(-1),2)					
	16.68118	0.020660	-0.690075	0.150360	-0.036340
	(3.08730)	(0.13068)	(0.09628)	(0.12782)	(0.02431)
	[5.40315]	[0.15809]	[-7.16737]	[1.17632]	[-1.49476]
D(LOG_CPO_(-2),2)					
	7.223011	0.107817	-0.356375	-0.012325	-0.004413
	(2.97175)	(0.12579)	(0.09268)	(0.12304)	(0.02340)
	[2.43056]	[0.85713]	[-3.84537]	[-0.10018]	[-0.18860]
D(LOG_LPG_(-1),2)	0.848427	-0.021366	0.043072	-0.622195	0.001713
	(2.17241)	(0.09195)	(0.06775)	(0.08994)	(0.01711)
	[0.39055]	[-0.23235]	[0.63577]	[-6.91764]	[0.10011]
D(LOG_LPG_(-2),2)	2.145160	0.068715	0.018474	-0.214230	-0.021115
	(2.13920)	(0.09055)	(0.06671)	(0.08857)	(0.01685)
	[1.00279]	[0.75888]	[0.27693]	[-2.41881]	[-1.25344]
D(LOG_EXR_(-1),2)	43.98111	-1.715254	0.156966	0.154342	-0.421169

	(12.4941)	(0.52885)	(0.38964)	(0.51729)	(0.09839)
	[3.52015]	[-3.24336]	[0.40285]	[0.29837]	[-4.28075]
D(LOG_EXR_(-2),2)	30.47447	-0.634760	-0.037132	0.989324	-0.255923
	(11.4830)	(0.48606)	(0.35811)	(0.47543)	(0.09043)
	[2.65387]	[-1.30594]	[-0.10369]	[2.08092]	[-2.83023]
C	0.005756	-0.001311	5.08E-05	-0.000643	7.35E-05
	(0.13061)	(0.00553)	(0.00407)	(0.00541)	(0.00103)
	[0.04407]	[-0.23722]	[0.01247]	[-0.11889]	[0.07148]
R-squared	0.675106	0.327645	0.403684	0.383660	0.460249
Adj. R-squared	0.644297	0.263887	0.347137	0.325214	0.409066
Sum sq. resids	252.9929	0.453280	0.246050	0.433673	0.015688
S.E. equation	1.476812	0.062511	0.046056	0.061144	0.011629
F-statistic	21.91268	5.138906	7.138881	6.564339	8.992184
Log likelihood	-225.2293	179.5455	218.6480	182.3756	394.8162
Akaike AIC	3.706708	-2.617899	-3.228876	-2.662119	-5.981503
Schwarz SC	3.974086	-2.350521	-2.961498	-2.394741	-5.714125
Mean dependent	-0.007188	-0.000831	-3.58E-05	-0.000115	3.27E-05
S.D. dependent	2.476175	0.072859	0.057000	0.074434	0.015128

Determinant resid covariance (dof adj.)	6.74E-12
Determinant resid covariance	4.12E-12
Log likelihood	769.6462
Akaike information criterion	-11.01010
Schwarz criterion	-9.561800
Number of coefficients	65

Table 16. Long-Run Estimation (Error Correction Term)
Vector Error Correction Estimates
Date: 05/13/26 Time: 19:49
Sample (adjusted): 2015M05 2025M12
Included observations: 128 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	**CointEq1**
D(INFAD(-1))	1.000000
D(LOG_OIL_(-1))	-6.354108
	(2.30597)
	[-2.75550]
D(LOG_CPO_(-1))	10.51584
	(3.00661)
	[3.49757]
D(LOG_LPG_(-1))	1.136509
	(1.90014)
	[0.59812]
D(LOG_EXR_(-1))	48.22533
	(13.6505)
	[3.53286]
C	-0.054676

Table 17. Granger Causality Test
Pairwise Granger Causality Tests
Date: 05/13/26 Time: 19:55

Sample: 2015M01 2025M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LOG_OIL_ does not Granger Cause INFAD	130	1.01423	0.3656
INFAD does not Granger Cause LOG_OIL_		0.01417	0.9859
LOG_CPO_ does not Granger Cause INFAD	130	0.33570	0.7155
INFAD does not Granger Cause LOG_CPO_		1.40933	0.2482
LOG_LPG_ does not Granger Cause INFAD	130	0.29955	0.7417
INFAD does not Granger Cause LOG_LPG_		0.55943	0.5730
LOG_EXR_ does not Granger Cause INFAD	130	0.23851	0.7882
INFAD does not Granger Cause LOG_EXR_		0.23362	0.7920
LOG_CPO_ does not Granger Cause LOG_OIL_	130	3.96358	0.0214
LOG_OIL_ does not Granger Cause LOG_CPO_		2.78278	0.0657
LOG_LPG_ does not Granger Cause LOG_OIL_	130	0.98573	0.3760
LOG_OIL_ does not Granger Cause LOG_LPG_		2.24422	0.1103
LOG_EXR_ does not Granger Cause LOG_OIL_	130	3.29181	0.0404
LOG_OIL_ does not Granger Cause LOG_EXR_		6.40590	0.0022
LOG_LPG_ does not Granger Cause LOG_CPO_	130	0.23445	0.7914
LOG_CPO_ does not Granger Cause LOG_LPG_		2.70531	0.0708
LOG_EXR_ does not Granger Cause LOG_CPO_	130	1.41016	0.2480
LOG_CPO_ does not Granger Cause LOG_EXR_		7.22930	0.0011
LOG_EXR_ does not Granger Cause LOG_LPG_	130	2.38224	0.0965
LOG_LPG_ does not Granger Cause LOG_EXR_		5.20878	0.0067

Table 18. Variable Contribution (Variance Decomposition)

Variance Decomposition of D(INFAD):						
Period	S.E.	D(INFAD)	D(LOG_OIL_)	D(LOG_CPO_)	D(LOG_LPG_)	D(LOG_EXR_)
1	1.476812	100.0000	0.000000	0.000000	0.000000	0.000000
2	1.599234	87.75389	3.025896	0.564017	0.025272	8.630930
3	1.666730	83.95329	3.858741	2.391422	0.332724	9.463823
4	1.779512	77.79431	6.980299	3.690689	0.321051	11.21365
5	1.872053	78.35471	6.644343	3.560688	0.293724	11.14654
6	1.896759	76.51690	6.955826	3.870656	0.438910	12.21770

7	1.943833	73.02045	8.058516	5.070023	0.418468	13.43255
8	1.994316	70.80525	9.128324	5.056760	0.398022	14.61164
9	2.033931	69.89738	9.395048	4.956233	0.405749	15.34559
10	2.066933	68.55898	9.806147	5.190981	0.403183	16.04071

Variance Decomposition of D(LOG_OIL_):

Period	S.E.	D(INFAD)	D(LOG_OIL_)	D(LOG_CPO_)	D(LOG_LPG_)	D(LOG_EXR_)
1	0.062511	0.024278	99.97572	0.000000	0.000000	0.000000
2	0.072958	1.811422	94.99154	1.797309	0.013971	1.385755
3	0.078682	2.113356	91.39331	4.751308	0.483893	1.258138
4	0.087179	3.812199	90.36437	4.023113	0.423382	1.376937
5	0.094642	3.592321	90.78438	3.866374	0.362588	1.394335
6	0.100477	3.320455	90.59745	4.408164	0.425809	1.248119
7	0.106525	3.557980	90.69591	4.200692	0.426523	1.118896
8	0.112327	3.941911	90.36228	4.287802	0.398899	1.009111
9	0.117505	3.879631	90.34909	4.435123	0.410756	0.925402
10	0.122512	3.814101	90.57021	4.351754	0.412072	0.851860

Variance Decomposition of D(LOG_CPO_):

Period	S.E.	D(INFAD)	D(LOG_OIL_)	D(LOG_CPO_)	D(LOG_LPG_)	D(LOG_EXR_)
1	0.046056	0.615243	4.921602	94.46315	0.000000	0.000000
2	0.048877	2.557362	7.342618	89.86180	0.222201	0.016018
3	0.053077	2.818070	6.636082	90.30453	0.194532	0.046784
4	0.060101	2.218667	6.409542	91.04201	0.165075	0.164704
5	0.063433	2.320687	6.810944	90.53159	0.182975	0.153800
6	0.067564	2.734393	6.605797	90.34265	0.177029	0.140135
7	0.071482	2.596998	6.832913	90.26350	0.174475	0.132119

8	0.074908	2.445737	6.886687	90.37734	0.169804	0.120434
9	0.078468	2.440176	6.777606	90.50032	0.171682	0.110219
10	0.081657	2.460492	6.858305	90.40583	0.172593	0.102777

Variance Decomposition of D(LOG_LPG_):

Period	S.E.	D(INFAD)	D(LOG_OIL_)	D(LOG_CPO_)	D(LOG_LPG_)	D(LOG_EXR_)
1	0.061144	0.298049	5.944272	0.660241	93.09744	0.000000
2	0.067237	0.608404	6.847731	3.904516	87.93619	0.703162
3	0.076609	0.921348	8.740383	3.007674	85.09259	2.238007
4	0.084567	0.756704	8.342522	2.946487	86.09501	1.859279
5	0.091131	0.652441	8.627556	3.538198	84.97327	2.208531
6	0.097874	0.583111	8.988604	3.139392	85.02368	2.265210
7	0.103548	0.528624	9.044591	3.190190	85.14265	2.093945
8	0.109273	0.481727	9.193727	3.209382	84.95482	2.160349
9	0.114635	0.440346	9.321128	3.075675	85.03900	2.123847
10	0.119651	0.407144	9.375975	3.100589	85.02885	2.087446

Variance Decomposition of D(LOG_EXR_):

Period	S.E.	D(INFAD)	D(LOG_OIL_)	D(LOG_CPO_)	D(LOG_LPG_)	D(LOG_EXR_)
1	0.011629	4.649886	10.63240	0.000267	0.839457	83.87799
2	0.013333	10.99485	8.089121	9.313734	0.838786	70.76351
3	0.014191	12.06489	7.856068	8.369767	2.598954	69.11032
4	0.015693	14.06340	7.023492	7.374499	2.172869	69.36574
5	0.016760	13.63739	6.890391	7.891059	2.278028	69.30313
6	0.017725	14.21179	6.571641	7.489871	2.542675	69.18402
7	0.018736	15.17409	6.305961	7.376974	2.452282	68.69069
8	0.019650	15.59035	6.110428	7.412817	2.508699	68.37770

9	0.020506	15.65483	5.955939	7.240746	2.563626	68.58486
10	0.021336	15.92467	5.847885	7.166841	2.563751	68.49685

Cholesky Ordering: D(INFAD) D(LOG_OIL_) D(LOG_CPO_) D(LOG_LPG_) D(LOG_EXR_)

Table 19. Robustness Test (Alternative Lag)
Date: 05/13/26 Time: 20:39
Sample (adjusted): 2015M06 2025M12
Included observations: 127 after adjustments
Trend assumption: Linear deterministic trend
Series: D(INFAD) D(LOG_OIL_) D(LOG_CPO_) D(LOG_LPG_) D(LOG_EXR_
Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.528147	242.7375	69.81889	0.0000
At most 1 *	0.342721	147.3494	47.85613	0.0000
At most 2 *	0.287119	94.05427	29.79707	0.0000
At most 3 *	0.202075	51.07235	15.49471	0.0000
At most 4 *	0.161720	22.40322	3.841465	0.0000

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

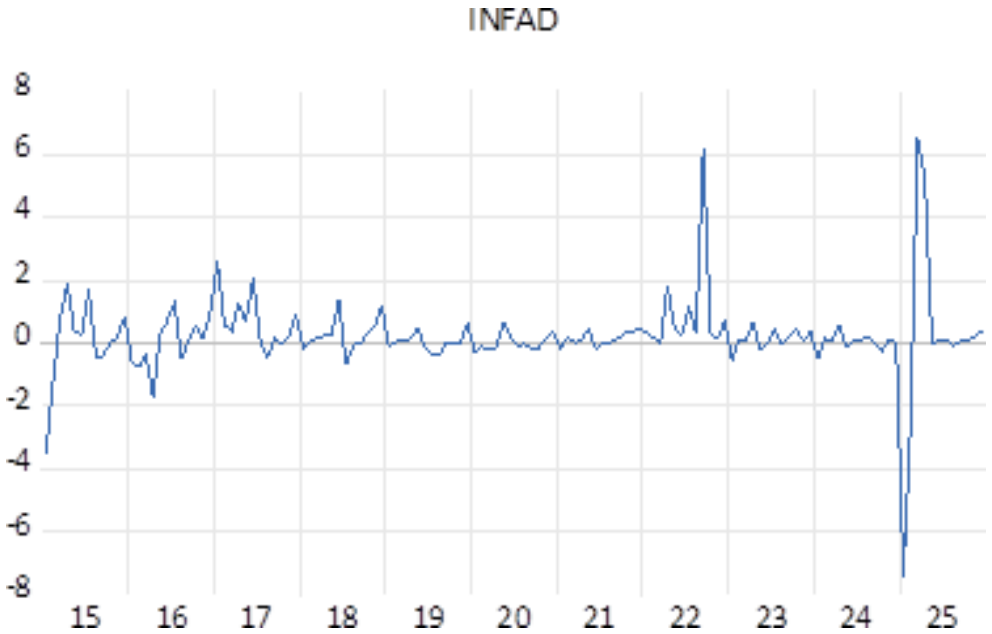


Figure 1. Inflation Volatility Graph in Indonesia for the 2015–2025 Period Figure

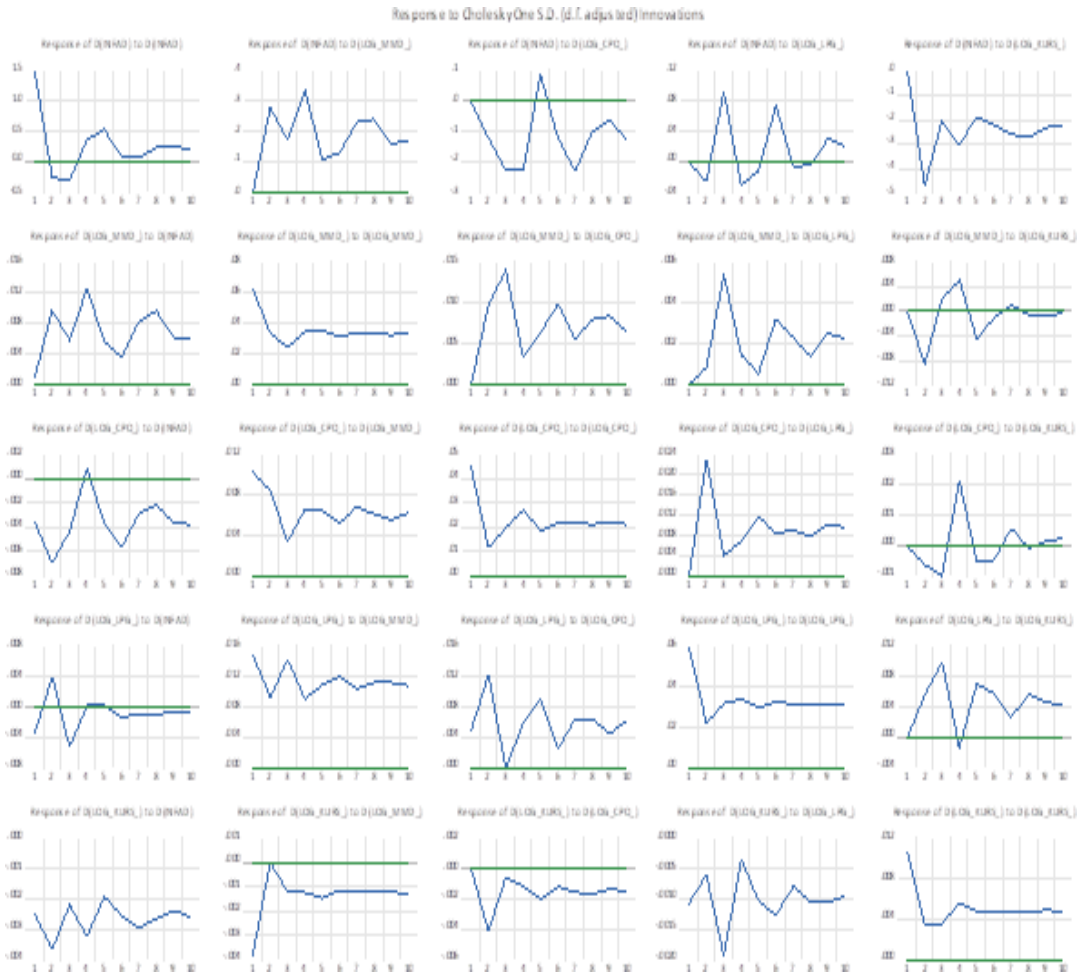


Figure 2. Shock Dynamics (Impulse Response Function)

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