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The Transmission Mechanism of World Oil Prices to Inflation in Indonesia through the Exchange Rate, Interest Rate, and Import Channels

Mekanisme Transmisi Harga Minyak Dunia terhadap Inflasi di Indonesia melalui Nilai Tukar, Suku Bunga, dan Impor

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Abstract

This study aims to examine the short-run and long-run relationships between world oil prices, the Rupiah exchange rate, Bank Indonesia's policy interest rate (BI Rate), imports, and inflation in Indonesia. The analysis employs a Vector Error Correction Model (VECM) using monthly data from 2010 to 2024, supported by unit root tests (ADF and PP), Johansen cointegration test, and ARDL bounds test for robustness. The results show that most variables are non-stationary at level but become stationary at first difference I(1), and the Johansen cointegration test identifies two cointegrating vectors, indicating long-run equilibrium relationships among variables. In the short run, inflation is mainly influenced by its own past inertia (over 90% in FEVD), and none of the external transmission channels are significant. In the long run, oil prices and exchange rates correlate negatively with inflation (coefficients of -0.223 and -16.963), while imports have a strong positive influence (coefficient of 26.425), and the BI Rate is statistically insignificant.

Keywords: Inflation; Global Oil Price; Exchange Rate; VECM

Abstrak

Penelitian ini bertujuan untuk mengkaji hubungan jangka pendek dan jangka panjang antara harga minyak dunia, nilai tukar Rupiah, suku bunga kebijakan Bank Indonesia (BI Rate), impor, dan inflasi di Indonesia. Analisis ini menggunakan Model Koreksi Kesalahan Vektor (VECM) dengan data bulanan dari tahun 2010 hingga 2024, yang didukung oleh uji akar unit (ADF dan PP), uji kointegrasi Johansen, serta uji batas ARDL untuk menguji ketahanan model. Hasilnya menunjukkan bahwa sebagian besar variabel bersifat non-stasioner pada level tetapi menjadi stasioner pada selisih pertama I(1), dan uji kointegrasi Johansen mengidentifikasi dua vektor kointegrasi, yang mengindikasikan adanya hubungan keseimbangan jangka panjang di antara variabel-variabel tersebut. Dalam jangka pendek, inflasi terutama dipengaruhi oleh inersia masa lalunya sendiri (lebih dari 90% dalam FEVD), dan tidak ada saluran transmisi eksternal yang signifikan. Dalam jangka panjang, harga minyak dan nilai tukar berkorelasi negatif dengan inflasi (koefisien sebesar -0,223 dan -16,963), sementara impor memiliki pengaruh positif yang kuat (koefisien sebesar 26,425), dan BI Rate secara statistik tidak signifikan.

Kata Kunci: Inflasi; Harga Minyak Dunia; Nilai Tukar; VECM

INTRODUCTION

Inflation is defined as a general and sustained increase in prices that reduces purchasing power and disrupts economic stability.[1] Over the past 15 years, Indonesia's inflation has peaked at 8%, with spikes often coinciding with rising world oil prices. Mufarrikhah emphasizes that excessive inflation hinders economic growth.[2] Based on BPS and Bank Indonesia data (2010-2024), inflation has remained relatively stable, peaking at 8% in 2013-2014, stabilizing at 1.5%-2.0% post-pandemic, and reaching a low of 1.57% in 2024. These fluctuations are triggered by external pressures such as global oil price and Rupiah exchange rate volatility, which increase energy costs and import prices.[3] Yusnita et al. shows that oil price increases due to geopolitical conflicts cause Rupiah depreciation and higher import costs, affecting aggregate supply and inflation.[4]

World oil prices have experienced extreme volatility, spiking to US$122.71 per barrel in 2022. Aditya and Sopiana highlights that rising oil prices weaken the exchange rates of oil-importing countries.[5] These dynamics reinforce economic volatility.[6] Monetary policy serves as a buffer against external shocks.[7] Aggregate supply shocks from oil price increases can slow growth and raise inflation.[8] Negative impacts of oil shocks on India's growth.[9]

The first channel is the exchange rate. Rising oil prices worsen the current account balance and pressure the exchange rate,[10] which then increases import prices and inflation through the pass-through mechanism.[11] The Rupiah exchange rate tended to weaken during the observation period, Susanto identifies a significant correlation between exchange rates, exports-imports, and

1 Suparti Suparti, "Analisis Data Inflasi Di Indonesia Menggunakan Model Regresi Spline," *Media Statistika* 6, no. 1 (2013): 1–9, https://doi.org/10.14710/medstat.6.1.1-9.

2 Julla Mufarrikhah, "Analisis Faktor Yang Mempengaruhi Inflasi Di Indonesia Periode 1988-2019 Dengan Metode Error Correction Model (ECM)," *Diponegoro Journal of Economics* 10, no. 4 (2024): 308–21, https://doi.org/10.14710/djoe.31660.

3 Onsardi, "Journal of Economic, Business and Accounting (COSTING)," *Journal of Economic, Business and Accounting (COSTING)* 2, no. 1 (2018): 1–13.

4 Fitri Yusnita, Indah Khairunnisa, and Peny Cahaya Azwari, "Pengaruh Kurs, Emas, Minyak Terhadap Harga Saham Dengan Inflasi Sebagai Variabel Intervening," *Value : Jurnal Manajemen Dan Akuntansi* 18, no. 2 (2023): 618–31, https://doi.org/10.32534/jv.v18i2.4107.

5 Muhammad Bagus Aditya and Yunita Sopiana, "Analisis Tingkat Suku Bunga Bank, Subsidi BBM Dan Harga Minyak Dunia Terhadap Inflasi Di Indonesia," *JIEP: Jurnal Ilmu Ekonomi Dan Pembangunan* 7, no. 2 (2024): 494–505, https://doi.org/10.20527/jiep.v7i2.134.

6 Septia Tri Rahmania and Ali Anis, "Dampak Guncangan Harga Minyak Dunia Terhadap Dinamika Inflasi Di Indonesia," *Jurnal Kajian Ekonomi Dan Pembangunan* 6, no. 1 (2024): 13, https://doi.org/10.24036/jkep.v6i1.15834.

7 Alla Asmara et al., "International Oil Price Volatility and Its Impact on Manufacturing Sector and Indonesian Macroeconomic Performance," *Agro Ekonomi* 29 (2011): 49–69.

8 Khaliq Abdul, "Mekanisme Transmisi Goncangan Harga Minyak Dan Harga Pangan Dunia Terhadap Perekonomian Makro Indonesia: Pendekatan Structural Vector Autoregressive (SVAR)," *Business Management Journal* 10, no. 1 (2015): 1–9, https://journal.ubm.ac.id/index.php/business-management/article/view/625.

9 Megha Agarwalla and Shib Sankar Jana, "How Far Are the Crude Oil Price and Inflation Relevant to Forecast the Stock Prices ? Evidence from India," 2025, https://doi.org/10.1108/RAMJ-03-2024-0064.

10 Biplob Kumar Nandi, Md Humayun Kabir, and Mohitosh Kumar Nandi, "Crude Oil Price Hikes and Exchange Rate Volatility: A Lesson from the Bangladesh Economy," *Resources Policy* 91, no. January (2024): 104858, https://doi.org/10.1016/j.resourpol.2024.104858.

11 Shusheng Ding et al., "The Oil Price-Inflation Nexus: The Exchange Rate Pass- through Effect," *Energy Economics* 125, no. January (2023): 106828, https://doi.org/10.1016/j.eneco.2023.106828.

inflation in Indonesia.[12] The second channel is imports. Rising oil prices and exchange rate depreciation increase energy import and production input costs, driving up producer and consumer prices explains that imports affect inflation both directly and indirectly.[13] The third channel is the BI Rate, which fluctuated between 3.50%-7.50% in response to inflation. However, Chen and Semmler finds that interest rate hikes can potentially increase inflation if they make production costs more expensive.[14]

Although many studies have been conducted, important research gaps remain. Baek and Yoon show that economic responses to oil price shocks vary depending on the source and nature of the shock.[15] Most previous studies have examined the exchange rate, imports, or monetary policy as separate transmission channels, whereas in reality these mechanisms operate simultaneously and interact with one another. This fragmented approach limits a comprehensive understanding of how global oil price shocks affect inflation, particularly in emerging economies such as Indonesia. To address this issue, a multidimensional perspective is required. The Mundell–Fleming framework explains that in a small open economy with a floating exchange rate regime, external shocks are transmitted through exchange rate movements and monetary policy responses. Complementing this view, the Exchange Rate Pass-Through (ERPT) theory argues that exchange rate depreciation is transmitted into domestic prices, while the oil price transmission framework identifies three major channels through which oil price shocks influence inflation: the exchange rate, import costs, and monetary policy.

These theoretical perspectives are supported by a growing body of empirical evidence. Studies generally confirm that oil price shocks contribute to inflation dynamics through exchange rate depreciation, import costs, and monetary policy transmission, although the magnitude and persistence of these effects differ across countries and economic conditions. For example, Ding et al. demonstrate that exchange rate pass-through plays a significant role in transmitting oil price shocks to inflation,[16] while Aharon et al. show that the inflationary effects of oil shocks vary considerably across ASEAN economies.[17] Likewise, previous evidence suggests that the impact of oil price shocks has become increasingly moderate over time as monetary policy frameworks have strengthened and inflation expectations have become better anchored. These findings indicate that the transmission of oil price shocks is inherently multidimensional and cannot be fully understood by analyzing each channel independently.

12 Susanto Susanto, "Pengaruh Inflasi, Tingkat Suku Bunga, Dan Nilai Tukar Terhadap Pertumbuhan Ekonomi Indonesia," *JEBI | Jurnal Ekonomi Bisnis Indonesia* 12, no. 01 (2018): 52–68, https://doi.org/10.36310/jebi.v12i01.27.

13 Vasilis Nikou, "From Exit to Exposure: Gas Import Shocks and Macroeconomic Asymmetries in the Wake of Europe's Coal Phaseout," *Energy* 335, no. June (2025), https://doi.org/10.1016/j.energy.2025.138254; Magdalena Szyszko and Agata Kliber, "The Asymmetric Impact of Fuel and Oil Prices on Inflation and Inflation Expectations in Emerging Economies," *Energy Economics* 147, no. 2020 (2025): 108519, https://doi.org/10.1016/j.eneco.2025.108519; Elva Dona et al., "Berpengaruhkah Jumlah Uang Beredar, Suku Bunga, Ekspor Dan Impor Terhadap Inflasi Di Indonesia?," *Jurnal Ekobistek* 11, no. 4 (2022): 355–60, https://doi.org/10.35134/ekobistek.v11i4.411.

14 Pu Chen and Willi Semmler, "Wage – Price Dynamics and Financial Market in a Disequilibrium Macro Model: A Keynes – Kaldor – Minsky Modeling of Recession and Inflation Using VECM," *Journal of Economic Behavior and Organization* 220, no. November 2022 (2024): 433–52, https://doi.org/10.1016/j.jebo.2024.01.012.

15 Jungho Baek and Jee Hee Yoon, "Do Macroeconomic Activities Respond Differently to Oil Price Shocks? New Evidence from Indonesia," *Economic Analysis and Policy* 76 (2022): 852–62, https://doi.org/10.1016/j.eap.2022.09.023.

16 Ding et al., "The Oil Price-Inflation Nexus: The Exchange Rate Pass- through Effect."

17 David Y. Aharon, Mukhriz Izraf Azman Aziz, and Ido Kallir, "Oil Price Shocks and Inflation: A Cross-National Examination in the ASEAN5+3 Countries," *Resources Policy* 82, no. December 2022 (2023): 103573, https://doi.org/10.1016/j.resourpol.2023.103573.

Building upon these theoretical and empirical considerations, this study employs the Vector Error Correction Model (VECM), complemented by the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD), to simultaneously examine the exchange rate, import, and monetary policy channels through which global oil price shocks are transmitted to inflation in Indonesia. Unlike previous studies that primarily focus on individual transmission mechanisms, this integrated framework enables a comprehensive assessment of both the short-run and long-run interactions among the three channels. Accordingly, this study aims to analyze the transmission mechanism of global oil prices to Indonesian inflation through the exchange rate, BI Rate, and import channels, measure the relative significance and dominance of each transmission channel, and examine the long-run dynamic relationships among these variables.

Method

This study employs a quantitative research design using time-series econometric techniques to examine the dynamic relationships among world oil prices, the Rupiah exchange rate, Bank Indonesia's policy interest rate (BI Rate), imports, and inflation in Indonesia.[18] Monthly secondary data covering the period from January 2010 to December 2024 were obtained from Statistics Indonesia (BPS), Bank Indonesia (BI), and the U.S. Energy Information Administration (EIA). Inflation (INF) is specified as the dependent variable, while world oil prices (OIL), the Rupiah exchange rate (EXR), the BI Rate (BIR), and imports (IMP) are treated as the independent variables. Inflation is measured by the percentage change in the Consumer Price Index (CPI), world oil prices are represented by Brent crude oil prices (USD per barrel), the exchange rate is measured using the IDR/USD middle exchange rate, the BI Rate represents Bank Indonesia's policy interest rate, and imports are measured in million USD.

The data were collected through documentation by compiling monthly observations from the respective official institutions. The primary analytical method employed is the Vector Error Correction Model (VECM), which allows the estimation of both short-run dynamics and long-run equilibrium relationships among the variables. Prior to the VECM estimation, several preliminary tests were conducted, including unit root tests using the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) methods, optimal lag length selection, VAR stability testing, and the Johansen cointegration test. The dynamic effects of oil price shocks were subsequently analyzed using the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD). As a robustness check, the Autoregressive Distributed Lag (ARDL) model was also estimated to verify the consistency of the empirical findings. All estimations were performed using Stata 17, and the estimated VECM specification is presented as follows:

$$\Delta INF_t = \alpha\, ECT_{(t-1)} + \sum_{i=1}^{k-1} \beta 1, i\, \Delta INF_{t-i} + \sum_{i=1}^{k-1} \beta 2, i\, \Delta HMD_{t-i} + \sum_{i=1}^{k-1} \beta 3, i\, \Delta IMP_{t-i} + \sum_{i=1}^{k-1} \beta 4, i\, \Delta NTK_{t-i} + \sum_{i=1}^{k-1} \beta 5, i\, \Delta BIR_{t-i} + \varepsilon_t$$

Where:

ΔINFt = change in inflation at time t

α = speed of adjustment coefficient

ECT(t−1) = error correction term at lag 1

Bj = short-run coefficients for variable j at lag i

εt = error term

18 John W. Creswell, *Research Design: Qualitative, Muantitative, and Mixed Methods Approaches (4th Ed.)*, *Sage Publications*, 2014.

The VECM specification captures both the short-run dynamics and the long-run equilibrium relationships among inflation, global oil prices, the exchange rate, the BI Rate, and imports. The error correction term (ECT) measures the speed at which short-run deviations from the long-run equilibrium are corrected, while the differenced variables represent the short-run responses of inflation to changes in each explanatory variable. This specification enables the analysis of both the immediate and persistent effects of global oil price shocks on inflation in Indonesia within a unified econometric framework.

RESULTS AND DISCUSSION

Descriptive Statistics and Correlation Analysis

To provide an initial overview of the data characteristics, descriptive statistical analysis was conducted for all variables included in the study. This analysis summarizes the central tendency and dispersion of each variable over the observation period from January 2010 to December 2024, offering preliminary insights into the distribution and variability of the data before proceeding to the unit root test and subsequent time-series econometric analyses. The results of the descriptive statistics are presented in Table 1.

Table 1. Descriptive Statistics and Correlation Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Inflation	180	4.10	1.87	0.05	8.79
Oil price	180	78.19	25.25	4.27	124.9
Exchange Rate	180	9.45	.1958	9.05	9.71
BI Rate	180	5.69	1.25	3.5	7.75
Import	180	9.59	.208	9.04	10.01

Source: Authors' calculation (2026)

The table above presents the descriptive statistics of the variables used in this study for the period January 2010–December 2024. The average inflation rate in Indonesia is 4.10 percent with a standard deviation of 1.87 percent, indicating that inflation fluctuations remain within a moderate range around the inflation target set by the monetary authority. The average world oil price reaches 78.18 USD per barrel with a standard deviation of 25.24, reflecting a relatively high degree of volatility in the global oil market over the observation period.

The Rupiah exchange rate has a logarithmic mean of around 9.45 within a range from 9.05 to 9.71, capturing episodes of both appreciation and depreciation against the US dollar while remaining within a relatively contained band. The Bank Indonesia policy rate (BI Rate) averages 5.69 percent, with a minimum of 3.5 percent and a maximum of 7.75 percent, indicating phases of monetary easing and tightening in response to developments in inflation and broader macroeconomic conditions.

The import variable has a logarithmic mean of 9.59 with a standard deviation of 0.21 and lies within the range of 9.04 to 10.01, which reflects variations in Indonesia's import value consistent with shifts in domestic demand and external factors. The use of descriptive statistics at this initial stage of analysis is in line with Gujarati (2003) and Stock and Watson (2019),[19] who emphasize the importance of examining the distribution and dispersion of the data prior to estimating more complex time-series econometric models.

19 Gujarati, 2003; James H. Stock and Mark W Watson, *Intoducción a La Econometría*, 2019.

Unit Root Test

Before estimating the VECM, it is necessary to examine the stationarity properties of the time-series data to avoid spurious regression and to determine the appropriate order of integration for each variable. Following the recommendations of Gujarati (2003) and Stock and Watson (2019), this study employs the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests to assess whether the variables are stationary at the level or after first differencing. The results of the stationarity tests are presented in Table 2.

Table 2. Unit Root Test

Variables	ADF		PP		Order Of Integration
	Level	1st Diff	Level	1st Diff	
Inflation	0.153	0.000	0.193	0.000	0.193
Oil Prices	0.667	0.000	0.498	0.000	0.498
Import	0.002	0.000	0.001	0.000	0.015
Exchange Rate	0.718	0.000	0.739	0.000	0.739
BI Rate	0.734	0.000	0.516	0.000	0.516

Source: Authors' calculation (2026)

Based on the results of the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests, the variables inflation, world oil prices, the Rupiah exchange rate, and the BI Rate have probability values greater than 0.05 at the level, but become statistically significant after first differencing. This indicates that these four variables are non-stationary in levels but become stationary at the first order of integration, I(1). In contrast, the import variable is already significant at the level and remains significant at the first difference, so it can be categorized as stationary at level, I(0), over the sample period.

These findings imply that the empirical model must be able to accommodate a combination of variables integrated of order I(0) and I(1), making cointegration techniques and modeling frameworks based on VECM and ARDL particularly relevant for further analysis. The use of ADF and PP tests as an initial step to examine the time-series stationarity properties is consistent with the recommendations of Gujarati (2003) & Stock and Watson (2019),[20] who emphasize the importance of establishing stationarity before estimating time-series econometric models in order to avoid the problem of spurious regression.

Optimal Lag Length Determination

Following the stationarity tests, the optimal lag length was determined to establish an appropriate VAR specification prior to estimating the VECM. Selecting the optimal lag is essential to adequately capture the dynamic interactions among variables while avoiding model misspecification due to overfitting or underfitting. In this study, the lag order was selected using three information criteria, namely the Akaike Information Criterion (AIC), the Hannan–Quinn Information Criterion (HQIC), and the Schwarz Bayesian Information Criterion (SBIC). The results of the lag selection procedure are presented in Table 3.

20 Gujarati, 2003; Stock & Watson, 2019.

Table 3. Optimal Lag Length Determination

Lag	AIC	HQIC	SBIC
0	13.708	13.73	13.79
1	1.925	2.143	2.463*
2	1.738*	2.138*	2.725
3	1.821	2.404	3.257

Source: Authors' calculation (2026)

Note: The asterisk indicates the optimal lag selected by each information criterion. AIC and HQIC identify lag 2 as the optimal specification, whereas SBIC selects lag 1.*

The optimal lag selection results indicate that, for the VAR model with five variables (inflation, oil price, exchange rate, BI Rate, and imports), the Akaike Information Criterion (AIC) and the Hannan-Quinn Information Criterion (HQIC) attain their minimum values at lag 2, as indicated by the asterisk (*symbols next to 1.738 and 2.138 respectively. Meanwhile, the Schwarz Bayesian Information Criterion (SBIC) selects lag 1, marked by an asterisk*) next to 2.463.

Taking into account the trade-off between goodness of fit and model parsimony, and referring to common VAR/VECM modeling practice that tends to rely more heavily on AIC and HQIC when the sample size is sufficiently large (Stock & Watson, 2019), this study adopts lag 2 as the optimal lag in the VAR system, which subsequently forms the basis for the VECM specification. The choice of lag length based on these information criteria is consistent with the recommendations of Gujarati (2003) as well as Stock and Watson (2019), who emphasize the importance of selecting the lag order that minimizes the information criteria in order to obtain a stable and efficient time-series model.

Stability Test (Inverse Roots of AR Characteristic Polynomial)

Before estimating the VECM, the stability of the underlying VAR model was evaluated by examining the inverse roots of the AR characteristic polynomial. A stable VAR model requires all characteristic roots to lie within the unit circle (i.e., have moduli less than one), ensuring that the dynamic system is well specified and that subsequent analyses, including the VECM, Impulse Response Function (IRF), and Forecast Error Variance Decomposition (FEVD), produce reliable and valid results. The results of the stability test are presented in Table 4.

Table 4. Stability Test (Inverse Roots of AR Characteristic Polynomial)

Eigenvalue			Modulus
0.991939			0.991939
0.960721	+	.0976886i	0.965675
0.960721	-	.0976886i	0.965675
0.878421			0.878421
0.388285	+	.259054i	0.46677
0.388285	-	.259054i	0.46677
0.361121			0.361121
-0.23539	+	.103676i	0.257207
-0.23539	-	.103676i	0.257207

-0.11014			0.110142

Source: Authors' calculation (2026)

The VAR stability test results show that all characteristic roots (eigenvalues) have moduli less than one, indicating that the dynamic system implied by the model is stable. This implies that the response of the variables to shocks will tend to return to their equilibrium paths rather than diverging over time, so the model is suitable for subsequent analyses such as VECM, impulse response functions, and forecast error variance decomposition.

Assessing stability by examining the location of the characteristic roots relative to the unit circle is a standard procedure in VAR/VECM modeling to ensure the validity of inference and the reliability of forecasting results, as recommended in the time-series econometrics literature, including Gujarati (2003) & Stock and Watson, and Seddighi (2013).[21]

Johansen Cointegration Test and ARDL Bounds Test

Johansen Cointegration Test

Since the variables exhibit different orders of integration, the next step is to examine whether a long-run equilibrium relationship exists among them. This study employs the Johansen cointegration test, which is appropriate for multivariate time-series models such as the VECM. The existence of cointegration indicates that although the variables may deviate from equilibrium in the short run, they move together over the long run. The results of the Johansen cointegration test are presented in Table 5.

Table 5. Johansen Cointegration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	Critical value 5%	Conclusion
None	0.299	117.90	68.52	Reject H0, there is ≥ 1 cointegrating vector
At most 1	0.147	54.47	47.21	Reject H0, there is ≥ 2 cointegrating vectors
At most 2	0.085	25.97	29.68	Fail to reject H0
At most 3	0.048	10.03	15.41	Fail to reject H0
At most 4	0.006	1.10	3.76	Fail to reject H0

Source: Authors' calculation (2026)

The Johansen cointegration test results indicate that the trace statistics for the hypotheses "None" and "At most 1" exceed the 5 percent critical values, so the null hypotheses of no cointegration and of at most one cointegrating vector are rejected. This implies the existence of at least two cointegrating vectors in the system, while for the hypotheses "At most 2" and higher the trace statistics fall below the critical values, so the corresponding null hypotheses cannot be rejected.

Accordingly, there is strong evidence of long-run equilibrium relationships among the variables in the model, making cointegration-based approaches such as VECM and ARDL with an error-correction term appropriate to capture both short-run dynamics and long-run linkages among inflation, oil prices, imports, the exchange rate, and the BI Rate. This framework is consistent

21 Gujarati, (2003); Stock and Watson, *Intoducción a La Econometría*.; Hamid Seddighi, *Introductory Econometrics*, *Introductory Econometrics*, 2013, https://doi.org/10.4324/9780203157688.

with time-series modeling methodology that uses unit root and cointegration test results as the basis for choosing between VAR in differences, VECM, or ARDL when dealing with a combination of I(0) and I(1) variables.

ARDL Bounds Test

As a robustness check, the Autoregressive Distributed Lag (ARDL) model was estimated to validate the long-run and short-run relationships identified by the VECM. The ARDL approach is particularly suitable for models containing variables integrated of order I(0) and I(1), provided that none of the variables is integrated of order I(2). By estimating both the long-run coefficients and the associated error-correction model, the ARDL framework provides an additional assessment of the stability and consistency of the estimated relationships. The estimation results are presented in Table 6.

Table 6. Results of ARDL Estimation. Dependent Variable: Inflation (INF)

Long Run Variable	Coefficient	Prob.	Short Run Variable	Coefficient	Prob.
INF_{t-1}	0.8628743***	0.000	C	-0.0419	0.469
OIL_t	0.0710152	0.806	ΔINF_{t-1}	-0.0706	0.362
EXR_t	-0.6513851	0.118	ΔOIL_{t-1}	0.0007	0.939
BIR_t	0.7652983**	0.02	ΔEXR_{t-1}	-1.9659	0.397
BIR_{t-1}	-0.7183745**	0.025	ΔBIR_{t-1}	0.4452	0.151
IMP_t	-0.0081206	0.984	ΔIMP_{t-1}	0.763	0.117
C	6.219414	0.101	ECT(-1)	-0.0305	0.156
R-squared	0.8726		R-squared	0.8726	
F-statistic	196.41		F-statistic	196.41	
Prob(F-statistic)	0.0000		Prob(F-statistic)	0.0000	

Source: Authors' calculation (2026)

Note(s): *** p<0.01, ** p<0.05, * p<0.1*

Based on the ARDL estimation results, inflation dynamics in Indonesia exhibit a highly persistent behavior, as reflected by the coefficient on lagged inflation INFt−1 of 0.8629, which is strongly significant at the 1 percent level. In addition, the BI Rate plays an important role in the monetary policy transmission mechanism: an increase in the policy rate in the current period tends to raise inflation in the very short run, but this is followed by a dampening effect on inflation in the subsequent period, as indicated by a positive and significant contemporaneous coefficient on BIRt and a negative and significant coefficient on BIRt−1. Meanwhile, world oil prices, the exchange rate, and imports do not appear to have a directly significant short-run impact once other variables are controlled for, although they may still matter through long-run relationships embedded in the cointegrating structure and the error-correction component. Overall, the high R-squared, significant F-statistic, and relatively low root MSE suggest that the chosen ARDL specification adequately captures inflation behavior and provides a sound basis for formulating an ECM that consistently separates short-run and long-run effects in line with the modern time-series methodological framework.

VECM Test Results

Long-Run VECM Coefficients (Normalized on Inflation)

Having established the existence of cointegration among the variables, the next step is to estimate the long-run equilibrium relationship using the Vector Error Correction Model (VECM). The long-run coefficients indicate the direction and magnitude of the equilibrium relationship between inflation and its explanatory variables after controlling for short-run fluctuations. In this study, the cointegrating equation is normalized on inflation, allowing the long-run effects of world oil prices, the exchange rate, the BI Rate, and imports on inflation to be interpreted directly. The estimation results are presented in **Table 7**.

Table 7. Long-Run VECM Coefficients (Normalized on Inflation)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
INF	1,000	–	–	–
OIL	-0.223	0.029	−9.10	0,000
EXR	−16.963	3.091	−5.97	0,000
BIR	-0.063	0.265	-0.48	0,629
IMP	26.425	3.192	8.28	0,000
Constant	−80.537	–	–	

Source: Authors' calculation (2026)

The long-run VECM estimates reveal that world oil prices, the exchange rate, and imports have statistically significant long-run relationships with inflation, whereas the BI Rate does not exhibit a significant long-run effect. Specifically, oil prices and the exchange rate are negatively associated with inflation, while imports have a positive and relatively large coefficient, suggesting that import activities constitute an important channel through which external shocks are transmitted to domestic prices. By contrast, the BI Rate is statistically insignificant, indicating that policy interest rate adjustments do not play a dominant role in determining long-run inflation dynamics over the sample period. Overall, these findings confirm the existence of a stable long-run equilibrium relationship among the variables and provide the basis for examining the short-run adjustment process in the subsequent VECM analysis.

Short-Run Adjustment Coefficients (α - Speed of Adjustment)

Following the estimation of the long-run equilibrium relationship, the short-run dynamics were examined through the adjustment coefficients of the VECM. These coefficients capture the immediate responses of inflation to changes in the explanatory variables, while the error correction term (ECT) measures the speed at which short-run deviations from the long-run equilibrium are corrected. A negative and statistically significant ECT indicates that the system converges toward its long-run equilibrium following a temporary shock. The estimated short-run adjustment coefficients are presented in Table 8.

Tabel 8. Short-Run Adjustment Coefficients (α - Speed of Adjustment)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ECT_{t-1} (_ce1_{t-1})	−0.0305	0.0215	−1.42	0.156
ΔINF_{t-1}	−0.0706	0.0774	−0.91	0.362
ΔOIL_{t-1}	0.0007	0.0098	0.08	0.939

ΔEXR_{t-1}	−1.9659	2.3191	-0.85	0.397
ΔBIR_{t-1}	0.4452	0.3099	1.44	0.151
ΔIMP_{t-1}	0.7630	0.4871	1.57	0.117
Constant	−0.0419	0.0579	−0.72	0.469

Source: Authors' calculation (2026)

In the long run, the VECM results indicate a strong equilibrium relationship between inflation and oil prices, the exchange rate, and imports, as reflected in the negative and statistically significant coefficients on OIL and EXR and the positive and statistically significant coefficient on IMP, while the BI Rate does not have a significant effect in the cointegrating equation, implying that the policy interest rate does not play a dominant role in the long-run relationship. In the short run, the adjustment of inflation toward deviations from the long-run equilibrium is relatively slow, as indicated by the error-correction term ECTt−1, which is negative at around −0.0295 and only marginally significant, whereas short-run changes in inflation and the other macroeconomic variables (ΔOIL, ΔEXR, ΔBIR, ΔIMP) are not statistically significant at conventional levels, suggesting that inflation dynamics are driven more by the gradual correction toward the long-run relationship than by one-period shocks to each variable.

Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD)

Following the estimation of the long-run and short-run VECM coefficients, the dynamic effects of shocks among the variables were further examined using the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD). The IRF traces the response of inflation to a one-standard-deviation shock in each explanatory variable over time, while the FEVD quantifies the relative contribution of each variable to the forecast error variance of inflation across different forecast horizons. Together, these analyses provide a more comprehensive understanding of the persistence, magnitude, and transmission mechanisms of global oil price shocks within the VECM framework. The IRF results are presented in Figure 1, followed by the FEVD results in Table 9.

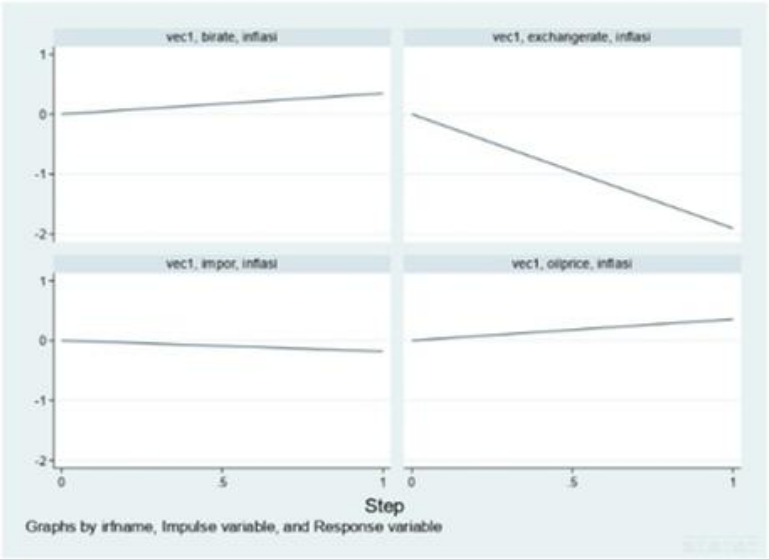

Figure 1. Impulse Response Function (IRF) of Inflation to Shocks in Oil Price, Exchange Rate, BI Rate, and Imports

Source: Authors' calculation (2026)

The response of inflation to a shock in the BI Rate shows only a modest change that persists for a few periods before converging back toward its initial level, implying that the interest-rate channel in this model has a temporary effect and does not permanently displace inflation from its equilibrium path. The response of inflation to a shock in the Rupiah exchange rate is likewise limited in magnitude and gradually decays toward zero, indicating that inflationary pressures arising from episodes of depreciation or appreciation of the currency are not sustained over the medium term. The response of inflation to an import shock exhibits relatively small fluctuations that dissipate quickly, suggesting that sudden changes in imports do not generate a permanent shift in the inflation rate over the sample period. The response of inflation to a shock in world oil prices follows a similar pattern, where an increase in oil prices triggers only a bounded and gradually vanishing effect on inflation, so that oil price shocks are essentially transitory and do not push inflation away from the identified long-run relationship.

Table 9. Forecast Error Variance Decomposition (FEVD) of Inflation

Period	Inflation	Oil price	exchange rate	BI Rate	Imports
1	100%	0.00%	0.00%	0.00%	0.00%
6	94.76%	1.85%	2.13%	0.76%	0.54%
12	92.15%	2.41%	3.05%	1.28%	1.11%
24	90.83%	2.67%	3.42%	1.51%	1.57%

Source: Authors' calculation (2026)

Note: FEVD shows the percentage contribution of each variable's shock to the variation in inflation over different forecast horizons. The results are based on the VECM estimation with monthly data from January 2010 to December 2024.

From the forecast error variance decomposition (FEVD), at various forecast horizons more than 90–95 percent of the variation in inflation is still accounted for by its own shocks. At the 24-month horizon, inflation's own shocks explain 90.83 percent of its forecast error variance, while shocks to oil prices contribute 2.67 percent, the exchange rate contributes 3.42 percent, the BI Rate contributes 1.51 percent, and imports contribute 1.57 percent. This pattern indicates that inflation dynamics in the estimated VECM are driven mainly by the internal persistence of inflation (own shocks), whereas external shocks associated with oil prices, the exchange rate, monetary policy, and imports play a relatively minor role in explaining the forecast error variance of inflation over the observation period.

Transmission mechanism of global oil price shocks to inflation through exchange rate, BI Rate, and import channels

The results show that global oil price shocks no longer translate directly into large and persistent inflation spikes in Indonesia, but instead produce moderate and temporary responses.[22] This marks an important shift from the classical oil crisis narrative where rising oil prices meant prolonged high inflation.[23] The VECM results partially support H1, showing significant long-run transmission from oil prices, exchange rates, and imports to inflation. However, the negative coefficients for oil prices (-0.223) and exchange rates (-16.963) contradict conventional theory.

22 Bella Clarisa Meylani and Paiman Eko Prasetyo, "The Impact of International Crude Oil Prices on the Monetary Sector in Indonesia," *International Journal of Sustainable Development and Planning* 18, no. 6 (2023): 1707–14, https://doi.org/10.18280/ijsdp.180606.

23 Rina Juliet Artami and Yonosuke Hara, "The Asymmetric Effects of Oil Price Changes on the Economic Activities in Indonesia," *Signifikan: Jurnal Ilmu Ekonomi* 7, no. 1 (2018): 59–76, https://doi.org/10.15408/sjie.v7i1.6052.

H2 is not proven since no channel dominates (each contributes less than 5% in FEVD). H3 is proven through two cointegrating vectors indicating a long-run equilibrium among variables.

In the long run, the VECM shows a cointegrating relationship between inflation, oil prices, exchange rates, and imports, while the BI Rate is not significant[24] The oil price coefficient of -0.223 (significant at α=1%) suggests that higher oil prices correlate with lower inflation in the long run. This may be explained by an income effect where rising oil prices reduce purchasing power (as a net importer), suppressing aggregate demand and inflation. Fiscal policy responses (energy subsidies) and proactive monetary policy may have also dampened cost pressures. The import coefficient of 26.425 (significant at α=1%) shows a strong positive influence on long-run inflation, consistent with imported inflation.

In the short run, the error correction term (ECT) is small (-0.0305) and not significant (p=0.156). None of the short-run variables (ΔOIL, ΔEXR, ΔIMP, ΔBIR) are significant at the 5% level. This means inflation dynamics are more driven by adjustment toward long-run equilibrium than by oil price shocks in a single period, so short-run effects are limited.

The IRF analysis reinforces that transmission of oil price shocks to inflation is limited and temporary. Inflation responses to shocks in oil prices, exchange rates, BI Rate, and imports are all moderate and return to zero (mean-reverting) within a few periods. This indicates that Indonesia's economy has a strong adjustment mechanism, preventing external shocks from becoming persistent deviations. This moderate response likely reflects stronger macroeconomic foundations and effective monetary policy in anchoring inflation expectations.

Significance and dominance of each transmission channel's influence

The FEVD results show that over 90% of inflation variation (at the 24-period horizon) is explained by inflation's own shocks. The contributions of oil price, exchange rate, BI Rate, and import shocks are each less than 4%.[25] Thus, although global oil prices remain relevant as an external pressure source, their role is more complementary than a main determinant of Indonesia's inflation volatility. These results align with cross-country studies in Asia showing incomplete transmission of oil price shocks, highly dependent on the shock source. SVAR studies on ASEAN and Asia-Pacific countries prove that supply-side vs demand-side oil shocks have significantly different impacts on financial stability, with responses weakening after the global financial crisis. Oil price pass-through in emerging Asia is generally less than one-to-one, with larger long-run magnitudes but a declining trend after 2008. Aharon et al[26] and Husaini and Lean[27] confirm that oil price shocks still significantly affect inflation in Asian countries, but the impact has been reduced due to stronger inflation targeting frameworks, energy diversification, and increased monetary policy credibility.

Thus, Indonesia remains vulnerable to global oil price shocks as a net importer, but with higher resilience than before, characterized by moderate, temporary inflation responses dominated by internal factors (inflation inertia). Policy implications include maintaining monetary policy credibility, exchange rate stability, and strengthening energy import management so that oil price shocks remain managed and do not become prolonged inflation pressure.

24 Meylani and Prasetyo, "The Impact of International Crude Oil Prices on the Monetary Sector in Indonesia."

25 Meylani and Prasetyo.

26 Aharon, Azman Aziz, and Kallir, "Oil Price Shocks and Inflation: A Cross-National Examination in the ASEAN5+3 Countries."

27 Dzul Hadzwan Husaini and Hooi Hooi Lean, "Asymmetric Impact of Oil Price and Exchange Rate on Disaggregation Price Inflation," *Resources Policy* 73, no. December 2020 (2021): 102175, https://doi.org/10.1016/j.resourpol.2021.102175.

Long-run relationships among variables

The exchange rate channel describes how Rupiah depreciation from rising oil prices creates inflationary pressure through incomplete exchange rate pass-through, where exchange rate weakening amplifies oil price shocks. This aligns with findings that changes in oil prices and exchange rates significantly impact inflation, so exchange rate stability is key to dampening transmission.[28]

The incomplete and asymmetric pass-through characteristics align with Widarjono,[29] who found that in ASEAN-3 countries, exchange rate changes are only partially passed through to consumer prices, but depreciation pushes inflation more strongly than appreciation reduces it.

However, the long-run VECM shows an exchange rate coefficient of -16.963 (statistically significant). This negative sign is interesting and does not fully align with conventional ERPT theory. In the 2010–2024 context, this may mean Rupiah depreciation is actually followed by lower inflation in the long run. Possible mechanisms: (1) excessive depreciation (overshooting) triggers tight monetary policy (higher BI Rate) which dampens inflation; (2) depreciation boosts exports and growth, creating price stability; or (3) structural breaks or policy regime changes affect the dynamic relationships.

Nevertheless, inflation responses are moderate and not prolonged, reflecting monetary policy credibility, a stronger inflation targeting framework, and exchange rate stabilization efforts. This aligns with Buana and Pradhani that increased monetary policy credibility reduces inflation persistence in Indonesia.[30] Unlike Mufarrikhah (2024) who used ECM and found oil insignificant in the long run, this study's VECM captures multi-channel simultaneity with a significant exchange rate coefficient of -16.963.

Theoretically, this pattern aligns with the Mundell-Fleming framework and Dornbusch's overshooting concept, where external shocks like rising oil prices trigger exchange rate depreciation beyond fundamentals in the short run before correcting to a new equilibrium. For Indonesia as a net oil importer, the combination of higher oil import bills and Rupiah depreciation channels global inflation pressures domestically, but effects can be suppressed when the central bank has credibility and manages expectations.

Empirically, exchange rate shocks do affect inflation, but their contribution to inflation variation still lags behind inflation's own shocks. Thus, the exchange rate channel remains relevant but acts more as an amplifier of cost pressures in the short run than a main determinant of long-run inflation.[31]

The import channel operates through higher costs of imported goods, especially energy and intermediate inputs, when oil prices rise and the Rupiah weakens, driving up production and distribution costs. The import coefficient of 26.425 (significant at α=1%) confirms imports as a strong transmission channel. Given Indonesia's dependence on imports for raw materials and consumer goods, higher import costs quickly accumulate into production costs and are reflected in producer and consumer prices.

28 Tata Fransiska Putri, "Pengaruh Inflasi terhadap Pertumbuhan Ekonomi di Indonesia Tahun 2022 Hingga 2024," *Jurnal Intelek Insan Cendikia,* 1, no. 7 (2024).

29 Agus Widarjono et al., "The Asymmetric Exchange Rate Pass-Through To Inflation In The Selected Asean Countries," *Buletin Ekonomi Moneter Dan Perbankan/Monetary and Banking Economics Bulletin* 26, no. 1 (2023): 105–24, https://doi.org/10.59091/1410-8046.2047.

30 Tri Buana and Wira Pradhani, "The Effect of Monetary Policy Credibility on The Volatility of BI Rate and Persistence of Inflation (A Case Study Towards The Inflation Targeting Regime in Indonesia) SCIENTIFIC JOURNAL," 2017.

31 Husaini and Lean, "Asymmetric Impact of Oil Price and Exchange Rate on Disaggregation Price Inflation."

Imports act as a channel absorbing the combination of oil and exchange rate shocks before pressures emerge as price increases, forming an imported inflation mechanism. Thus, every episode of rising oil prices with Rupiah weakening can increase cost pressures, though not always directly as core inflation spikes. However, FEVD shows import shocks contribute less than 2% to inflation variation at the 24-period horizon. This means imports are an important long-run channel but play a limited role in explaining monthly inflation fluctuations. The BI Rate channel represents Bank Indonesia's response to inflationary pressures from oil and exchange rate shocks through policy interest rate adjustments within the inflation targeting framework. Theoretically, higher policy rates should stabilize inflation expectations, attract capital inflows to stem Rupiah depreciation, and reduce aggregate demand to prevent second-round effects.

Data for 2010–2024 shows the BI Rate fluctuated between 3.50–7.50% in response to inflation. However, VECM results show the BI Rate is not significant in the long-run equilibrium (coefficient -0.063, p=0.629) and does not appear in the cointegrating vector. Short-run effects are also weak and insignificant. This suggests interest rate adjustments function more as a very short-run stabilization tool than a determinant of long-run inflation trends.

This finding aligns with modern macroeconomic studies highlighting monetary policy trade-offs, where overly aggressive rate hikes can increase production costs and weaken real activity, potentially strengthening inflation through the cost channel. Therefore, Bank Indonesia must calibrate interest rate policy carefully, considering interactions between oil shocks, exchange rates, and import costs so monetary responses dampen shocks without creating new distortions [32]. A concrete implication is that Bank Indonesia can prioritize Rupiah exchange rate stabilization over aggressive BI Rate hikes, given the slow error correction mechanism (-0.0305) and the BI Rate's insignificance in the long run (p=0.629), while simultaneously diversifying energy sources and improving import efficiency.

The findings of this study provide several implications for inflation management in Indonesia. Since inflation dynamics are largely driven by inflation inertia, maintaining well-anchored inflation expectations should remain a key priority for monetary authorities. Although global oil price shocks, exchange rate movements, and imports exhibit significant long-run relationships with inflation, their short-run effects are relatively limited. Therefore, policy responses should focus not only on mitigating external shocks but also on strengthening domestic macroeconomic stability through credible monetary policy, effective policy communication, and measures that enhance the resilience of the exchange rate against external volatility.

Furthermore, the positive long-run effect of imports suggests that reducing dependence on imported energy and intermediate goods could help alleviate inflationary pressures over time. Strengthening coordination between monetary and fiscal authorities, improving supply chain efficiency, and promoting energy diversification would enhance the economy's resilience to global commodity price fluctuations. These measures would not only mitigate the transmission of external shocks but also contribute to maintaining long-run price stability and supporting sustainable economic growth.

CONCLUSION

This study demonstrates that the transmission of global oil prices to inflation in Indonesia is predominantly a long-run phenomenon rather than an immediate short-run process. The existence of two cointegrating vectors confirms that inflation, world oil prices, the Rupiah exchange rate, imports, and the BI Rate move together toward a long-run equilibrium despite

32 Buana and Pradhani, "The Effect of Monetary Policy Credibility on The Volatility of BI Rate and Persistence of Inflation (A Case Study Towards The Inflation Targeting Regime in Indonesia) SCIENTIFIC JOURNAL."

temporary fluctuations. The findings indicate that imports constitute the primary transmission channel through which external shocks influence inflation, reflecting Indonesia's dependence on imported energy and production inputs. In contrast, the negative long-run relationships observed for world oil prices and the exchange rate suggest that the effects of external shocks are moderated by domestic economic adjustments and policy interventions rather than being transmitted directly to consumer prices. Furthermore, the absence of significant short-run effects implies that inflation dynamics in Indonesia are largely driven by domestic inflation persistence instead of immediate responses to global oil price shocks, highlighting the importance of structural factors in shaping long-run inflation behavior.

This study contributes to the literature by integrating the exchange rate, BI Rate, and import channels within a single VECM framework, providing a more comprehensive understanding of the multidimensional transmission mechanism of global oil prices to inflation in Indonesia. Nevertheless, several limitations should be acknowledged. The analysis is limited to four transmission variables and does not explicitly consider other macroeconomic factors, such as fiscal policy, energy subsidies, money supply, or global supply chain disruptions, which may also influence inflation dynamics. In addition, the use of aggregate national data may conceal sectoral differences in the transmission process. Future research is therefore encouraged to incorporate additional macroeconomic variables, distinguish between different types of oil price shocks, and employ sectoral or regional data to provide a more comprehensive explanation of inflation dynamics and strengthen policy recommendations.

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