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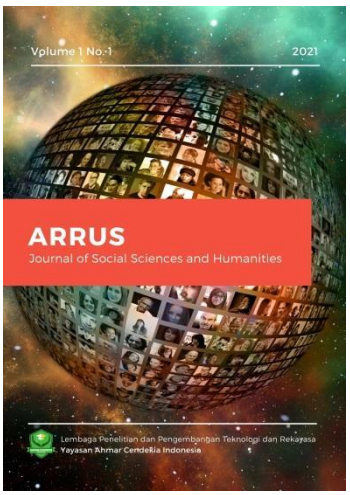

RESEARCH ARTICLE

An Applied Economic Analysis of Monetary Policy Transmission Channels and Inflation Control in Indonesia

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Abstract: This study analyzes the effectiveness of monetary policy transmission channels in controlling inflation in Indonesia using a Vector Autoregression model. Monthly data from December 2005 to March 2025 include the Federal Funds Rate, Bank Indonesia's policy rate, inflation, and exchange rate. The results show that Bank Indonesia's policy rate responds to inflationary pressures within two to four months, while exchange rate movements affect imported inflation within three to seven months. The Federal Funds Rate has fluctuating effects on the exchange rate and inflation, emphasizing the importance of monitoring monetary spillovers. Granger causality results indicate that the BI Rate is the only variable with significant predictive power for the exchange rate at the 5 percent level. Indonesian inflation exhibits strong short term persistence, with shocks remaining the main source of forecast error variance. Over six to ten months, shocks to the BI Rate and Federal Funds Rate jointly explain 20 to 30 percent of inflation variance. FEVD results show that exchange rate pass through is not dominant, although it remains relevant for mitigating imported inflation risks. These findings emphasize the need to accelerate monetary transmission, deepen domestic financial markets, and strengthen coordination between fiscal and monetary authorities to maintain price stability.

Keywords: BI Rate, Exchange Rate, Federal Funds Rate, Monetary Policy Transmission, Vector Autoregression.

1. Introduction

Price stability is a fundamental foundation for sustaining national economic growth. Through monetary policy, central banks seek to control inflation and maintain macroeconomic stability. The effectiveness of monetary policy in preserving price stability is largely determined by its responsiveness to economic dynamics, the adoption of an inflation-targeting framework, and coordination with fiscal and financial-sector policies. Bank Indonesia (BI) has implemented an inflation-targeting framework since 1999. However, structural constraints and external shocks continue to test the capacity of this framework to mitigate inflationary pressures (Bank Indonesia, 2022; Ocampo & Ojeda-Joya, 2022). BI plays a crucial role in controlling inflation and preventing deflation, both of which represent serious threats to a country's monetary system. High inflation can erode household purchasing power, whereas prolonged deflation may reduce aggregate demand, investment, and overall economic activity. Therefore, the effectiveness of monetary policy transmission, defined as

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the process through which policy decisions affect macroeconomic variables, is essential for maintaining a balance between these two risks (Mishkin, 1995).

The development of inflation theory over recent decades has provided an analytical framework for understanding the causes of inflation and the mechanisms through which it can be addressed. Classical and monetarist theories emphasize the direct relationship between money supply growth and inflation (Friedman, 1963), while modern Keynesian theory highlights the role of aggregate demand and inflation expectations. In the twenty-first century, New Keynesian theory has incorporated price rigidities and rational expectations into the design of monetary policy (Clarida et al., 1999). These theoretical developments provide the foundation for a more complex understanding of monetary policy transmission channels, particularly in developing and emerging economies where inflation may be influenced simultaneously by domestic demand conditions, supply-side disturbances, exchange-rate movements, and global financial shocks (Ha et al., 2025; Ocampo & Ojeda-Joya, 2022).

The monetary policy transmission mechanism operates through several main channels, including interest rates, exchange rates, financial markets, and credit access. Each channel has a different level of effectiveness in controlling inflation. An increase in the policy rate, for example, is intended to suppress consumption and investment demand. However, market responses are often constrained by the structure of the domestic economy, which remains significantly influenced by the informal sector. Exchange-rate depreciation triggered by capital outflows may generate imported inflation, while limited domestic financial-market depth can weaken the effectiveness of the interest-rate, credit, and capital-market channels. The relationship between exchange-rate movements and inflation may also be nonlinear because the degree of pass-through depends on inflation expectations, macroeconomic conditions, trade openness, and the characteristics of domestic price formation (Anderl & Caporale, 2023; Phuc & Duc, 2021). In periods of deflation, however, expansionary monetary policy, such as policy-rate cuts or asset purchases through quantitative easing, may be required to stimulate demand. Market responses to such policies are not always linear, as they are shaped by inflation expectations, the behavior of economic agents, and the depth of domestic financial markets (Montiel, 1999).

In Indonesia, coordination between monetary and fiscal policy, as well as price interventions for strategic commodities, also influences the dynamics of monetary policy transmission (Bank for International Settlements, 2020; International Monetary Fund, 2021). Structural factors within the domestic economy, such as banking-sector depth, financial inclusion, and the efficiency of goods distribution, further affect transmission effectiveness. In addition, the large informal sector and dependence on imported strategic commodities make monetary policy more vulnerable to local distortions. Food and energy price volatility caused by supply disruptions may limit the ability of monetary authorities to control headline inflation, particularly when inflationary pressure originates from the supply side rather than aggregate demand (Ocampo & Ojeda-Joya, 2022).

The effectiveness of monetary policy also depends on the interaction between conventional and macroprudential instruments. In Indonesia, macroprudential policies may complement interest-rate policy by moderating credit growth and reducing financial-system vulnerabilities. Evidence based on a structural VAR model indicates that loan-to-value policy in Indonesia can restrain credit growth in the medium term, although its effects on other macroeconomic variables may vary (Dąbrowski & Widiantoro, 2023). More broadly, the interaction between monetary policy, exchange-rate arrangements, capital mobility, and macroprudential policies is important for emerging markets facing external financial shocks (Juhro et al., 2024). The transmission mechanism is also shaped by banking-sector conditions because changes in policy rates may influence lending through bank capital, liquidity, and balance-sheet channels (Mohammad & Khan, 2024).

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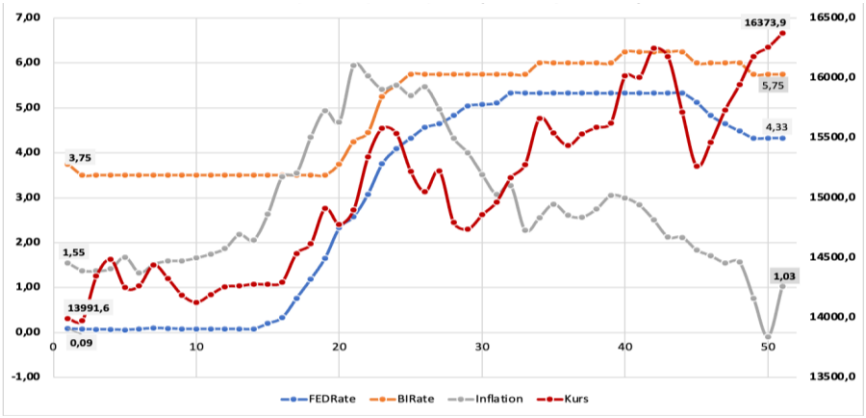
External conditions, including global oil-price volatility, United States monetary policy, and foreign capital flows, also pose significant challenges. Exchange-rate depreciation caused by capital outflows can trigger imported inflation, whereas global crises, such as pandemics or trade wars, may generate deflationary pressures through weakening international demand. US monetary-policy shocks can propagate internationally through financial-market adjustments, changes in capital flows, and exchange-rate pressures (Ha, 2021). The identification of such shocks is also important because changes in the Federal Funds Rate may reflect unexpected monetary-policy actions rather than merely anticipated policy adjustments or information effects (Bu et al., 2021). Recent evidence from emerging Asia further indicates that exchange-rate pass-through is influenced by global shocks, including oil-price changes, global output conditions, US monetary policy, and financial-market uncertainty (Beirne et al., 2024).



Source: Statistics Indonesia (BPS), Bank Indonesia, and the World Bank (2025)

Figure 1. Trends in the Federal Funds Rate, Bank Indonesia Policy Rate, Inflation, and Exchange Rate, December 2005–March 2025

Figure 1 presents the trends in the Federal Funds Rate, Bank Indonesia policy rate, inflation, and the IDR/USD exchange rate. Over the last five years, from 2021 to March 2025, the exchange rate increased by 17%. During the same period, the Federal Funds Rate rose by 4.25 percentage points, while Bank Indonesia's policy rate increased by 2 percentage points. Meanwhile, inflation declined by 0.25 percentage points, indicating deflationary pressure during the period. Policy coordination between monetary and fiscal authorities is a key determinant in strengthening the effectiveness of monetary policy transmission. In the Indonesian context, energy subsidy programs and government interventions in food prices often create a trade off between short term price stability and long term fiscal sustainability. Without optimal policy synergy, monetary policy may face limitations in effectively controlling inflation or preventing deflation (Bank Indonesia, 2022).

Evidence from ASEAN also suggests that exchange-rate pass-through is neither uniform nor necessarily symmetric. Anh et al. (2021) find that the exchange-rate channel remains important across ASEAN countries, although the magnitude and persistence of pass-through differ across national economies. Similarly, Widarjono et al. (2023) show that depreciation tends to exert a stronger effect on inflation than appreciation in Indonesia, Malaysia, and the Philippines, with Indonesia exhibiting the highest degree of long-run pass-through among the countries examined. These findings imply that exchange-rate management remains relevant for mitigating imported inflation risk, even when pass-through is incomplete.

Recent evidence shows that the impact of BI policy instruments may differ across financial-market segments. Sugandi (2022) finds that the BI 7-Day Reverse Repo Rate, reserve-requirement policies, and monetary operations influenced Indonesian money, bond, and foreign-exchange markets differently during the pandemic period. This highlights the importance of analysing monetary transmission not only through the policy-rate channel but also through the interaction between financial-market conditions, exchange-rate movements,

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and external shocks. Improving the effectiveness of monetary policy transmission therefore requires policy innovation that accounts for structural dynamics and external risks. Strengthening domestic financial markets, developing macroprudential instruments, and improving transparency in policy communication should become key priorities.

Recent empirical studies have examined monetary policy transmission in Indonesia through different channels, policy settings, and methodological approaches. Handayani & Kacaribu (2021) investigated the asymmetric transmission of monetary policy to money-market, deposit, and lending rates following the transition to the BI 7-Day Reverse Repo Rate framework. Their study demonstrated that the transmission of policy-rate changes to financial-sector interest rates may differ across instruments and adjustment periods. Arintoko & Kadarwati (2022) further examined the response of Indonesian monetary policy to macroeconomic shocks through a Vector Error Correction Model (VECM), impulse response functions, and forecast error variance decomposition. Their study focused on the response of monetary policy to domestic macroeconomic shocks, particularly inflation, output, and exchange-rate movements.

Other recent studies have adopted more complex dynamic approaches to assess Indonesian monetary and macro financial policy. Budiman et al. (2022) employed an estimated DSGE-VAR framework to evaluate the effectiveness of monetary and macro-financial policy responses during the COVID-19 pandemic. Meanwhile, Soedarmono et al. (2023) revisited the bank-lending channel by examining the interaction between monetary policy, funding liquidity, and undisbursed loans in Indonesia. Dąbrowski & Widiantoro (2023) examined the role of macroprudential policy in controlling credit growth and property-price developments, while Sugandi (2022) focused on the interaction between BI policy instruments and financial-market dynamics during the pandemic. These studies demonstrate that monetary-policy transmission in Indonesia has been examined through different channels and dynamic econometric approaches.

Comparable evidence from emerging Asian economies provides useful benchmarks for interpreting monetary-policy transmission in Indonesia. Bhatia (2023) showed that accommodative monetary policy in India can strengthen bank profitability and capital, thereby expanding credit supply and influencing broader economic activity. At the regional level, Beirne et al. (2023) used an SVAR model to demonstrate that monetary policy shocks from the United States and China affect output, inflation, and external sector conditions in Asian economies. Similarly, Parmanand (2022) found that US interest rates and oil prices influence domestic monetary-policy transmission to prices, output, credit, and exchange rates in the Philippines, while H. Li et al. 2021) identified distinct asset-price, credit, interest-rate, and exchange-rate channels in China. Previous studies further indicate that exchange-rate pass-through in Asia is shaped by domestic macroeconomic conditions and exposure to global shocks (Anh et al., 2021; Beirne et al., 2024; Phuc & Duc, 2021).

Taken together, these studies demonstrate that the timing and relative strength of monetary-policy transmission channels vary across emerging markets. These differences are shaped by financial-market depth, banking-sector structure, exchange-rate regimes, inflation expectations, and exposure to external shocks. For Indonesia, the evidence suggests that external monetary conditions should be analysed alongside domestic policy instruments rather than in isolation. This perspective is particularly relevant because changes in the Federal Funds Rate can affect capital flows, exchange-rate pressures, and imported inflation. The emerging-market literature also warns that standard monetary-policy models may generate price and foreign-exchange puzzles when they do not fully account for forward-looking expectations and the endogenous nature of monetary-policy responses (Ha et al., 2025).

Therefore, the novelty of the present study does not lie in introducing the VAR model as a new method for analysing monetary policy transmission in Indonesia. Rather, its contribution lies in integrating the Federal Funds Rate, Bank Indonesia policy rate, inflation, and the

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IDR/USD exchange rate within one monthly dynamic system covering December 2005 to March 2025. This integrated specification is important because Indonesia, as an open emerging economy, is affected not only by domestic inflationary pressures and domestic policy adjustments but also by global monetary conditions, particularly changes in the Federal Funds Rate that may influence capital flows, exchange-rate volatility, and imported inflation.

Furthermore, this study uses monthly observations from December 2005 to March 2025. This period captures several major domestic and international economic episodes, including the global financial crisis, the tapering episode, exchange-rate pressures associated with global monetary tightening, the COVID-19 pandemic, and the post-pandemic inflationary period. Compared with studies using shorter periods, quarterly observations, or a focus on individual monetary transmission channels, the longer monthly dataset enables the analysis to identify relatively short policy-response lags and dynamic interactions among domestic and external monetary variables.

By applying the VAR model, Impulse Response Function (IRF), and Forecast Error Variance Decomposition (FEVD), this study examines the timing and persistence of responses among the Federal Funds Rate, Bank Indonesia policy rate, inflation, and the IDR/USD exchange rate. The analysis also assesses the relative contribution of domestic and external monetary shocks to inflation dynamics in Indonesia. Accordingly, the study provides updated empirical evidence on how global monetary conditions, domestic monetary-policy responses, exchange-rate movements, and inflation interact within the Indonesian economy.

Based on the background above, this study formulates the following research questions:

(1). What are the characteristics and dynamics of monetary policy in controlling inflation in relation to the Federal Funds Rate, Bank Indonesia policy rate, and exchange rate?
(2). How have inflation theory and monetary policy evolved over time?
(3). Which monetary policy transmission channels are effective in controlling inflationary fluctuations based on the Federal Funds Rate, Bank Indonesia policy rate, and exchange rate in the Indonesian context?

2. Literature Review

Modern monetary policy in Indonesia and other countries places price stability as a primary objective through an inflation targeting approach. The effectiveness of this policy depends on its responsiveness to economic dynamics, including the use of the benchmark policy rate, open market operations, and reserve requirement ratios to adjust liquidity conditions. Synergy with fiscal and sectoral policies is also crucial, particularly through collaboration between Bank Indonesia and the government in controlling the prices of strategic commodities through subsidies or direct intervention. Structural challenges, such as a large informal sector, import dependence, and limited financial market depth, combined with external pressures from global commodity price volatility and monetary policy decisions in advanced economies, further complicate Bank Indonesia's efforts to maintain inflation stability.

Since 1999, Bank Indonesia has adopted this strategy by setting annual inflation targets that are publicly announced in a transparent manner. This approach aims to strengthen policy credibility and anchor public inflation expectations. Inflation targets are generally formulated within a certain range, for example 3 ± 1%, to provide flexibility in responding to temporary shocks while maintaining medium term price stability (Bank Indonesia, 2022). Another important characteristic of monetary policy is its ability to respond quickly and flexibly to changing economic conditions. Bank Indonesia employs various instruments, including the BI 7-Day Reverse Repo Rate, open market operations, and the reserve requirement ratio, to adjust liquidity in the financial system. This responsiveness was tested during crises, such as the COVID-19 pandemic, when Bank Indonesia significantly lowered interest rates and intensified market interventions to prevent deflation and maintain financial system stability (Bank for International Settlements, 2020). However, the effectiveness of such responses is

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often constrained by the complexity of the domestic economic structure and global uncertainty.

Monetary policy does not operate in isolation; synergy with fiscal and sectoral policies is essential for achieving macroeconomic stability. In the Indonesian context, Bank Indonesia works closely with the government to control inflation through interventions in the prices of strategic commodities, such as rice and fuel, as well as through subsidy programs. This coordination helps reduce short term inflationary pressures without undermining fiscal balance. Nevertheless, differences in policy priorities between the central bank, which focuses on price stability, and the government, which emphasizes growth and social welfare, may create trade offs that need to be carefully managed (International Monetary Fund, 2021). The effectiveness of key monetary policy characteristics, such as inflation targeting, policy responsiveness, and institutional coordination, cannot be separated from structural and external constraints. A large informal sector, import dependence, and limited financial market depth reduce the efficiency of monetary transmission channels. On the external side, global commodity price volatility, foreign capital flows, and monetary policy decisions in advanced economies, particularly those of the Federal Reserve, often increase the burden on Bank Indonesia in controlling domestic inflation (Mishkin, 1995). Therefore, policy adaptation that accounts for these dynamics is a priority for strengthening monetary transmission in the future.

The monetary policy transmission mechanism is often described as a complex "black box." This is because the transmission process is not always linear, as monetary policy decisions, such as changes in interest rates, affect macroeconomic variables, including inflation, through a series of interconnected channels (Mishkin, 1995). This uncertainty arises from three main factors that influence the effectiveness of transmission. First, the behavior of economic agents and institutions may change. The effectiveness of the transmission mechanism depends on how consumers, firms, investors, and financial institutions, including banks and financial markets, respond to monetary policy. Second, policy effects are subject to time lags. Transmission does not occur instantaneously. There are two types of lags: internal lag and external lag. Internal lag refers to the time required by the central bank to identify economic shocks and formulate policy responses, while external lag refers to the time between policy implementation and its impact on economic activity and inflation. According to Mishkin (1995), the external lag for the interest rate channel may reach 12 to 18 months, whereas the exchange rate and asset price channels may operate more quickly. This uncertainty requires central banks to act proactively, often by setting policy based on forecasts of future economic conditions. Third, monetary policy transmission channels, such as interest rates, exchange rates, financial markets, and credit access, are not static. Structural economic changes, such as the expansion of the informal sector or trade globalization, as well as financial innovation, including the emergence of digital currencies, may alter the way monetary policy affects the real economy (Bank for International Settlements, 1997).

The evolution of inflation theory and monetary policy dynamics has undergone significant transformation from the sixteenth century to the contemporary era. This development has been shaped by changing economic realities, global crises, and intellectual exchanges among different schools of thought. The historical trajectory reflects an ongoing intellectual debate among classical theory, the Keynesian revolution, monetarist critique, and modern experiments such as Modern Monetary Theory. The earliest understanding of inflation in the sixteenth to nineteenth centuries was rooted in the Quantity Theory of Money. This theory argues that price increases arise from an imbalance between the money supply and the volume of available goods, often described as too much money chasing too few goods. Bodin (1568) was among the first scholars to associate inflation in sixteenth century Europe with the inflow of gold from Latin America. Hume (1752) later extended this argument by emphasizing that an increase in the money supply leads to a proportional increase in prices in the long run.

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The classical formulation reached its peak in Irving Fisher's The Purchasing Power of Money (1911), which introduced the equation MV = PT, where the money supply multiplied by velocity equals prices multiplied by transactions. This theory became the foundation for monetary policy focused on controlling the money supply. However, it began to be questioned when major economic crises, particularly the Great Depression of 1929, revealed its limitations in explaining mass unemployment. In the 1930s, the Keynesian Revolution shifted the focus toward demand as a driver of inflation. John Maynard Keynes challenged the classical paradigm by emphasizing the role of aggregate demand in determining inflation. In The General Theory, Keynes argued that when an economy operates below full capacity, such as during a recession, increases in demand through consumption, investment, or government spending can stimulate economic growth without necessarily generating inflation (Keynes, 1936). However, when the economy reaches full capacity, inflation emerges as a result of excess demand, commonly referred to as demand-pull inflation.

Within the Keynesian perspective, conventional monetary policy was considered less effective than fiscal intervention, such as government stimulus. This approach dominated post-World War II economic policy until the 1970s. However, its dominance declined when stagflation, characterized by high inflation and high unemployment, disrupted the global economy following the 1973 oil crisis. The period from the 1950s to the 1970s marked a new phase involving the dual role of costs and money, as well as growing criticism of Keynesian economics. Two competing schools of thought emerged during this period. Cost push inflation theory, developed by Alfredo Stonier and other scholars, emphasized that inflation could also originate from the supply side, such as increases in wages, energy prices, or production costs. This explanation became particularly relevant during the oil crises of the 1970s, when rising global energy prices triggered imported inflation even amid recessionary conditions.

On the other hand, Friedman (1956) launched a strong critique of Keynesian economics through monetarism, arguing that inflation is always and everywhere a monetary phenomenon. He emphasized that controlling the money supply is the key to price stability, while fiscal intervention tends to create long-term distortions. Monetarist theory gained momentum when Paul Volcker, as Chair of the Federal Reserve, addressed the stagflation of the 1980s through tight monetary policy, although this policy came at the cost of a severe recession. The crises of the 1970s encouraged a synthesis between Keynesian and monetarist perspectives within the New Keynesian framework. This theory recognizes that prices and wages are sticky, meaning that inflation may arise from temporary disturbances in labor markets or production sectors. Central banks began to focus on core inflation by excluding temporary price fluctuations, such as those in energy prices, in order to assess medium-term inflation trends. Forward guidance and central bank credibility became central to monetary policy, as reflected in the practice of inflation targeting adopted by Bank Indonesia since 1999. This development marked a new stage in New Keynesian monetary policy.

Keynes argued that inflation arises when aggregate demand for goods and services exceeds the economy's available productive capacity. Inflation should be distinguished from isolated relative-price adjustments because it refers to a sustained and broad-based increase in the overall price level, whereas a temporary rise in the price of a particular good does not necessarily constitute inflation (Béland et al., 2024). The 2008 global financial crisis and the 2020 pandemic renewed debate over conventional monetary and fiscal policy frameworks, including Modern Monetary Theory (MMT). From the MMT perspective, governments that issue debt in their own sovereign currency are primarily constrained by real resource availability and inflation risks rather than by tax revenue or borrowing capacity alone (Ehnts, 2022). Accordingly, inflation may emerge when aggregate spending exceeds productive capacity, although this view remains contested in mainstream macroeconomic literature, particularly regarding its implications for fiscal discipline, monetary-policy independence, and financial stability (Drumetz & Pfister, 2021).

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The development of the Mundell Fleming framework also introduced the concept of the Mundell trilemma, or the impossible trinity. This concept states that a country cannot simultaneously achieve three objectives: full capital mobility, a fixed exchange rate, and independent monetary policy. Only two of these three objectives can be pursued at the same time. For example, if a country maintains a fixed exchange rate and allows high capital mobility, domestic monetary policy loses its autonomy due to global interest rate arbitrage pressures. The evolution of inflation theory reflects an ongoing struggle between two forces: mechanical determinism, which treats the money supply as the dominant explanatory variable, and institutional complexity, which emphasizes expectations, market structure, and fiscal policy. Each economic crisis has forced economists to revise previous assumptions, leading to new theories that criticize, complement, or replace earlier frameworks. Amid global uncertainty, including climate change, trade wars, and digitalization, the question of how to control inflation without sacrificing economic growth remains at the center of dynamic economic debate.

3. Research Method and Materials

This study uses a quantitative approach based on time series data with a Vector Autoregression (VAR) model to analyze the dynamic interactions between monetary policy variables, inflation, and the exchange rate in Indonesia. The VAR model is considered appropriate because it treats all variables in the system as endogenous, allowing each variable to be explained by its own lagged value and the lagged values of other variables in the system. This characteristic makes VAR relevant for analyzing monetary policy transmission, given that inflation, interest rates, exchange rates, and external monetary conditions can dynamically influence each other.

Sims (1980) introduced the VAR framework as an alternative to traditional simultaneous equations models, which rely heavily on strict a priori theoretical restrictions. Unlike this approach, VAR allows empirical time series data to reveal the dynamic relationships between variables with more restrictive structural assumptions. Therefore, this model is relevant for analyzing the interactions between the Federal Funds Rate, Bank Indonesia's policy interest rate, inflation, and the IDR/USD exchange rate in the context of Indonesia as a developing open economy.

This study uses actual monthly data from December 2005 to March 2025, resulting in 232 observations for each variable. The variables used include the Federal Funds Rate, Bank Indonesia's policy interest rate, inflation, and the IDR/USD exchange rate. Data were obtained from publicly available secondary sources, namely the Federal Reserve Economic Data (FRED), Bank Indonesia, Statistics Indonesia (BPS), and the World Bank. No forecasting, projection, simulation, or interpolation data were used in the estimation. Therefore, the period 2005–2025 in this study refers to the availability of monthly data through March 2025, not the entire calendar year 2025.

Before the VAR model was estimated, all variables were tested for stationarity using the Augmented Dickey-Fuller (ADF) test. Stationarity testing is necessary in VAR estimation to reduce the risk of pseudo-regression and ensure that the variables entered the system are suitable for use in dynamic time series analysis. Based on the ADF test results, BIRate is stationary at the level, therefore, it is maintained in level form. In contrast, FEDRate, Inflation, and Exchange Rate are not stationary at the level but become stationary after the first differentiation. Therefore, these three variables are transformed into first-difference form before VAR estimation.

Thus, the empirical VAR system in this study consists of BIRate, FEDRate_diff, Inflation_diff, and Kurs_diff. Specific transformations based on the characteristics of each variable ensure that the VAR model is estimated using a stationary representation of the variables, while avoiding unnecessary differentiation of BIRate. The use of this stationary mixed specification aligns with the methodological view that VAR analysis can be applied to

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stationary representations of variables when the primary objective of the study is to analyze short-term dynamic interactions, rather than to estimate long-term equilibrium relationships. Lütkepohl (2005) asserts that VAR models are primarily designed to analyze dynamic interdependencies between time series variables, provided the variables entering the system are stationary. Similarly, Enders (2014) explains that differentiation of non-stationary variables is an appropriate approach when the focus of the study is on short-term fluctuations and dynamic adjustment, rather than long-term cointegration relationships.

In this study, the cointegration test is not treated as the primary modeling framework because the empirical objective of the study is not to estimate long-run equilibrium parameters. Instead, this study focuses on short- and medium-term dynamic responses through the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD). If the research objective were to examine the long-run equilibrium relationship between variables, a cointegration-based model, such as the Vector Error Correction Model (VECM), would be more appropriate.

Therefore, the omission of the cointegration test in this study is recognized as a methodological limitation. Therefore, the research results are interpreted as dynamic responses within a reduced-form VAR framework, not as estimates of long-run equilibrium relationships. The general VAR model of order p, denoted as VAR(p), can be written as follows:

$$Y_t = C + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + \varepsilon_t$$

Where:

Y_t: denotes the vector of stationary endogenous variables at time t. Following the stationarity testing procedure, the empirical specification consists of $[\Delta FEDRate_t, BIRate_t, \Delta Inflation_t, \Delta Kurs_t]'$, where Δ denotes the first difference operator.

A_i : represents the coefficient matrix for lag (i).

ε_t : error term (white noise).

BIRatet is retained in level form because it is stationary at level, whereas FEDRate, Inflation, and Kurs are transformed into first differences based on the ADF test results.

The optimal lag length is determined empirically using several information criteria, including the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Hannan-Quinn Information Criterion (HQIC). The use of multiple information criteria allows the study to compare alternative lag specifications and balance model fit with parsimony. AIC tends to favour a more dynamic model with a larger number of lags, while BIC and HQIC impose stronger penalties on model complexity. The final lag structure is selected by considering the information criteria results and subsequent diagnostic tests.

To validate the selected VAR specification, diagnostic tests are conducted after the model estimation. First, the VAR residual serial correlation LM test is applied to examine whether the residuals are free from serial correlation. The null hypothesis of this test states that there is no serial correlation in the residuals. A probability value greater than 0.05 indicates that the null hypothesis cannot be rejected, suggesting that the model does not suffer from significant residual autocorrelation. Second, the stability of the VAR system is examined using the inverse roots of the characteristic polynomial. The VAR model satisfies the stability condition when all inverse roots lie inside the unit circle. A stable VAR system is required to ensure that the impulse response function and forecast error variance decomposition results are reliable.

The Impulse Response Function (IRF) is used to trace the dynamic response of one variable to a shock originating from another variable within the VAR system. This analysis allows the study to identify the timing, direction, and persistence of responses among the Federal Funds

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Rate, Bank Indonesia policy rate, inflation, and the exchange rate. Meanwhile, Forecast Error Variance Decomposition (FEVD) is employed to identify the relative contribution of each variable's shocks to the forecast error variance of other variables. FEVD is particularly useful for assessing whether inflation dynamics in Indonesia are mainly driven by internal inflation shocks, domestic monetary-policy shocks, external monetary-policy shocks, or exchange-rate shocks.

In addition, a Granger causality test is employed to complement the VAR, IRF, and FEVD analyses. The Granger causality test examines whether past values of one variable contain useful information for predicting another variable. The null hypothesis states that one variable does not Granger-cause another variable. If the probability value is less than 0.05, the null hypothesis is rejected, indicating the existence of predictive causality. However, the results of the Granger causality test are interpreted as predictive relationships rather than structural causality. This distinction is important because the reduced-form VAR model does not separately identify exogenous structural monetary-policy shocks.

Table 1. Stages of VAR Analysis

Analytical Stage	Description
Descriptive Statistics	Describes the basic characteristics, distribution, and variation of each variable.
ADF Test	Examines whether the time-series variables are stationary at level or require first differencing.
Variable Transformation	Retains stationary variables in level form and transforms non-stationary variables into first differences.
Lag Order Selection	Determines the optimal lag length using AIC, BIC, HQIC, and other relevant information criteria.
VAR Estimation	Estimates the dynamic relationships among FEDRate_diff, BIRate, Inflation_diff, and Kurs_diff.
VAR Diagnostic Tests	Tests residual serial correlation using the LM test and evaluates model stability using inverse roots of the characteristic polynomial.
Granger Causality Test	Examines predictive causal relationships among the variables within the VAR framework.
Impulse Response Function	Analyses the response of one variable to shocks originating from other variables over time.
Forecast Error Variance Decomposition	Identifies the relative contribution of each variable's shocks to forecast error variance.
Interpretation	Interprets the findings as short-run and medium-term dynamic responses within a reduced-form VAR framework.

The operational definitions of the variables used in this study are presented in Table 2.

Table 2. Operational Definitions of Variables

No.	Variable	Operational Definition	Data Source
1	Federal Funds Rate	The policy interest rate set by the Federal Reserve as a key instrument for controlling inflation and maintaining economic stability in the United States, measured in percent (%).	Federal Reserve Economic Data (FRED)
2	Bank Indonesia Policy Rate	The policy interest rate set by Bank Indonesia to maintain exchange rate stability and control inflation in Indonesia, measured in percent (%).	Bank Indonesia Economic and Financial Statistics
3	Inflation	The change in the general price level of goods and services in Indonesia, measured using the Consumer Price Index (CPI), expressed in percent (%).	Statistics Indonesia (BPS) / Bank Indonesia
4	IDR/USD Exchange Rate	The exchange rate of the Indonesian rupiah against the United States dollar, reflecting external pressures on the Indonesian economy, measured in rupiah per US dollar.	Bank Indonesia

4. Results and Discussion

Based on the descriptive and inferential analysis of monthly observations from December 2005 to March 2025, the results are presented as follows.

Table 3. Descriptive Statistics

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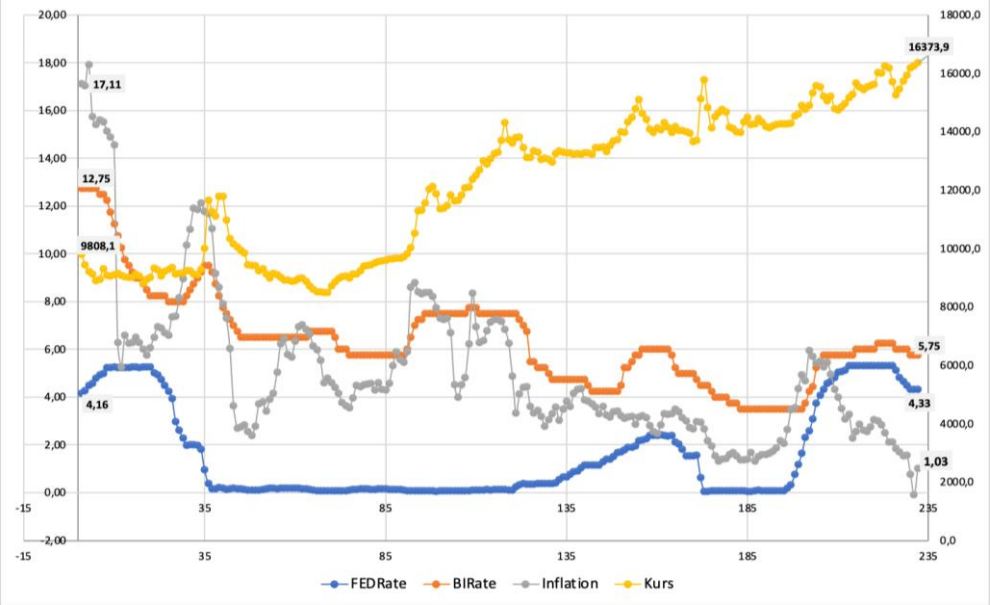
Statistic	FEDRate	BIRate	Inflation	Exchange Rate
Count	232.000000	232.000000	232.000000	232.000000
Mean	1.651983	6.393103	5.090431	12155.315086
Std. Dev.	1.971745	2.002287	3.279621	2492.434285
Min	0.050000	3.500000	-0.090000	8489.200000
25%	0.120000	5.000000	3.000000	9312.175000
50%	0.385000	6.000000	4.305000	13063.950000
75%	2.587500	7.500000	6.395000	14264.325000
Max	5.330000	12.750000	17.920000	16373.900000

The descriptive statistics indicate that the four variables, namely FEDRate, BIRate, inflation, and the exchange rate, exhibit distinct characteristics. The mean value of the FEDRate is 1.65%, suggesting that the Federal Funds Rate tended to be lower than the BIRate, which recorded an average of 6.39%. This reflects differences in the monetary policy stance between the United States and Indonesia. The average inflation rate of 5.09% indicates that changes in the general price level of goods and services were relatively controlled, although inflation reached a maximum value of 17.92% during the observation period. Meanwhile, the rupiah exchange rate against the US dollar recorded an average value of IDR 12,155 per US dollar, with relatively high volatility, as reflected in its standard deviation of 2,492. The highest exchange rate reached IDR 16,373.90 per US dollar.

In terms of data dispersion, all variables show a relatively wide range between their minimum and maximum values. This indicates substantial variation throughout the observation period. For instance, the FEDRate ranged from 0.05% to 5.33%, while the BIRate moved between 3.50% and 12.75%, suggesting different policy responses to macroeconomic conditions, such as economic crises or changes in inflationary pressure. Inflation also recorded a negative value at a certain point, indicating deflation, although it generally remained within the central bank's target range. The exchange rate shows considerable volatility, particularly due to external pressures such as global monetary policy shifts and foreign capital flows. The broad variation across these four variables provides a strong basis for further analysis using a dynamic model such as Vector Autoregression (VAR), which is suitable for examining dynamic interrelationships among the variables.



Source: Statistics Indonesia (BPS), Bank Indonesia, and the World Bank (2025)

Figure 2. Trends in the Federal Funds Rate, Bank Indonesia Policy Rate, Inflation, and Exchange Rate in Indonesia, December 2005–March 2025

Based on monthly data from December 2005 to March 2025, the dynamic trends among the Federal Funds Rate, Bank Indonesia policy rate, inflation, and exchange rate indicate a

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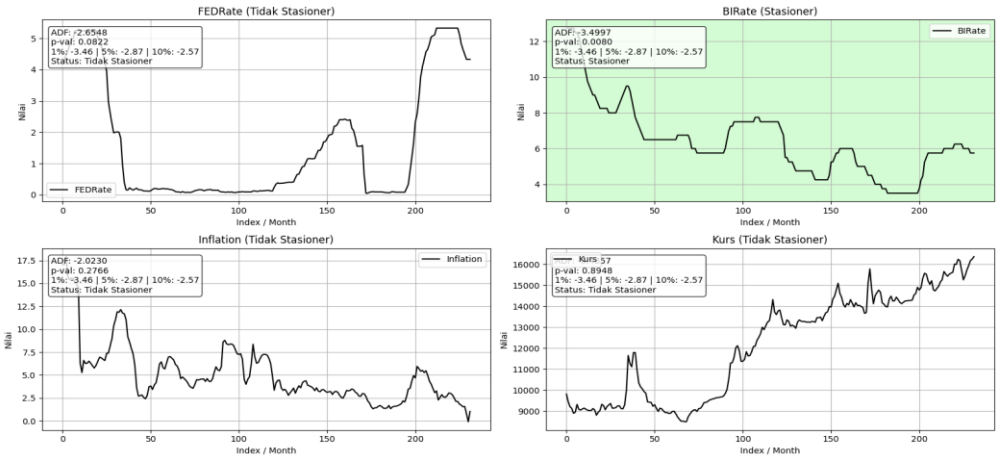
complex and mutually interrelated relationship. The Federal Funds Rate experienced substantial fluctuations, beginning with a relatively high level during 2005–2008, at approximately 5%, followed by a decline to near zero after the 2008 global financial crisis, and then rising again to around 4.33% in 2025 in response to global inflationary pressures. These movements exerted pressure on the exchange rate, as the depreciation of the rupiah to IDR 16,373 per US dollar during 2022–2023 coincided with the increase in the Federal Funds Rate. This pattern reflects capital outflows from emerging markets.

Bank Indonesia's policy rate adjusted in response to these changing conditions, as reflected in its increase to 12.75% in 2013 and its subsequent stabilization within the range of 4–6% after 2015. This policy response was intended to mitigate imported inflation arising from exchange rate depreciation. Although Indonesia's inflation reached 17.92% at its peak, it has generally remained under control within the range of 3–6% since 2015, supported by timely policy responses from Bank Indonesia. Nevertheless, inflation remains vulnerable to external shocks. Overall, this analysis highlights the importance of coordination between domestic monetary policy and policy responses to global dynamics in maintaining macroeconomic stability.

4.1. Stationarity Test

The Augmented Dickey-Fuller (ADF) test is a statistical test used to determine whether a time-series variable is stationary. This test is an extension of the standard Dickey-Fuller test, incorporating lagged differences of the variable to eliminate autocorrelation in the error term. The following section presents the results of the stationarity test at the level form.



Source: Processed Data (2026)

Figure 3. Stationarity Test at Level Form

Figure 3 presents the results of the Augmented Dickey-Fuller (ADF) test used to examine the stationarity of the variables prior to VAR estimation. Since VAR analysis requires stationary time-series data, stationarity testing is an essential preliminary step. The results of the stationarity test at the level form indicate that only the Bank Indonesia policy rate is stationary. Meanwhile, the Federal Funds Rate, inflation, and the exchange rate are not stationary at level. Therefore, the stationarity of these variables needs to be improved through a differencing process, as presented in Table 4.

Table 4. Stationarity Test Results at Level and First Difference

Variable	ADF Statistic (Level)	p-value (Level)	Critical Value 1%	Critical Value 5%	Critical Value 10%	Status (Level)	ADF Statistic (First Difference)	p-value (First Difference)	Status (First Difference)
FEDRate	-2.6548	0.0822	-3.4596	-2.8744	-2.5736	Non-stationary	-3.6108	0.0056	Stationary
BIRate	-3.4997	0.0080	-3.4592	-2.8742	-2.5735	Stationary	-	-	-

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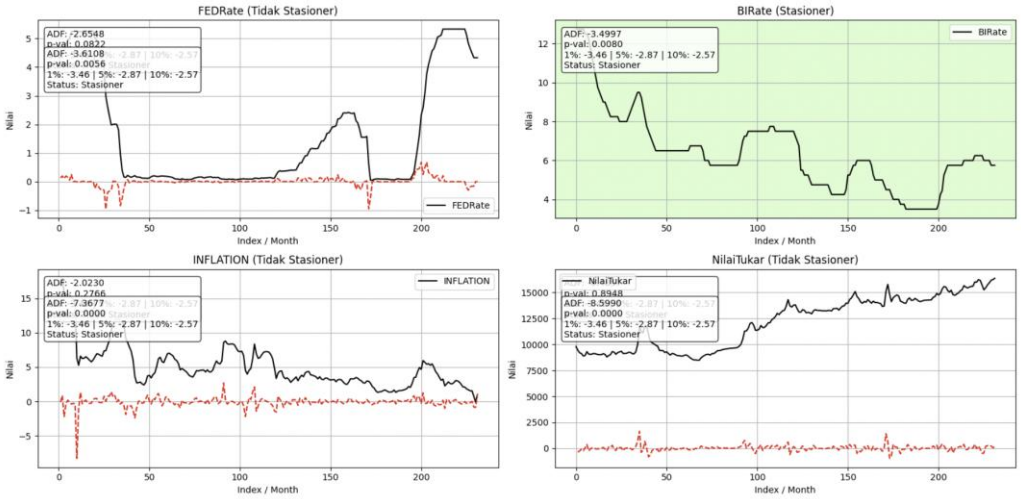
Variable	ADF Statistic (Level)	p-value (Level)	Critical Value 1%	Critical Value 5%	Critical Value 10%	Status (Level)	ADF Statistic (First Difference)	p-value (First Difference)	Status (First Difference)
Inflation	-2.0230	0.2766	-3.4606	-2.8748	-2.5739	Non-stationary	-7.3677	0.0000	Stationary
Exchange Rate	-0.4857	0.8948	-3.4594	-2.8743	-2.5736	Non-stationary	-8.5990	0.0000	Stationary

The stationarity results for the transformed variables are visually presented in Figure 4.



Source: Processed Data (2026)

Figure 4. Stationarity Test Results after Variable Specific Transformation

Based on the stationarity test results, BIRate is stationary at level and is therefore retained in level form. In contrast, FEDRate, Inflation, and Exchange Rate are non-stationary at level but become stationary after first differencing. Accordingly, these three variables are transformed into first differences before VAR estimation. This variable-specific transformation ensures that the VAR system is estimated using stationary representations of the variables while avoiding unnecessary differencing of BIRate. Consequently, the estimated VAR model is designed to examine short-run dynamic interactions among monetary policy variables, inflation, and the exchange rate, rather than to estimate long-run equilibrium relationships.

4.2. Determining the Optimal Lag Length

The determination of the optimal lag length based on the analysis produced the following VAR model results:

Table 5. Optimal Lag Selection Results

Lag	AIC	BIC	HQIC
1	3.149404	3.448367	3.270000
2	2.811974	3.351773	3.029742
3	2.765737	3.547868	3.081303
4	2.794682	3.820659	3.208679
5	2.868614	4.139964	3.381679
6	2.950351	4.468618	3.563130
7	3.022368	4.789113	3.735512
8	3.044794	5.061595	3.858963
9	3.137107	5.405559	4.052967
10	2.454612	4.976326	3.472835
11	2.494916	5.271520	3.616182

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12	2.540454	5.573596	3.765451

Recommended Lag Length Based on Selection Criteria

AIC: Lag 10, as it has the lowest value.
BIC: Lag 2, as it has the lowest value.
HQIC: Lag 2, as it has the lowest value.

Based on the lag-order selection results, the criteria provide different recommendations. While the AIC selects lag 10, the BIC and HQIC favour lag 2 because they impose stronger penalties on model complexity. Given that the AIC identifies lag 10 and that the reported VAR estimates, IRF, and FEVD analyses are based on the corresponding lag structure, VAR(10) is retained as the baseline specification in this study. The BIC and HQIC results are reported to acknowledge the alternative parsimonious specification.

4.3. *VAR Diagnostic Tests*

To evaluate the adequacy of the selected VAR(10) specification, residual serial-correlation and stability tests were conducted after model estimation. First, the residual Portmanteau test was employed to examine whether the residuals were free from autocorrelation up to lag 12. The null hypothesis states that no residual autocorrelation exists up to the specified lag. The test produced a statistic of 38.742, which was lower than the critical value of 46.194, with a p-value of 0.176. Since the p-value exceeded the 5% significance level, the null hypothesis could not be rejected. This result indicates that the residuals of the VAR(10) model do not exhibit statistically significant serial correlation up to lag 12. Therefore, the residuals can be considered serially independent and satisfy the white-noise assumption. The stability of the VAR system was subsequently assessed using the inverse roots of the characteristic polynomial. The results indicate that all inverse roots lie strictly inside the unit circle, with the maximum root modulus recorded at 0.963. Since all root moduli are below one, the estimated VAR(10) model satisfies the stability condition. This finding implies that shocks occurring within the system are expected to diminish gradually and converge over time rather than producing explosive or persistent dynamics.

Overall, the diagnostic results demonstrate that the selected VAR(10) specification satisfies both the residual independence and stability requirements. Although lag 10 was selected based on the Akaike Information Criterion, its adequacy is also supported by the post-estimation diagnostic tests. Therefore, the VAR(10) specification may be retained as the final model. Consequently, the impulse response function and forecast error variance decomposition results generated from this specification can be interpreted as dynamically stable and statistically reliable. This diagnostic-testing section is most appropriately presented after the lag-length selection results and before the detailed VAR estimation results, impulse response analysis, and forecast error variance decomposition.

Table 6. VAR (10) Diagnostic Test Result

Diagnostic Test	Test Statistic	Critical Value	p-value	Conclusion
Residual Portmanteau Test	38.742	46.194	0.176	No significant residual serial correlation was detected up to lag 12; the residuals satisfy the white-noise assumption.
VAR Stability Test	Maximum root modulus = 0.963	< 1.000	—	The VAR(10) model is dynamically stable because all inverse roots lie inside the unit circle.

4.4. *Granger Causality Test*

The Granger causality results indicate that the BI Rate is the only variable with statistically significant predictive power for movements in the exchange rate at the 5% significance level, with an F-statistic of 1.9248 and a p-value of 0.039. This finding suggests that historical information on the BI Rate provides additional explanatory information for predicting changes in the exchange rate. The predictive contribution of the BI Rate remains significant even after accounting for the information already contained in the lagged values of the

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exchange rate itself. In practical terms, past adjustments in Bank Indonesia's policy rate appear to help explain subsequent movements in the domestic currency. Therefore, changes in the BI Rate may be regarded as one of the monetary policy transmission channels affecting exchange-rate dynamics.

In contrast, the FED Rate does not exhibit statistically significant Granger causality with the BI Rate, inflation, or the exchange rate. This result implies that the lagged values of the FED Rate do not provide significant additional information for predicting these domestic variables within the specified VAR framework. Similarly, inflation does not Granger-cause any of the other variables included in the system. These findings do not necessarily mean that the FED Rate and inflation have no economic influence on domestic monetary conditions. Rather, their effects may operate indirectly, emerge through different lag structures, or be transmitted through other mechanisms that are not identified as direct predictive relationships in the Granger causality test.

Several relationships nevertheless produce p-values that are relatively close to the 10% significance threshold. These include the relationship from the BI Rate to the FED Rate, with a p-value of 0.079, the relationship from the exchange rate to the BI Rate, with a p-value of 0.0736, and the relationship from the exchange rate to inflation, with a p-value of 0.0700. However, because these p-values exceed the 5% significance level adopted in the analysis, the corresponding null hypotheses cannot be rejected. Consequently, these relationships should not be interpreted as strong evidence of Granger causality under the main testing criterion. If the study adopts a 10% significance level, they may be described as weak or marginal evidence of predictive causality, but this alternative threshold must be explicitly stated and justified in the methodology.

Table 7. Summary of Granger Causality Test Result

Cause	Effect	F-statistic	p-value	Result
BI Rate	FED Rate	1.6898	0.0790	Not significant
Inflation	FED Rate	0.9604	0.4769	Not significant
Exchange Rate	FED Rate	1.3098	0.2207	Not significant
FED Rate	BI Rate	1.0478	0.4011	Not significant
Inflation	BI Rate	1.5020	0.1339	Not significant
Exchange Rate	BI Rate	1.7139	0.0736	Not significant
FED Rate	Inflation	0.7190	0.7071	Not significant
BI Rate	Inflation	1.6041	0.1010	Not significant
Exchange Rate	Inflation	1.7310	0.0700	Not significant
FED Rate	Exchange Rate	1.5203	0.1275	Not significant
BI Rate	**Exchange Rate**	**1.9248**	**0.0390**	**Significant**
Inflation	Exchange Rate	0.6528	0.7686	Not significant

4.5. VAR Summary

Summary of the VAR Model:

Table 8. Results for the FEDRate_diff Equation

Variable	Coefficient	Std. Error	t-statistic	Probability	Significant
const	0.098822	0.038617	2.559028	1.049652e-02	Yes
L1.FEDRate_diff	0.577698	0.074998	7.702817	1.330989e-14	Yes
L2.Kurs_diff	0.000098	0.000039	2.514585	1.191724e-02	Yes
L3.FEDRate_diff	0.226231	0.087749	2.578162	9.932750e-03	Yes
L10.FEDRate_diff	-0.156800	0.075829	-2.067810	3.865785e-02	Yes

Based on the results above, the Federal Funds Rate exhibits persistence, indicating that current interest rate decisions are strongly influenced by their past values. This suggests that changes in the Federal Reserve's monetary policy are not random, but follow a pattern shaped by previous dynamics. Furthermore, the negative coefficient at lag 10 indicates a reversal effect, in which the Federal Reserve takes stabilization measures following periods of high volatility. This reflects the ability of US monetary policy to adjust proactively to longer-term

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disturbances. This pattern illustrates a balance between short-term responses to market fluctuations and medium-term adjustments aimed at maintaining macroeconomic stability.

Table 9. Results for the BIRate Equation

Variable	Coefficient	Std. Error	t-statistic	Probability	Significant
L1.BIRate	1.327667	0.074898	17.726280	2.628595e-70	Yes
L2.Inflation_diff	0.036682	0.016208	2.263169	2.362526e-02	Yes
L4.Inflation_diff	0.041281	0.016786	2.459190	1.392509e-02	Yes
L6.Kurs_diff	0.000126	0.000051	2.453586	1.414399e-02	Yes
L10.FEDRate_diff	0.196478	0.096592	2.034098	4.194175e-02	Yes

The response of the Bank Indonesia policy rate to inflation indicates a delayed yet sustained monetary transmission mechanism. An increase in inflation two periods earlier, represented by L2.Inflation_diff, leads to an increase in the current Bank Indonesia policy rate. This suggests that Bank Indonesia responds to inflationary pressures with a delay of approximately two months as part of its effort to control prices. This response reaches its peak at lag 4, represented by L4.Inflation_diff, where the effect of inflation on interest rate policy becomes more significant. This indicates that the monetary transmission mechanism requires approximately four months to fully influence Bank Indonesia's policy rate decisions. This pattern suggests that inflation has a medium-term effect on monetary policy, requiring Bank Indonesia to adjust interest rates gradually in order to maintain price stability over a longer horizon.

Table 10. Results for the Inflation_diff Equation

Variable	Coefficient	Std. Error	t-statistic	Probability	Significant
L1.BIRate	0.565362	0.250614	2.255904	0.024077	Yes
L1.Inflation_diff	0.200371	0.053660	3.734106	0.000188	Yes
L2.Inflation_diff	-0.172677	0.054234	-3.183912	0.001453	Yes
L3.Kurs_diff	-0.000400	0.000173	-2.321273	0.020272	Yes
L7.Kurs_diff	-0.000509	0.000175	-2.915306	0.003553	Yes

The positive coefficient on L1.BIRate should be interpreted with caution. It indicates a positive short-run association between the previous period's Bank Indonesia policy rate and the current change in inflation within the reduced-form VAR system, but it does not establish that an increase in the policy rate directly causes inflation to rise. This result may reflect the endogenous response of Bank Indonesia to emerging inflationary pressures, exchange-rate movements, or cost-push shocks that are already present when monetary policy is tightened. In this context, increases in the policy rate may coincide with persistent inflation dynamics rather than represent an expansionary effect of monetary policy.

The reduced form VAR does not separately identify exogenous monetary policy shocks. Therefore, the estimated coefficient should be interpreted as a dynamic association rather than a causal monetary policy effect. Any broader disinflationary effect of monetary tightening may emerge over subsequent periods. Such effects should be evaluated through the impulse response function and FEVD results rather than inferred from a single short-run coefficient. This interpretation is also consistent with the possibility that policy adjustments are implemented in response to already-existing inflationary pressures.

The Inflation_diff equation also indicates inflation persistence, as changes in inflation in the previous month are positively associated with current inflation changes. In contrast, the negative coefficient of inflation at lag two suggests partial mean reversion following an earlier increase in inflation. Exchange-rate changes are associated with inflation dynamics at lags three and seven, indicating that exchange-rate movements may affect inflation with a delayed pattern. The direction and broader magnitude of this transmission should be interpreted primarily through the IRF results.

Table 11. Results for the Kurs_diff Equation

Variable	Coefficient	Std. Error	t-statistic	Probability	Significant
L1.FEDRate_diff	-330.831866	145.866394	-2.268047	0.023326	Yes

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L1.Kurs_diff	0.255029	0.073973	3.447597	0.000566	Yes
L2.FEDRate_diff	490.983570	167.145721	2.937458	0.003309	Yes
L2.Kurs_diff	-0.274923	0.076158	-3.609881	0.000306	Yes
L7.BIRate	-592.897358	185.286561	-3.199894	0.001375	Yes
L8.BIRate	520.227627	184.906639	2.813461	0.004901	Yes
L9.FEDRate_diff	-367.475332	172.428063	-2.131181	0.033074	Yes
L10.FEDRate_diff	365.494465	147.482227	2.478227	0.013204	Yes
L10.BIRate	-254.864770	111.762700	-2.280410	0.022583	Yes

Based on the results, changes in the IDR/USD exchange rate are strongly influenced by both internal and external dynamics, with delayed responses. An increase in the Federal Funds Rate one month earlier, represented by L1.FEDRate_diff, is associated with an appreciation of the rupiah by approximately 330 points. This suggests that Bank Indonesia responds quickly to external pressures through stabilization policies. However, this effect reverses at lag 2, where an increase in the Federal Funds Rate two months earlier leads to exchange rate depreciation of approximately 491 points. This indicates the persistence of imported inflation pressures or market expectations that cannot be fully offset in the short run. In addition, the exchange rate itself exhibits momentum, as depreciation in the previous month tends to continue, but then begins to correct at lag 2, indicating mean reversion due to Bank Indonesia's intervention or market adjustment. This pattern reflects the complex interaction among US monetary policy, exchange rate volatility, and domestic policy responses.

The response of the exchange rate to Bank Indonesia's policy rate shows a gradual but significant effect. An increase in the Bank Indonesia policy rate seven months earlier, represented by L7.BIRate, strengthens the rupiah by approximately 593 points, reflecting effective policy coordination in attracting capital inflows. However, this effect is followed by overshooting at lag 8, where the exchange rate depreciates by approximately 520 points, indicating an excessive market reaction or structural adjustment that requires time. Nevertheless, the influence of the Bank Indonesia policy rate remains evident up to 10 months, as shown by L10.BIRate. This demonstrates that domestic monetary policy has a longer-term impact on exchange rate stability. Meanwhile, the delayed effect of increases in the Federal Funds Rate at lags 9 and 10 also affects the exchange rate in a fluctuating pattern, reinforcing the need for dynamic monitoring of global shocks and proactive policy adjustment to maintain Indonesia's macroeconomic stability.

4.6. Impulse Response Function (IRF)

The Impulse Response Function (IRF) is an analytical tool in the Vector Autoregression (VAR) model that describes the dynamic response of one variable to a shock originating from another variable within the system.

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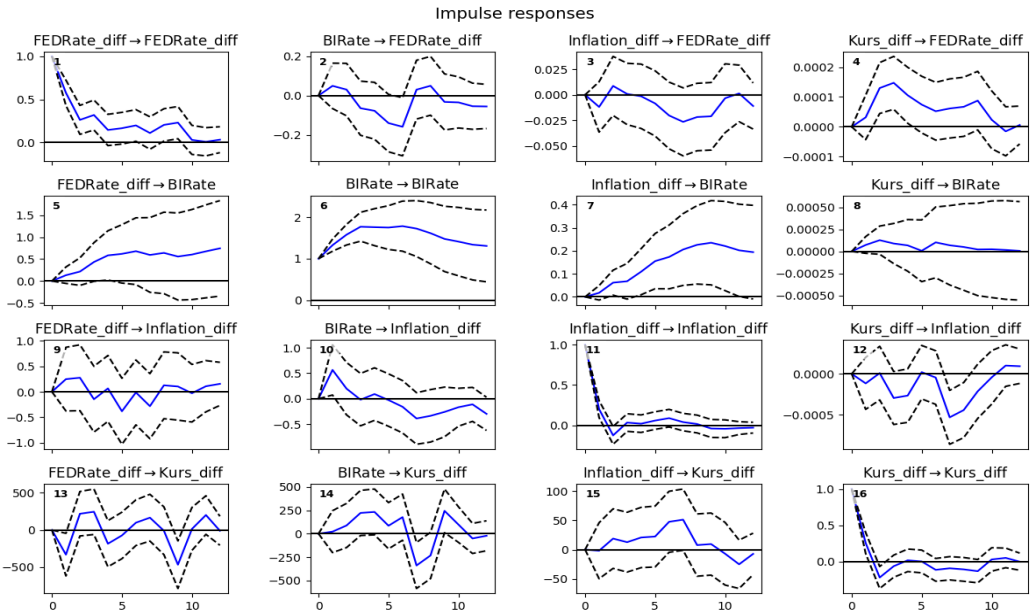

Source: Processed Data (2026)

Figure 5. Impulse Response Functions (IRF)

The Impulse Response Functions (IRF) output shows the average response of the dependent variable to a shock, represented by the blue line. The 95% confidence interval is indicated by the upper and lower bounds, shown as black dashed lines. The horizontal axis represents time (0–10 months), while the vertical axis represents the magnitude of the response. Based on the Impulse Response Functions (IRF) figure, the following factors influence inflation ((Inflation_diff)).

Table 12. Summary of Monetary Transmission Channels

Transmission Channel	Lag	Effect on Inflation/Exchange Rate	Supporting Theory
Inflation → BI Rate	L2–L4	BI Rate responds to prior inflationary pressures within approximately 2–4 months	Taylor Rule; Interest Rate Smoothing
BI Rate → Inflation	L1	Positive short-run reduced-form association; interpreted cautiously due to policy endogeneity	Monetary Policy Reaction Function
Exchange Rate → Inflation	L3–L7	Exchange-rate movements are associated with delayed inflation dynamics	Exchange Rate Pass-Through
Federal Funds Rate → Exchange Rate	L1–L10	Opposing effects on the exchange rate (L1: appreciation, L2–L10: depreciation)	Mundell-Fleming Model
BI Rate → Exchange Rate	L7–L10	The BI Rate stabilizes the exchange rate with a lagged effect	Interest Rate Smoothing

Source: Impulse Response Functions output (appendix) and supporting theories.

The results indicate that Bank Indonesia's policy rate responds to prior inflationary pressures over an approximately two to four month horizon. The positive short-run coefficient of BIRate in the inflation equation is interpreted as a reduced-form policy reaction relationship rather than direct evidence that monetary tightening increases inflation. The exchange rate contributes to inflation dynamics with a delayed effect, highlighting the importance of exchange-rate management in monetary policy.

4.6.1. Forecast Error Variance Decomposition (FEVD)

Forecast Error Variance Decomposition (FEVD) is an analytical tool in the VAR model that decomposes the relative contribution of each variable to forecast error variance for each variable in the system. In the context of the figure 6, FEVD shows the extent to which shocks

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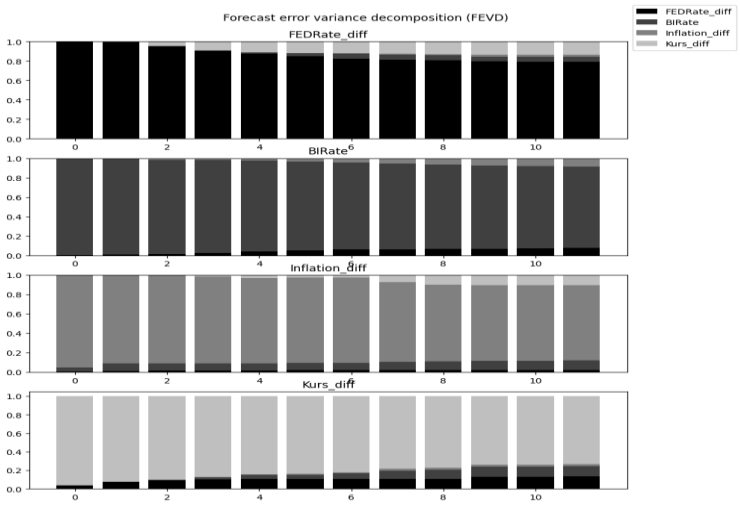
in each variable, namely FEDRate_diff, BIRate, Inflation_diff, and Kurs_diff, contribute to the forecast volatility of other variables over the 0–10 period or time horizon.



Source: Processed Data (2026)

Figure 6. Forecast Error Variance Decomposition (FEVD) Results

The X-axis represents the time period from 0 to 10 months, while the Y-axis indicates the percentage contribution to forecast variance. Based on the Forecast Error Variance Decomposition (FEVD) results, inflation (Inflation_diff) is predominantly influenced by its own internal shocks, particularly over horizons 0–4, where these shocks account for more than 70% of forecast error variance. This pattern indicates substantial inflation persistence and suggests that domestic price-setting behaviour, inflation expectations, supply-side disturbances, and aggregate demand conditions remain the primary drivers of inflation dynamics. Therefore, inflation's own shocks should be regarded as the dominant source of variation in the estimated system.

At the medium-term forecast horizon of 6–10 months, shocks to the Bank Indonesia policy rate and the Federal Funds Rate become increasingly visible in explaining inflation forecast variance. Their combined contribution reaches approximately 20–30%, with Bank Indonesia policy-rate shocks contributing approximately 15–20% and Federal Funds Rate shocks contributing approximately 5–10%. Although these contributions are meaningful, they remain secondary to the influence of inflation's own shocks. This result indicates that domestic and external monetary conditions provide additional explanatory power rather than becoming the primary determinants of inflation volatility. Accordingly, the effects of monetary-policy and external shocks should be interpreted as complementary to domestic inflation persistence.

The exchange rate has a relatively limited contribution to the variance of inflation forecasts across all observation horizons. Exchange rate shocks (Kurs_diff) explain less than 5% of the variance in inflation forecasts, indicating a limited level of exchange rate pass-through (ERPT) in the estimated VAR system. This low pass-through may be related to differences in import price adjustment mechanisms, domestic supply conditions, pricing behavior, and Bank Indonesia's policy response to exchange rate pressures. This finding is generally consistent with recent empirical evidence in the ASEAN region and developing Asia. Beirne et al. (2024) state that ERPT in emerging Asia is generally imperfect and varies across countries, depending on inflation persistence, import structure, and the credibility of monetary policy. Anh et al. (2021) also show that ERPT differs across ASEAN countries, with Indonesia having relatively stronger long-run pass-through compared to some of its neighbors, although its short-run impact remains limited. Similarly, Widarjono et al. (2023) found that exchange rate depreciation had a stronger long-term impact on inflation than

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appreciation in Indonesia, Malaysia, and the Philippines, while its short-term transmission was relatively weak.

Thus, the FEVD contribution of less than 5% in this study supports the view that exchange rate movements are not a major source of inflation variability in Indonesia. Nevertheless, exchange rate management remains important to mitigate the risk of imported inflation and maintain macroeconomic stability. Overall, the FEVD results indicate that inflation dynamics in Indonesia are primarily influenced by internal factors, while domestic monetary policy and external shocks have a significant but secondary influence over the medium-term horizon. These results should be interpreted as variance contributions within a reduced-form VAR framework, rather than as structural causal estimates.

5. Conclusion

Bank Indonesia (BI) exhibits a delayed response to inflationary pressures, with the monetary transmission mechanism requiring approximately two to four months to affect the BI Rate. This pattern is consistent with the Taylor Rule, in which BI adjusts interest rates in response to deviations of inflation from its target, as well as the Cost-Push Inflation Hypothesis, which explains that increases in production costs or inflation expectations may lead to policy adjustments that do not occur immediately. The positive short-run association between BIRate and inflation changes should not be interpreted as a causal inflationary effect of monetary tightening. Rather, it likely reflects the endogenous response of Bank Indonesia to prevailing inflationary and external pressures within the reduced-form VAR framework.

Despite structural challenges, including the dominance of the informal sector and dependence on imports, BI has supported price stability in Indonesia. Exchange-rate movements are associated with inflation dynamics over a three-to-seven-month horizon, although their contribution to inflation volatility remains relatively small, at less than 5% based on the FEVD results. This finding suggests that exchange-rate pass-through in Indonesia is limited and may be moderated by import-price heterogeneity and BI's policy response. Changes in the Federal Funds Rate are also associated with fluctuations in Indonesia's exchange rate and inflation, underscoring the need for Bank Indonesia to monitor and anticipate external monetary spillovers.

At the medium-term forecast horizon of six to ten months, the combined contribution of Bank Indonesia policy-rate shocks and Federal Funds Rate shocks reaches approximately 20–30%. Although this contribution is meaningful, inflation's own shocks remain the dominant source of forecast variance in the estimated system. This finding suggests that domestic inflation persistence continues to play the leading role in shaping inflation dynamics, while monetary-policy and external shocks provide additional influence. Accordingly, changes in the Federal Funds Rate are relevant for Bank Indonesia's monitoring of capital-flow pressures, exchange-rate movements, and imported inflation risks. An increase in the Federal Funds Rate may increase the challenge for BI in maintaining exchange-rate stability and domestic price stability.

The policy implications of this study should be interpreted in line with the observed transmission dynamics. Because inflation's own shocks account for more than 70% of forecast variance during the first four months, inflation control should not rely solely on interest-rate adjustments. Bank Indonesia and the Government should strengthen short-run coordination on food supply, strategic commodity distribution, inflation expectations, and temporary supply-side disturbances. The two-to-four-month response lag of the BI Rate also highlights the importance of forward-looking policy assessment and timely communication to prevent inflationary pressures from becoming more persistent. Given the three-to-seven-month exchange-rate transmission pattern and its limited contribution to inflation variance, exchange-rate management should focus primarily on reducing excessive volatility and mitigating imported inflation risks. Finally, the increasing contribution of BI Rate and Federal Funds Rate shocks over the six-to-ten-month horizon supports stronger scenario-based

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monitoring of global monetary conditions, capital flows, and domestic financial-market resilience.

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