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Determinants of Inflation in Indonesia: The Role of Monetary Variables, External Debt, and the Rupiah Exchange Rate (2001-2025)

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ABSTRACT

The relationships between money supply growth, the depreciation of the Indonesian rupiah, and inflation have remained inconsistent over time, while previous empirical studies have reported mixed findings regarding the determinants of inflation. This study examines the effects of money supply growth, real interest rates, external debt growth, and the rupiah exchange rate on inflation in Indonesia and identifies the most influential determinant. Annual time-series data covering the period 2001–2025 (25 observations) were collected from Statistics Indonesia, Bank Indonesia, the Ministry of Finance, and the World Bank. The analysis employs the Autoregressive Distributed Lag-Error Correction Model (ARDL-ECM) with the bounds testing approach to estimate both short-run and long-run relationships. The results confirm the existence of a long-run equilibrium relationship among the variables, as indicated by an F-Bounds statistic of 15.85255. The error correction term (ECT = −0.982171, $p < 0.01$) demonstrates a rapid adjustment toward long-run equilibrium following short-run deviations, while the model explains 86.60% of the variation in inflation (Adjusted $R^2 = 0.8660$). In the long run, real interest rates and the exchange rate significantly influence inflation, whereas in the short run only the exchange rate remains statistically significant. In contrast, money supply growth and external debt growth do not exert significant effects in either the short or long run. These findings contribute to the inflation literature by jointly examining monetary and external-sector determinants within a unified ARDL-ECM framework using the most recent Indonesian data and by distinguishing their short-run and long-run impacts. The study highlights the critical role of exchange rate stability in maintaining price stability and underscores the importance of coordinated monetary and exchange rate policies in controlling inflation.

Introduction

Inflation remains one of the most fundamental issues in macroeconomics because persistent increases in the general price level reduce household purchasing power, increase uncertainty in business investment, distort resource allocation, and ultimately hinder sustainable economic growth (Ha, Kose, & Ohnsorge, 2023; Benigno & Eggertsson, 2023). Following the COVID-19 pandemic, the global economy experienced the highest inflation episode in several decades, with inflation accelerating sharply across both advanced and emerging economies during 2021–2023. Unlike previous inflationary periods that were primarily associated with domestic monetary expansion, recent evidence suggests that global inflation has become increasingly influenced by external supply-side disturbances. Cross-country empirical analyses demonstrate that disruptions in global supply chains accounted for approximately one-third of global headline inflation volatility, exceeding the contributions of oil price shocks and monetary policy adjustments (Asadollah et al., 2024). These findings indicate that contemporary inflation dynamics can no longer be adequately explained solely through traditional monetarist perspectives.

The underlying sources of post-pandemic inflation continue to generate considerable debate within the macroeconomic literature. While some studies argue that inflation was primarily driven by excessive aggregate demand resulting from expansionary fiscal and monetary policies, others emphasize the dominant role of supply constraints, labor shortages, and global production disruptions (Giannone & Primiceri, 2024; Bernanke & Blanchard, 2023). Distinguishing between demand-driven and supply-driven inflation is particularly important because each requires fundamentally different policy responses. Demand-induced inflation generally calls for tighter monetary policy, whereas supply-driven inflation often necessitates structural reforms aimed at improving production efficiency and restoring supply chain resilience (Benigno & Eggertsson, 2023). Furthermore, empirical evidence from small open economies suggests that conventional monetary variables remain significant determinants of inflation. Using an Autoregressive Distributed Lag (ARDL) framework, Albahouth (2025) demonstrates that money supply growth, exchange rate movements, global supply-chain disruptions, and international uncertainty exert significant long-run effects on inflation, highlighting the continued relevance of monetary transmission mechanisms even under conditions of heightened global integration.

The recent tightening of global monetary policy has introduced additional challenges for developing economies. Since 2022, the United States Federal Reserve has implemented one of the most aggressive monetary tightening cycles in recent decades, leading to substantial increases in global interest rates, capital outflows from emerging markets, exchange rate depreciation, and imported inflation (World Bank, 2025; IMF, 2025). These pressures have coincided with a rapid accumulation of external debt among many developing countries following the pandemic, increasing financial vulnerability and reducing fiscal policy flexibility (Kose et al., 2022). Rising external borrowing costs, combined with exchange rate depreciation, may amplify inflationary pressures through higher import prices, increasing debt-servicing obligations, and deteriorating investor confidence (Aizenman, Chinn, & Ito, 2022). Consequently, inflation in emerging economies is increasingly shaped by interactions among domestic monetary conditions, exchange rate fluctuations, and external financial shocks rather than by domestic monetary expansion alone.

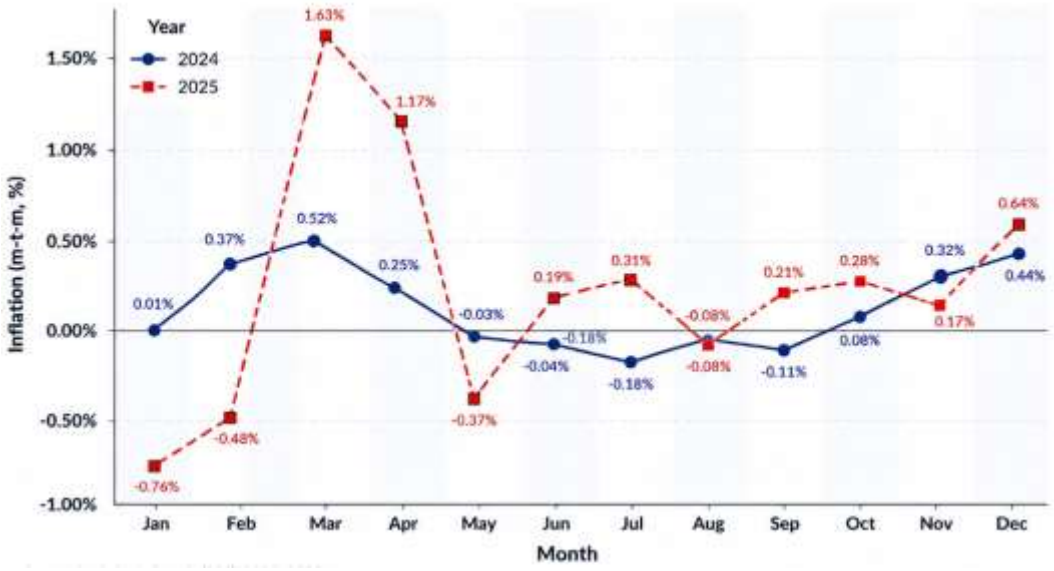
Indonesia provides an important context for examining these interactions. Between 2001 and 2025, broad money (M2) expanded continuously from approximately IDR 844 trillion to more than IDR 10,134 trillion, while the rupiah depreciated from around IDR 10,260 to approximately IDR 16,477 per U.S. dollar. Contrary to conventional monetarist expectations, however, inflation did not increase proportionally and instead declined to 1.57% in 2024. This divergence raises important questions regarding the validity of the Quantity Theory of Money in an increasingly open and globally integrated economy. The coexistence of sustained monetary expansion, persistent exchange rate depreciation, and relatively low inflation suggests that inflation dynamics in Indonesia may be governed by more complex mechanisms involving monetary variables, external debt dynamics, and exchange rate transmission.

Although numerous studies have investigated inflation determinants in Indonesia, previous research has generally focused on individual factors such as money supply, interest rates, exchange rates, or fiscal variables in isolation. Limited empirical attention has been devoted to examining the combined roles of monetary variables, external debt, and exchange rate movements over an extended observation period encompassing multiple economic regimes, including post-crisis recovery, commodity price cycles, the COVID-19 pandemic, and the global monetary tightening episode. This limitation creates an important empirical gap in understanding how domestic and external macroeconomic factors jointly influence inflation in Indonesia.

Accordingly, this study aims to analyze the determinants of inflation in Indonesia by examining the effects of monetary variables, external debt, and the rupiah exchange rate over the period 2001–2025. By incorporating both domestic monetary indicators and external financial variables within a

unified empirical framework, this study seeks to provide updated evidence on the evolving drivers of inflation in an emerging economy under increasing global financial integration. The findings are expected to contribute to the literature on inflation dynamics while offering practical implications for monetary authorities in designing more effective inflation stabilization policies under conditions of heightened global uncertainty.

Figure 1. Indonesia's Monthly Inflation (Month-to-Month) Trends, 2024–2025



Source: Statistics Indonesia (BPS); authors' calculations.

Figure 1 illustrates that Indonesia's monthly inflation rate in 2025 was generally higher and more volatile than in 2024. The most pronounced increase occurred in March 2025, when month-to-month inflation reached 1.65%, substantially exceeding the highest monthly inflation recorded in 2024, which was 0.52% in the same month (Statistics Indonesia [BPS], 2026). This pattern suggests that monthly inflation dynamics in Indonesia cannot be fully explained by the relatively steady growth in the money supply or the gradual depreciation of the rupiah observed during the study period. Instead, inflation appears to be influenced by a broader set of domestic and external macroeconomic factors.

The empirical literature presents mixed evidence regarding the determinants of inflation. In Saudi Arabia, Albahouth (2025) found that money supply growth exerts a positive and statistically significant effect on inflation in both the short and long run. Similarly, using an Autoregressive Distributed Lag (ARDL) model with Indonesian data spanning 1995–2022, Kurniasih et al. (2024) reported that long-run inflation is significantly influenced by corruption, interest rates, and money supply growth. In contrast, Novanto and Soebagyo (2024) found that money supply growth had no significant effect on inflation in Indonesia during the 1998–2023 period. Comparable findings have also been reported in the Indonesian capital market, where money supply growth and policy interest rates were insignificant, whereas inflation and exchange rate movements exerted substantial effects (Aulya & Hasmarini, 2024). Furthermore, Borio et al. (2023) argue that the relationship between money supply and inflation is regime-dependent, approaching a one-to-one relationship during periods of high inflation but becoming considerably weaker under low and stable inflation regimes. These contrasting findings indicate that the inflationary impact of monetary expansion is contingent upon broader macroeconomic conditions and institutional settings.

External financing conditions may also play a critical role in shaping inflation dynamics. Indonesia's external debt increased substantially from USD 133.1 billion in 2001 to approximately USD 433.6 billion in 2025. Examining the period 2012–2021, Anas and Setyowati (2024) found that external debt has a positive and statistically significant effect on the rupiah exchange rate. This evidence suggests the existence of an indirect transmission channel through which external debt influences inflation by affecting exchange rate movements. Consistent with this perspective, Agathon and Setyowati (2024)

argue that monetary and external sector variables should be viewed as an integrated macroeconomic system rather than as isolated determinants of inflation. Consequently, understanding inflation requires a comprehensive framework that simultaneously considers monetary expansion, exchange rate fluctuations, interest rate movements, and external debt dynamics.

Against this background, the present study aims to examine the determinants of inflation in Indonesia during the 2001–2025 period. Specifically, it seeks to (1) describe the evolution of money supply growth, real interest rates, external debt growth, the rupiah exchange rate, and inflation; (2) investigate the short-run and long-run effects of these macroeconomic variables on inflation using both simultaneous and partial analyses; and (3) identify the dominant determinant of inflation over the study period. The findings are expected to provide updated empirical evidence on Indonesia's inflation dynamics and offer quantitative estimates of both short-run and long-run elasticities, thereby contributing to the formulation of more effective monetary policy and sustainable external debt management strategies.

Quantity Theory of Money as the Grand Theory

Inflation is generally defined as a persistent increase in the overall price level of goods and services over a given period, resulting in a decline in the purchasing power of money. One of the earliest and most influential explanations of inflation is provided by the Quantity Theory of Money, which identifies money supply growth as a fundamental determinant of long-run price movements. Fisher (1911) formalized this relationship through the equation of exchange:

$$MV = PT$$

where Mrepresents the money supply, Vdenotes the velocity of money, Prefers to the general price level, and Trepresents the volume of transactions in the economy. Under the assumptions that money velocity and transaction volume remain relatively constant, an increase in the money supply is expected to generate a proportional increase in the general price level.

However, contemporary empirical evidence suggests that the relationship between money supply growth and inflation is conditional rather than universal. Its magnitude may vary across monetary regimes and macroeconomic environments. Borio et al. (2023), for example, demonstrated that the relationship tends to approach proportionality during high-inflation regimes but becomes substantially weaker when inflation is low and stable. This evidence implies that the inflationary consequences of monetary expansion may depend on institutional credibility, financial development, output dynamics, and the prevailing inflation regime.

In this study, broad money is measured using the annual growth rate of M2, denoted as **GM2**, rather than its logarithmic level. This specification is adopted because the level series is integrated of order two, $I(2)$, and is therefore incompatible with the Autoregressive Distributed Lag bounds-testing framework, which requires variables to be integrated only at level, $I(0)$, or first difference, $I(1)$(Pesaran et al., 2001). The use of money supply growth is also theoretically consistent with the Quantity Theory of Money, which links inflation to changes in the money stock rather than merely to its nominal level.

Interest Rate Theory and Monetary Policy Transmission

The interest rate channel constitutes one of the principal mechanisms through which monetary policy affects aggregate demand and inflation. Changes in interest rates influence household consumption, business investment, credit demand, asset valuation, and overall economic activity. An increase in interest rates raises the cost of borrowing and the opportunity cost of current expenditure, thereby discouraging consumption and investment. The resulting decline in aggregate demand is expected to reduce inflationary pressure.

This study employs the annual real interest rate reported by the World Bank rather than the BI Rate or the BI 7-Day Reverse Repo Rate commonly used in Indonesian monetary studies. The real interest rate reflects borrowing conditions after accounting for changes in the general price level and therefore provides an indication of whether financing conditions are relatively restrictive or accommodative in purchasing-power terms.

Nevertheless, this measurement choice has an important interpretive implication. Because the variable does not directly represent a particular policy instrument of Bank Indonesia, the estimated coefficient should not be interpreted as a direct evaluation of the effectiveness of the BI Rate or the BI 7-Day Reverse Repo Rate. Instead, it captures the broader relationship between inflation-adjusted financing conditions and domestic inflation.

External Debt and Inflation

The relationship between external debt and inflation can be explained through the Fiscal Theory of the Price Level and the concept of fiscal dominance. The Fiscal Theory of the Price Level proposes that the general price level is partly determined by the interaction between outstanding government liabilities and the government's capacity to generate future primary surpluses. When public debt rises beyond the government's credible fiscal capacity, expectations of debt monetization, fiscal adjustment, or currency depreciation may intensify, thereby generating inflationary pressure.

External debt may also influence inflation through the exchange rate channel. Higher external debt obligations increase the demand for foreign currency required to service principal and interest payments. When foreign-exchange earnings and reserve buffers are insufficient, this additional demand may place downward pressure on the domestic currency. Depreciation subsequently raises the domestic prices of imported consumption goods, raw materials, intermediate inputs, and capital goods, thereby contributing to imported inflation.

This mechanism has become increasingly relevant in developing economies because post-pandemic increases in external debt and debt-servicing costs have constrained fiscal space and heightened exposure to global financial shocks (International Monetary Fund [IMF], 2025). In Indonesia, external debt may therefore affect inflation both directly, through fiscal and liquidity pressures, and indirectly, through exchange rate depreciation.

Exchange Rate Theory and Inflation

The relationship between exchange rates and inflation can be explained through Purchasing Power Parity and exchange rate pass-through. Purchasing Power Parity suggests that, in the long run, exchange rate movements reflect differences in price levels or inflation rates across countries. A depreciation of the domestic currency increases the domestic-currency prices of imported goods and internationally traded inputs, thereby contributing to inflation.

Exchange rate pass-through refers to the extent to which changes in the exchange rate are transmitted to import prices, producer prices, and consumer prices. The magnitude and speed of this transmission vary across countries depending on their import structure, economic openness, market competition, monetary policy credibility, and firms' pricing behavior (Albahouth, 2025).

As a relatively open emerging economy, Indonesia remains dependent on imported raw materials, energy products, intermediate inputs, and capital goods. Consequently, rupiah depreciation may represent an important transmission channel through which global shocks affect domestic inflation. This argument is consistent with evidence that global monetary tightening generates substantial spillover effects in developing economies through exchange rate depreciation, capital outflows, and higher import costs (Organisation for Economic Co-operation and Development [OECD], 2025).

Research Gap

Despite the extensive literature on inflation determinants, several empirical and methodological gaps remain.

First, previous studies report inconsistent findings regarding the relationship between money supply growth and inflation. Some studies identify a positive and statistically significant relationship (Albahouth, 2025), whereas others report an insignificant effect in the Indonesian context (Novanto & Soebagyo, 2024). These conflicting findings have not been fully reconciled using a longer observation period that captures different inflation regimes and major macroeconomic episodes in Indonesia.

Second, Indonesian studies generally examine external debt as a determinant of the exchange rate rather than as a potential determinant of inflation. For example, Anas and Setyowati (2024) focused on the effect of external debt on rupiah movements. As a result, the direct inflationary implications

of external debt and its possible transmission through exchange rate movements remain insufficiently examined within an integrated empirical framework.

Third, most domestic studies use nominal policy rates, such as the BI Rate or the BI 7-Day Reverse Repo Rate. Empirical assessments based on real interest rates remain relatively limited, even though nominal and real interest rates capture different aspects of monetary conditions and may generate different interpretations of the relationship between financing conditions and inflation.

Fourth, a substantial proportion of the Indonesian literature continues to rely on static models that do not distinguish short-run adjustments from long-run equilibrium relationships. This limitation is particularly important because the transmission of monetary and external sector variables to inflation is unlikely to occur instantaneously. Exchange rate depreciation, changes in external debt, and adjustments in money supply may affect inflation with different time lags.

Fifth, previous studies rarely compare the relative importance of monetary, external debt, and exchange rate variables using standardized coefficients. Claims regarding the most influential determinant are therefore often based solely on statistical significance rather than on effect sizes measured on a comparable scale.

Research Novelty

This study offers several contributions that distinguish it from previous research.

First, it simultaneously examines money supply growth, the real interest rate, external debt growth, and the rupiah exchange rate within an integrated **Autoregressive Distributed Lag–Error Correction Model (ARDL–ECM)** framework. The study covers the 2001–2025 period, enabling the analysis to capture long-term macroeconomic changes, major global shocks, and different inflationary conditions in Indonesia.

Second, money supply and external debt are operationalized as annual growth rates rather than logarithmic levels. This transformation addresses the presence of $I(2)$ variables, which would otherwise violate the requirements of the ARDL bounds-testing procedure. The specification therefore strengthens the econometric validity of the model while maintaining consistency with the study's theoretical interpretation.

Third, the study employs the real interest rate rather than a nominal policy rate. This approach allows the analysis to capture inflation-adjusted financing conditions and provides an alternative perspective on the role of monetary conditions in explaining inflation.

Fourth, the study explicitly evaluates the relative dominance of the explanatory variables using standardized beta coefficients. This procedure enables direct comparison of the magnitude of monetary, external debt, and exchange rate effects after differences in measurement scales have been accounted for. The identification of the dominant variable is therefore based not only on statistical significance but also on the relative size of its estimated effect.

Fifth, the study integrates monetary and external sector determinants within a single dynamic framework. Rather than treating money supply, interest rates, external debt, and exchange rates as isolated predictors, the model recognizes that these variables operate through interrelated macroeconomic transmission mechanisms. This integrated approach is expected to provide a more comprehensive explanation of inflation dynamics in Indonesia.

H1: Money supply growth has a significant effect on inflation in Indonesia in the short and long run.
H2: The real interest rate has a significant effect on inflation in Indonesia in the short and long run.
H3: External debt growth has a significant effect on inflation in Indonesia in the short and long run.
H4: The rupiah exchange rate has a significant effect on inflation in Indonesia in the short and long run.
H5: Money supply growth, the real interest rate, external debt growth, and the rupiah exchange rate jointly have a significant effect on inflation in Indonesia.
H6: The relative magnitude of the effects of money supply growth, the real interest rate, external debt growth, and the exchange rate on inflation differs after the coefficients are standardized

Research Design and Methodology

This study employs a quantitative approach using a non-experimental, explanatory, and ex post facto research design. The analysis relies on annual secondary time-series data that have already occurred and were not subject to manipulation by the researchers. The study examines the dynamic relationships between inflation, money supply growth, the real interest rate, external debt growth, and the rupiah exchange rate in Indonesia.

The observation period covers 2001–2025, resulting in 25 annual observations for each variable. All available observations within the predetermined study period were included in the analysis. Accordingly, the study applies a census approach to the selected time span rather than random sampling. The period was chosen based on data consistency and availability across all variables and sources.

Data Sources and Collection Procedure

Data were collected through document analysis of official publications issued by national and international institutions. Annual Consumer Price Index inflation data were obtained from Statistics Indonesia (BPS). Broad money supply and annual average exchange rate data were obtained from the Indonesian Economic and Financial Statistics published by Bank Indonesia.

External debt data were collected from the Statistics of Indonesia's External Debt, jointly published by Bank Indonesia and the Ministry of Finance of the Republic of Indonesia. Real interest rate data were obtained from the World Development Indicators database maintained by the World Bank.

The data collection instrument consisted of a structured documentation sheet containing the variable names, operational indicators, units of measurement, data sources, and observation periods. The use of official institutional sources was intended to ensure data consistency, credibility, and comparability throughout the study period.

Variable Measurement

The dependent variable is inflation (INF), measured by the annual percentage change in the Consumer Price Index.

The study includes four independent variables. First, money supply growth ($GM2$) is measured as 100 times the annual change in the natural logarithm of broad money supply:

$$GM2_t = 100 \times [\ln(M2_t) - \ln(M2_{t-1})]$$

Second, the real interest rate ($RATE$) is measured in percentage terms and represents the cost of funds after accounting for changes in the general price level.

Third, external debt growth ($GULN$) is measured as 100 times the annual change in the natural logarithm of Indonesia's outstanding external debt:

$$GULN_t = 100 \times [\ln(ULN_t) - \ln(ULN_{t-1})]$$

Fourth, the rupiah exchange rate ($LNKURS$) is measured as the natural logarithm of the annual average IDR/USD exchange rate:

$$LNKURS_t = \ln(KURS_t)$$

An increase in $LNKURS$indicates a depreciation of the rupiah against the U.S. dollar.

Rationale for Variable Transformation

Money supply and external debt are expressed in growth rates for both econometric and theoretical reasons. From an econometric perspective, the logarithmic level series of both variables were found to be integrated of order two, $I(2)$. Such variables cannot be included in the Autoregressive Distributed Lag bounds-testing framework, which is designed for variables integrated at level, $I(0)$, or first difference, $I(1)$(Pesaran et al., 2001).

From an economic perspective, expressing money supply in growth terms is consistent with the Quantity Theory of Money, which relates inflation to the rate of monetary expansion rather than

to the nominal stock of money. Similarly, external debt growth captures changes in external financing pressure more directly than its nominal level. The use of 100 times the logarithmic difference provides an approximation of annual percentage changes while reducing stochastic trends in the original series.

Data Analysis Technique

The study applies the Autoregressive Distributed Lag–Error Correction Model (ARDL–ECM) using EViews software. The ARDL approach was selected because it can accommodate variables with different orders of integration, provided that none is integrated of order two. It also enables the simultaneous estimation of short-run dynamics and long-run equilibrium relationships within a unified framework.

The ARDL method is particularly appropriate for relatively small samples. Nevertheless, because the study uses only 25 annual observations, model specification and lag selection were conducted parsimoniously to avoid excessive parameterization and loss of degrees of freedom.

The analysis was conducted in several stages. First, the stationarity properties of the variables were examined using the Augmented Dickey–Fuller unit root test. Second, the optimal lag structure was selected using the Akaike Information Criterion. Third, the existence of a long-run relationship among the variables was assessed using the ARDL bounds-testing procedure. Fourth, the long-run coefficients and short-run error correction model were estimated. Fifth, residual diagnostic tests and parameter stability tests were performed. Finally, standardized coefficients were calculated to assess the relative dominance of the explanatory variables.

Econometric Model Specification

The long-run inflation model is specified as follows:

$$INF_t = \beta_0 + \beta_1 GM2_t + \beta_2 RATE_t + \beta_3 GULN_t + \beta_4 LNKURS_t + \varepsilon_t \qquad (1)$$

where INF_t denotes inflation, $GM2_t$ represents money supply growth, $RATE_t$ represents the real interest rate, $GULN_t$ denotes external debt growth, $LNKURS_t$ represents the logarithm of the rupiah exchange rate, and ε_t is the error term.

The corresponding error correction model is expressed as:

$$\Delta INF_t = \alpha_0 + \sum_{i=1}^{p} \gamma_i \, \Delta INF_{t-i} + \sum_{j=1}^{4} \sum_{i=0}^{q_j} \theta_{ji} \, \Delta Z_{j,t-i} + \lambda ECT_{t-1} + \varepsilon_t \qquad (2)$$

where Z_j represents the four explanatory variables, namely $GM2$, $RATE$, $GULN$, and $LNKURS$. The coefficients γ_i and θ_{ji} capture short-run dynamics, while ECT_{t-1} represents the lagged error correction term derived from the long-run equilibrium relationship.

The coefficient λ measures the speed at which short-run deviations return to long-run equilibrium. A valid error correction mechanism requires λ to be negative and statistically significant. In a stable adjustment process, its absolute value is generally expected to fall between zero and one.

Diagnostic and Stability Tests

Several diagnostic tests were employed to evaluate the reliability of the estimated model. Serial correlation was examined using the Breusch–Godfrey Lagrange Multiplier test. Heteroskedasticity was assessed using an appropriate heteroskedasticity test, while residual normality was evaluated using the Jarque–Bera test.

Model specification was examined using the Ramsey RESET test. Parameter stability was evaluated using the cumulative sum of recursive residuals and cumulative sum of squares tests. The model was considered stable when the test statistics remained within the 5% critical boundaries.

Dominance Analysis

The relative importance of each explanatory variable was assessed using standardized beta coefficients. Standardization was necessary because the variables were measured using different units and scales. The standardized coefficient was calculated as follows:

$$\beta_j^* = \beta_j \left(\frac{SD_{Z_j}}{SD_{INF}} \right) \qquad (3)$$

where β_j^*denotes the standardized coefficient, $\beta_j$is the unstandardized estimated coefficient, $SD_{Z_j}$is the standard deviation of the relevant explanatory variable, and $SD_{INF}$is the standard deviation of inflation. All standard deviations were calculated using the common estimation sample.

The variable with the largest absolute standardized coefficient was interpreted as having the strongest relative association with inflation, provided that its estimated coefficient was statistically significant. Because standardized coefficients in dynamic time-series models may differ between short-run and long-run specifications, dominance was evaluated separately for each horizon where appropriate.

Hypothesis Testing

All hypotheses were tested at the 5% significance level. The joint significance of the explanatory variables was assessed using the F-test for the estimated ARDL model. The existence of a long-run equilibrium relationship was determined using the ARDL F-bounds test.

Partial effects were evaluated using t-tests on the estimated short-run and long-run coefficients. A coefficient was considered statistically significant when its probability value was below 0.05. The sign and magnitude of each coefficient were then interpreted in accordance with the theoretical framework and the operational definition of the corresponding variable.

Findings and Discussion

Development of Research Variables

Descriptive statistics of the five variables are presented in Table 1. The average inflation in Indonesia during the study period was 5.6784 percent with a median of 4.30 percent (Bank Indonesia, 2026) . The higher average than the median reflects the influence of several years with high inflation, especially 2001, 2002, 2005, and 2008. The maximum value of 17.11 percent occurred in 2005 when fuel price adjustments took place, while the minimum value of 1.57 percent occurred in 2024. The standard deviation of 3.8450 percent, which is quite large relative to the average, confirms that inflation has experienced significant variations.

Table 1. Descriptive Statistics of Research Variables

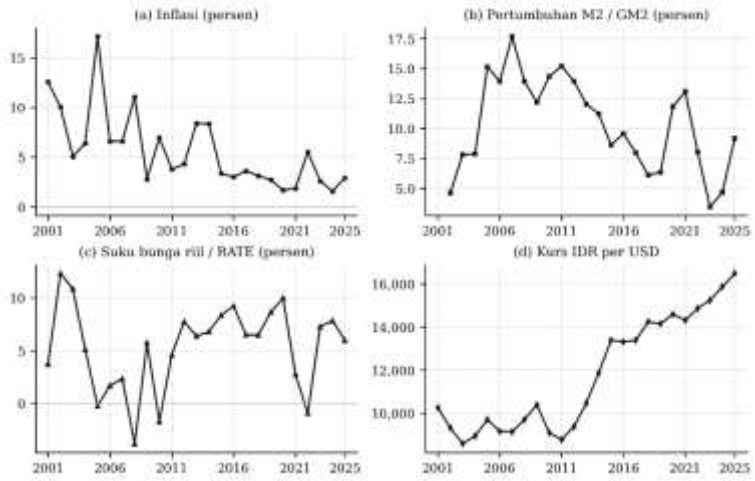
Variables	Mean	Median	Max.	Min.	Std. Dev.	N
INF (percent)	5,6784	4,3000	17,1100	1,5700	3,8450	25
GM2 (percent)	10,3563	10,3882	17,6682	3.4405	3.8831	24
RATE (percent)	5,3405	6,3749	12,3224	-3.8522	4,0618	25
GULN (percent)	4,9220	4.9776	15,7768	-4,9099	5,2144	24
LNCURS	9,3502	9,2554	9,7098	9,0569	0.2233	25

Source: Processed secondary data, 2026. GM2 and GULN were formed starting in 2002 because they require the value of one previous period.

The growth of the money supply averaged 10.3563 percent per year with the highest value of 17.6682 percent in 2007 and the lowest of 3.4405 percent in 2023 (Bank Indonesia, 2026) . Interestingly, GM2 never had a negative value throughout the study period, so that economic liquidity always increased, although at varying speeds. Foreign debt growth was much more fluctuating, with an average of 4.9220 percent and a range from -4.9099 percent in 2005 to 15.7768 percent in 2010. Real interest

rates fluctuated the widest among the percentage variables, namely from -3.8522 percent in 2008 to 12.3224 percent in 2002. Negative values in real interest rates reflect changes in the balance between nominal interest and inflation, not the setting of policy instruments below zero.

Figure 3. Development of Inflation, M2 Growth, Real Interest Rates, and the Rupiah Exchange Rate 2001-2025



Source: Processed secondary data, 2026.

Figure 3 shows the development of the four main variables. Panel (a) shows that inflation has not formed a permanent upward or downward trend, but rather a series of spikes followed by declines. Panel (b) shows consistently positive M2 growth with a tendency to slow towards the end of the period. Panel (c) shows that the real interest rate has penetrated negative territory several times, particularly in 2005, 2008, 2010, and 2022. Panel (d) shows the exchange rate, which has tended to increase since 2012, indicating a continued weakening of the rupiah. Comparing the four panels reveals one important point: inflation does not move identically to any of the variables. This misalignment is the primary reason for using a dynamic model.

Stationarity Test Results and Model Selection

The results of the Augmented Dickey-Fuller unit root test are presented in Table 2. Inflation and real interest rates are stationary at level or order I(0), while GM2, GULN, and LNKURS are stationary at the first difference or order I(1). In contrast, the logarithm of M2 and the logarithm of foreign debt only reach stationarity at the second difference, so they are of order I(2) and cannot be retained in the model. This finding underlies the replacement of the two stock series with their growth forms. After the replacement, all model variables consist only of a combination of I(0) and I(1) so that the prerequisite for bounds testing is met.

Table 2. Results of the Augmented Dickey-Fuller Stationarity Test

Variables	ADF Statistics	Probability	Conclusion
INF	-3,660139	0.0119	Stationary at level, I(0)
RATE	-3.376476	0.0223	Stationary at level, I(0)
GM2	-4.225941	0.0036	Stationary at first difference, I(1)
GULN	-5,321547	0.0003	Stationary at first difference, I(1)
LNCURS	-3.783284	0.0092	Stationary at first difference, I(1)
LNM2	-4.225941	0.0036	Stationary in the second differentiation, I(2), is not used.
LNULN	-5,321547	0.0003	Stationary in the second differentiation, I(2), is not used.

Source: Processed EViews output, 2026. Test using constants with automatic lag based on the Schwarz Information Criterion.

Model selection was performed automatically based on 16 combinations with a maximum lag length of one based on the Akaike Information Criterion. A lag limit of one was set because the data are annual and there are only 23 effective observations, so using a longer lag would excessively reduce the degrees of freedom. The selected model is ARDL(1,1,0,0,1), which means inflation uses one lag, GM2 uses one lag, RATE and GULN have no lag, and LNKURS uses one lag.

Cointegration Test Results

The results of the F-Bounds Test are presented in Table 3. The F-statistic value of 15.85255 far exceeds the upper limit of I(1) at all levels of significance, including the most stringent finite sample critical value of 5.840. Thus, the null hypothesis stating that there is no relationship between levels is rejected, and inflation is proven to be cointegrated with money supply growth, real interest rates, foreign debt growth, and the rupiah exchange rate. This result also serves as supporting evidence for H1, namely that the four independent variables together have a significant effect on inflation. The F test on the ARDL equation strengthens this conclusion with a value of 9.333934 and a probability of 0.000170.

Table 3. Results of the F-Bounds Cointegration Test

Information	Mark	Level	Limit I(0)	Limit I(1)
F-statistic	15.85255	10 percent	2,200	3,090
Number of regressors (k)	4	5 percent	2,560	3,490
Effective observation	23	1 percent	3,290	4,370
F test of ARDL equation	9.333934	Finite sample 1 percent	4,280	5,840

***Source**: Processed EViews output, 2026. The null hypothesis is that there is no relationship between levels.*

Long-Term and Short-Term Estimation Results

The long-term coefficient estimates are presented in Table 4 and the short-term estimates in Table 5. The long-term equations formed show that only the real interest rate and the exchange rate are significant, while the growth of money supply and the growth of foreign debt are not significant at the 5 percent level. The coefficient of determination of the error correction model is 0.8782 with a corrected value of 0.8660 indicating that approximately 86.60 percent of the variation in inflation changes can be explained by the model.

Table 4. Long-Term Estimation Results

Variables	Coefficient	Std. Error	t-Statistic	Probability
GM2	-0.354016	0.205381	-1.723701	0.1053
RATE	-0.635543	0.200955	-3,162610	0.0064
GULN	-0.096547	0.094121	-1.025774	0.3213
LNCURS	-10,821210	2.553525	-4.237753	0.0007
Constant	113,165000	25,177060	4.494765	0.0004

Source: Processed EViews output, 2026.

Table 5. Short-Term Estimation Results and Error Correction

Variables	Coefficient	Std. Error	t-Statistic	Probability
D(GM2)	0.118616	0.115304	1.028730	0.3199
D(LNKURS)	19,502950	5,206629	3,745791	0.0019
CointEq(-1)	-0.982171	0.087215	-11,261460	0.0000

Source: Processed EViews output, 2026. R-squared 0.878189 and adjusted R-squared 0.866008.

The error correction coefficient of -0.982171 is negative, significant, and has an absolute value less than one, thus confirming the validity of the error correction model. Its magnitude indicates that approximately 98.22 percent of the imbalance from the previous year was corrected within one year. In other words, when inflation deviates from its equilibrium trajectory, almost all of the deviation is readjusted in the following period. This high adjustment rate makes sense at an annual frequency, as monetary authorities, governments, businesses, and households all respond to price changes through adjustments in interest rates, demand, imports, contracts, and financing decisions over that timeframe.

Diagnostic and Stability Test Results

After partial and simultaneous significance tests using the t-test and F-test in the previous subsection, the feasibility of the ARDL-ECM model was examined through four tests, the results of which are summarized in Table 6. The residuals are normally distributed, do not contain serial correlation at the 5 percent level, and do not show conditional heteroscedasticity. The Cumulative Sum and Cumulative Sum of Squares plots remain within the 5 percent significance boundary throughout the testing period, thus confirming the model parameters are stable. This stability is important because the study period contains several major shocks, ranging from the 2005 fuel price adjustment, the 2008 global financial crisis, to the 2020 pandemic. The passing of all tests indicates that the estimation results are not limited to a specific subperiod.

Table 6. Summary of Diagnostic and Stability Test Results

Testing	Statistics	Probability	Conclusion
Jarque-Bera Normality	0.925615	0.629514	Normal residual
Breusch-Godfrey autocorrelation	2.846544	0.0916	Autocorrelation free
ARCH heteroscedasticity	0.289833	0.5903	Free of heteroscedasticity
CUSUM Stability	Within 5 percent limit	-	Stable parameters
CUSUM of Squares Stability	Within 5 percent limit	-	Stable variance

***Source**: Processed EViews output, 2026. Autocorrelation and heteroscedasticity statistics using Obs*R-squared.*

The Simultaneous Effect of Monetary Variables, Foreign Debt, and Exchange Rates
The evidence for cointegration indicates that money supply growth, real interest rates, external debt growth, and the exchange rate are all significantly related to inflation, thus H1 is accepted. This simultaneous conclusion does not require all variables to be individually significant, as the joint test assesses whether the combined information provided by all model components is able to explain changes in inflation after lags and interannual relationships are accounted for. Variables that are partially weak can still contribute because their movements interact with interest rates, exchange rates, fiscal conditions, and inflation adjustments in the previous period. A similar pattern is found in the ASEAN-6 context, where monetary policy has a simultaneous but not an individual effect (Ningsih et al., 2024) .

These findings align with research that places the money supply, exchange rate, and external shocks within a single explanatory framework for inflation (Albahouth, 2025) . This is also evident in the finding that price pressures originate from more than one channel (Giannone & Primiceri, 2024) . The substantive implication is that controlling inflation cannot be achieved through a single instrument. Policies that only tighten one channel have the potential to have limited impact if the primary pressures originate from import costs, supply disruptions, or fiscal adjustments.

The Effect of Money Supply Growth on Inflation
The growth in the money supply has no significant effect on inflation, either in the short or long term, thus H2 is rejected. Economically, this finding indicates that increasing liquidity appears to be absorbed more by output growth and increasing demand for money, rather than directly reflected in price increases. This finding is consistent with research examining Indonesia from 1998 to 2023, which also found no significant effect of the money supply on inflation (Novanto & Soebagyo, 2024) . Recent research on Indonesian monthly data also confirms a similar pattern: the logarithmic coefficient of M2 was recorded as negative and insignificant on short-term inflation, while inflation was explained more by the persistence of previous inflation periods than by monetary instruments (Agusfinah et al., 2026) , reinforcing the explanation that the relationship between money and inflation weakens in low and stable inflation regimes (Borio et al., 2023) . Conversely, this result differs from the findings of (Albahouth, 2025) and (Kurniasih et al., 2024) . The differences with Kurniasih et al.'s (2024) study are interesting to note because both used ARDL on Indonesian data. The source of the differences is suspected to lie in the sample period, the form of the monetary variables used, and the presence of different control variables. Aulya & Hasmarini (2024) also found the money supply to be insignificant in the context of the Indonesian capital market, suggesting that the weak aggregate monetary signal is not an isolated phenomenon but rather a fairly consistent pattern in Indonesia's recent low-inflation regime.

The Effect of Real Interest Rates on Inflation
Real interest rates have a negative and significant effect on inflation in the long run, thus accepting H3. When real interest rates rise, inflation tends to decline significantly through two channels. The first channel operates through financing costs, as rising real interest rates make consumer and investment credit more expensive, thus restraining aggregate demand growth. The second channel occurs through portfolio choice, as saving becomes more attractive than spending current income.
This finding is consistent with interest rate transmission theory and aligns with research that also positions interest rates as a determinant of long-term inflation in Indonesia (Kurniasih et al., 2024) . The selected model does not produce a stand-alone interest rate change coefficient in the short-run equation because the lag length of the variable is chosen to be zero. This should not be interpreted as evidence that interest rates are irrelevant in the current year, but rather indicates that the data structure does not select interest rate dynamics separately.

Interpretation needs to follow the characteristics of the data used. The RATE variable in this study is the real annual interest rate, not the BI-Rate or the BI 7-Day Reverse Repo Rate. The real interest rate already takes inflation into account, so its value reflects the tightness or looseness of the cost of funds in terms of purchasing power. The negative relationship found is consistent with transmission theory, but should not be claimed as a direct estimate of the effectiveness of a single Bank Indonesia policy instrument. This caution is important because other research shows that interest rates actually have a significant positive effect on the rupiah exchange rate (Anas & Setyowati, 2024) , indicating that the interest rate channel operates through more than one channel.

The Impact of Foreign Debt Growth on Inflation

Foreign debt growth has a negative long-term relationship, but its effect is insignificant, thus H4 is rejected. This negative trend differs from the positive trend hypothesized through the fiscal dominance channel, making it more economically plausible to interpret this finding as an indication that during the study period, Indonesia's foreign debt accumulation has not yet triggered monetization or depreciation pressures large enough to be felt in aggregate inflation. This pattern aligns with research that also found no significant effect of foreign debt on Indonesian inflation from 1998 to 2023 (Novanto & Soebagyo, 2024) . Studies of several developing countries also show that the relationship between foreign debt and inflation is not always consistent, depending on the structure of fund use and fiscal credibility of each country (Yaşa & Şentürk, 2025) , so the absence of a strong effect in the Indonesian case is not an isolated finding. Previous research found that foreign debt actually has a significant effect on the rupiah exchange rate, not directly on inflation (Anas & Setyowati, 2024) , so the channel is most likely indirect through the exchange rate, which is included separately in this model.

The Effect of the Rupiah Exchange Rate on Inflation

The exchange rate is the most interesting variable in this study because its influence reverses direction between the short and long term, resulting in only partial acceptance of H5. In the short term, rupiah depreciation is positively and significantly related to inflation, as initially expected. The mechanism is quite straightforward: companies using raw materials, energy, capital goods, or services from abroad face rising costs in rupiah, which are then gradually passed on to selling prices. This is a form of imported inflation and exchange rate pass-through, commonly found in small open economies, as reported by other studies (Albahouth, 2025). (Favian Ardine Agathon & Setyowati, 2024) .

In the long run, the relationship is negative and significant, contradicting the initial hypothesis that depreciation would permanently increase inflation. This long-run coefficient does not necessarily imply a direct price decrease; it reflects the relationship after the adjustment process, interest rate response, changes in demand, and external financing are taken into account. Several mechanisms could explain this reversal. Persistent depreciation tends to encourage monetary tightening, reduce consumption of imported goods, accelerate input substitution, and suppress domestic demand by reducing purchasing power. The rupiah exchange rate itself responds to interest rates and foreign debt, so it is not a completely exogenous variable (Anas & Setyowati, 2024) . This bidirectional finding enriches the discussion on purchasing power parity, demonstrating that the time horizon is as important as the direction of the relationship itself.

Dominance of Variables

The results of the long-run standardization of the coefficients are presented in Table 7. The real interest rate has the largest absolute beta value of 0.6998, closely followed by the exchange rate at 0.6849. Money supply growth and foreign debt growth have smaller betas and are not significant, so neither can be declared a dominant variable although they remain part of the cointegration relationship.

Table 7. Standardized Long-Run Coefficients

Variables	Coefficient	Std. Dev. X	Beta	|Beta|	Prob.
GM2	-0.354016	3,768269	-0.371827	0.371827	0.1053
RATE	-0.635543	3,950423	-0.699786	0.699786	0.0064
GULN	-0.096547	5,156021	-0.138749	0.138749	0.3213
LNCURS	-10,821210	0.227074	-0.684888	0.684888	0.0007

Source: Processed EViews data and output, 2026. The standard deviation of inflation in the common sample 2003-2025 is 3.587760.

The assumption that the exchange rate is the most dominant variable across all time horizons is not fully supported. Dominance depends on the time period under consideration. The exchange rate is the most obvious channel for short-term dynamics because changes in the exchange rate immediately affect import and production input costs. Real interest rates do not appear as separate changes in the short-run equation but become the strongest factor in the long-run relationship once all variables are scaled equal. The variables most important for cushioning current shocks are therefore not necessarily the same as those most powerful in maintaining sustained price stability.
The beta difference between real interest rates and the exchange rate is only about 0.015 units, so claims of dominance should be made with caution. This closeness actually reflects the reciprocal relationship between the two channels. Interest rates influence capital flows, domestic demand, expectations, and exchange rate pressures, while a weakening rupiah can encourage interest rate adjustments to maintain price stability and the attractiveness of domestic assets. Because both variables respond to each other, asserting absolute dominance of one variable without considering the adjustment horizon and mechanism simplifies a dynamic relationship.

Theoretically, this series of findings expands the quantity theory of money, not undermines it. Money fluctuations remain the foundation of nominal money, but during this study period, their partial influence is less strong than that of the funds price and foreign exchange price channels. Monetary policy weakens in low-inflation regimes, while interest and exchange rate mechanisms become more prominent (Borio et al., 2023) . At the same time, findings from Giannone & Primiceri, 2024, and Asadollah et al., 2024, remind us that the dominance of variables in the model does not eliminate the role of out-of-specification demand and supply shocks. These findings indicate that in the Indonesian context for the 2001–2025 period, the interest rate and exchange rate transmission mechanisms are more dominant than the quantity of money channel, thus providing empirical support for the modern approach to monetary policy transmission in a low inflation regime.

The findings of this study provide theoretical implications that, in the Indonesian context for the 2001–2025 period, the monetary policy transmission mechanism through real interest rates and the exchange rate plays a more dominant role than the quantity of money mechanism. These results reinforce the view that the effectiveness of inflation control in an open economy is more influenced by the asset price and exchange rate channels than by the traditional monetary channel, thus enriching the empirical evidence regarding the monetary policy transmission mechanism in developing countries.

Conclusion

This study provides clear evidence that inflation in Indonesia is shaped by the interaction between domestic monetary conditions and external sector pressures in both the short and long run. In the long run, the real interest rate and the rupiah exchange rate emerge as significant determinants of inflation. In the short run, however, only the exchange rate remains statistically significant. By contrast, money supply growth and external debt growth do not exhibit a significant effect on inflation during the 2001–2025 period. These findings suggest that exchange rate stability and the effectiveness of interest rate policy play a more substantial role in maintaining price stability than changes in broad

money growth or external debt accumulation alone. The findings offer several practical implications. Bank Indonesia and the government should strengthen policy coordination in managing inflationary pressures, particularly those transmitted through monetary and external channels. Monetary policy must remain credible and responsive to changes in real financing conditions, while exchange rate management should focus on limiting excessive rupiah volatility that may intensify imported inflation. At the same time, external debt should be managed prudently and directed toward productive sectors capable of generating sufficient economic returns and foreign exchange earnings. Such coordination is essential to ensure that external borrowing does not create additional inflationary or fiscal pressures in the future. When monetary credibility, exchange rate stability, and sustainable debt management are pursued in an integrated manner, macroeconomic stability can provide a stronger foundation for sustainable economic growth.

From an academic perspective, this study contributes to the literature on inflation determinants in Indonesia by integrating monetary and external sector variables within a unified Autoregressive Distributed Lag–Error Correction Model framework over the 2001–2025 period. In addition to distinguishing between short-run dynamics and long-run equilibrium relationships, the study evaluates the relative importance of the explanatory variables in influencing inflation. This approach provides a more comprehensive understanding of the mechanisms underlying inflation in Indonesia and highlights the dominant role of the exchange rate across different time horizons.

Nevertheless, this study has several limitations. First, it relies on annual data and a relatively small number of observations, which may limit the statistical power of the estimated model and restrict the identification of short-term fluctuations. Second, the model does not incorporate several potentially important determinants of inflation, including global commodity prices, energy prices, inflation expectations, supply-chain disruptions, and global economic shocks. Third, the use of aggregate national data may conceal sectoral and regional differences in inflation dynamics.

Future research should employ higher-frequency data, such as monthly or quarterly observations, to capture inflation transmission more precisely. Subsequent studies may also extend the model by including global commodity prices, energy costs, inflation expectations, fiscal variables, and indicators of external uncertainty. The use of alternative dynamic approaches, such as nonlinear ARDL, structural vector autoregression, or time-varying parameter models, may further reveal whether the effects of monetary and external variables differ across inflation regimes and periods of economic instability.

Statement on the Use of Generative Artificial Intelligence (AI)

During the preparation of this manuscript, the authors used generative artificial intelligence (AI) tools solely to support the scientific writing process. Specifically, Grammarly was used to improve grammar, language quality, readability, and writing clarity. The AI tools were not used to generate research ideas, analyze data, interpret findings, or draw scientific conclusions. All study design, data collection, analysis, interpretation of results, and conclusions were conducted and verified entirely by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the content presented in this manuscript.

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