



RESEARCH ARTICLE

The Effect of Interest Rates, Inflation, and Money Supply on Economic Growth through Exchange Rate Transmission in Indonesia

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Abstract

Understanding monetary transmission mechanisms is critical for emerging open economies navigating external volatility. This study investigates the direct and indirect impacts of interest rates, inflation, and money supply on Indonesia's economic growth from 2014 to 2024, examining the mediating role of the Rupiah-to-USD exchange rate. Utilizing a quantitative explanatory design with annual time-series data from Bank Indonesia and BPS, the research applies Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS 4. Empirical results demonstrate a high coefficient of determination for the exchange rate ($R^2 = 0.939$) and economic growth ($R^2 = 0.359$). Findings reveal that interest rates exert a significant direct effect on growth (coef = 0.417, $p = 0.003$) but have an insignificant impact on the exchange rate. Inflation positively influences growth (coef = 0.650, $p = 0.001$) while negatively affecting the exchange rate (coef = -0.313, $p = 0.007$). The money supply significantly impacts both exchange rates (coef = 0.791, $p = 0.000$) and economic growth (coef = -0.390, $p = 0.025$). Crucially, the exchange rate acts as a potent mediating channel (coef = 0.894, $p = 0.000$), transmitting shocks to real output. The findings underscore that monetary policy must integrate exchange rate stability and liquidity management alongside interest rate adjustments.

Keywords

Economic Growth; Interest Rates; Inflation; Money Supply; Exchange Rate; Structural Equation Modeling (SEM).

1 | INTRODUCTION

Economic growth serves as a key indicator of a nation's development success. During the period from 2014 to 2024, Indonesia has witnessed significant changes in its economic structure. The manufacturing and service sectors now play an increasingly vital role in shaping national output, alongside the more traditional agricultural and mining industries. In facing global challenges, it is essential for Indonesia to maintain its economic resilience. This requires a thorough understanding of the interactions among various macroeconomic variables. Effective policies must be formulated to ensure the stability of the real sector amid external uncertainties. Analyzing the evolving economic dynamics is crucial for identifying existing opportunities and challenges. With a critical approach, policymakers can design more effective strategies to promote sustainable growth. Through these efforts, Indonesia can optimally harness its economic potential and mitigate the negative impacts of global market fluctuations.

The dynamics of macroeconomic output are closely tied to domestic monetary instruments, particularly interest rates, inflation, and the money supply. The benchmark interest rate plays a pivotal role in shaping economic activity by influencing the cost of capital, which in turn affects investment decisions and public consumption. When interest rates rise, businesses often face challenges in expanding due to increased borrowing costs, which can hinder overall economic growth (Mamangkey *et al.*, 2025). Inflation embodies a complex nature; while moderate levels can aid in price discovery, high volatility can undermine purchasing power and create economic uncertainty. This necessitates careful management of inflationary pressures to maintain stability. Additionally, the Quantity Theory of Money underscores the importance of controlled liquidity expansion (M2) in facilitating transactions within the real sector, ensuring that growth does not lead to overheating (Friedman, 1956; Uçar, 2024). A nuanced approach to monetary policy is vital for fostering a stable economic environment. By critically assessing the interplay between these key variables, policymakers can develop strategies that not only promote sustainable growth but also address the inherent risks associated with inflation and interest rate fluctuations. This understanding is essential for navigating the complexities of today's economic landscape effectively.

Although there is a wealth of literature addressing conventional monetary transmissions, notable gaps remain regarding the effectiveness of policies in open economies that are marked by banking rigidities and external vulnerabilities (Mishkin, 2011). Many previous empirical studies (e.g., Thobarry, 2009; Mamangkey *et al.*, 2025) have primarily focused on interest rates, inflation, and money supply as direct exogenous factors influencing economic growth. This perspective often neglects the significant mediating role played by external sector shocks. Specifically, earlier research tends to overlook how external capital flows, fluctuations in global commodity prices, and exchange rate volatility can reshape the pathways through which monetary policy impacts developing countries, especially those reliant on imported intermediate goods. This oversight is critical, as it limits the understanding of how external factors can influence domestic economic conditions and policy effectiveness. Addressing these gaps requires a more nuanced analysis that considers the interactions between domestic monetary policies and external economic forces. Such an approach is essential for developing strategies that can enhance resilience and adaptability in the face of global economic challenges.

To address this critical research gap, this study explicitly positions the Rupiah-to-USD exchange rate as a mediating (intervening) variable rather than a mere secondary indicator. During the 2014–2024 period, Indonesia faced persistent external pressures, including the Federal Reserve's 'higher for longer' interest rate stance, commodity price swings, and imported inflation risks that exacerbated investment inefficiency and capital account volatility. Under the Mundell-Fleming framework and Purchasing Power Parity (PPP), domestic monetary shocks do not instantly translate into real GDP acceleration; rather, they are filtered, amplified, or absorbed through exchange rate fluctuations before impacting domestic production costs and investment efficiency (Sitorus & Fajarini, 2023).

Grounded in these structural challenges and theoretical imperatives, this study aims to empirically analyze and verify the direct and indirect transmission channels of interest rates, inflation, and money supply on Indonesia's economic growth through exchange rate mediation. Utilizing annual time-series data from 2014 to 2024 sourced from official institutions (Bank Indonesia and BPS), the research employs Structural Equation Modeling via SmartPLS 4. This methodological choice enables rigorous simultaneous estimation of complex path relationships, supported by bootstrap-based indirect effect testing to capture the exact magnitude of monetary policy transmission in an open economy.

The preliminary estimation findings indicate that domestic monetary instruments exert most of their influence indirectly through exchange rate adjustments rather than direct output acceleration. This outcome extends the application of open-economy macroeconomic theory to emerging markets and provides critical practical insights for Bank Indonesia and fiscal authorities. By identifying the mediating role of the exchange rate, this study offers robust policy recommendations for formulating an adaptive policy mix that balances external exchange stability with sustainable long-term economic growth.

2 | BACKGROUND THEORY

The primary theoretical framework anchoring this study is the Mundell-Fleming Model, which serves as the foundational open-economy extension of Keynesian macroeconomic theory. The Mundell-Fleming framework postulates that monetary policy effectiveness is inextricably linked to exchange rate regimes and capital mobility. Within an open-economy context like Indonesia, domestic monetary policy actions—specifically adjustments in interest rates and money supply (M2) do not operate in a closed vacuum. Instead, they interact directly with international capital flows and relative price adjustments, positioning the exchange rate as a vital mediating mechanism that channels domestic monetary shocks into real economic output (NX and domestic investment).

To further articulate the specific transmission channels, this study integrates Purchasing Power Parity (PPP), Interest Rate Parity (IRP), and the Quantity Theory of Money ($MV = PT$). PPP dictates that long-term exchange rate adjustments reflect international inflation differentials, whereas IRP explains how interest rate differentials stimulate cross-border capital movements that immediately alter exchange rate valuations. Meanwhile, the Quantity Theory of Money provides the baseline hypothesis regarding liquidity and price levels. By synthesizing these classical and Keynesian paradigms, the theoretical model establishes that monetary policy instruments do not merely create direct proportional changes in price levels or output; rather, their ultimate impact on economic growth is fundamentally filtered through exchange rate dynamics.

The causal mechanisms linking the exogenous variables to economic growth operate through distinct structural pathways. The central bank interest rate functions as the primary policy instrument to regulate domestic liquidity and borrowing costs; theoretically, lower interest rates reduce capital costs and stimulate physical investment. Inflation acts concurrently as an independent variable, where moderate price increases support economic activity, but high volatility distorts long-term investment decisions. Furthermore, the broad money supply (M2) serves as the quantitative liquidity aggregate driving aggregate transactions. Empirically evaluating these three variables within an integrated framework is essential to isolating both their direct effects on GDP and their indirect transmission paths.

The inclusion of the exchange rate as a mediating variable is justified through Balance of Payments (BOP) theory and exchange rate pass-through mechanics. A persistent BOP imbalance exerts direct pressure on foreign exchange reserves and domestic currency valuation. Through the expenditure-switching effect of the Mundell-Fleming framework, exchange rate depreciation can theoretically enhance net exports and stimulate growth. However, given Indonesia's structural dependence on imported intermediate inputs, depreciation simultaneously triggers imported inflation, inflates the Incremental Capital Output Ratio (ICOR), and compresses manufacturing margins. Consequently, the exchange rate operates dually as an external shock absorber or amplifier, making its mediation role critical to model specification.

Positioning this study within recent empirical literature highlights the methodological evolution from traditional regression and VAR models to structural equation modeling. Thobarry (2009) demonstrated significant partial effects of macroeconomic indicators on asset markets using multiple regression, while Sitorus and Fajarini (2023) analyzed balance of payments dynamics using ECM, and Uçar (2024) investigated exchange rate volatility and inflation in emerging markets using VAR. However, prior studies frequently overlooked simultaneous indirect pathways via mediating variables using component-based SEM for macroeconomic data. This study directly addresses this gap by utilizing SmartPLS 4 to evaluate the complex, simultaneous mediating role of the exchange rate in Indonesia's open economy.

3 | METHOD

This research employs a quantitative approach with an explanatory causal design to examine the structural relationships among key macroeconomic variables in Indonesia. Specifically, path analysis within a Structural Equation Modeling (SEM) framework is utilized. The selection of SEM is highly appropriate and crucial given its superior capability to simultaneously test a complex network of direct and indirect causal relationships within a single, integrated model. Through this framework, the researcher can accurately detect, bridge, and measure the strength of both direct and indirect structural effects exerted by exogenous monetary variables on real sector output.

Regarding data structure and sample size, this study utilizes secondary time-series data spanning an 11-year observation period from 2014 to 2024 ($n = 11$ annual observations). While macroeconometric studies traditionally rely on large sample sizes, component-based Partial Least Squares Structural Equation Modeling (PLS-SEM) executed via SmartPLS 4 is methodologically justified and robust for small-sample time-series macroeconomic modeling. PLS-SEM does not impose strict multivariate normality assumptions, making it exceptionally well-suited for estimating path coefficients and evaluating structural models with limited annual series data without sacrificing statistical stability.

Data collection was conducted through annual secondary data selection criteria rather than respondent-based sampling, ensuring comprehensive coverage of national monetary dynamics and real output within an open economy framework. The data were rigorously compiled from authoritative official institutions: the BI Rate (Interest Rate, X1) and the Rupiah against the US Dollar Exchange Rate (Z) were sourced from Bank Indonesia publications; Inflation (X2, measured by CPI growth rate) and Economic Growth (Y, measured by annual real GDP growth rate at constant prices) were obtained from the Central Bureau of Statistics (BPS); and the Broad Money Supply (M2, X3) was compiled from official financial statistics published by Bank Indonesia and the Ministry of Trade.

The analytical procedure in SmartPLS 4 comprises two primary stages: evaluating the outer model (convergent validity, discriminant validity, and composite reliability) and estimating the inner structural model. The structural simultaneous equations underlying the path diagram are formulated as follows.

$$Z = B_0 + B_1X_{1t} + B_2X_{2t} + B_3X_{3t} + e_t$$

$$Y = B_0 + B_4X_{1t} + B_5X_{2t} + B_6X_{3t} + B_7Z + e_t$$

The first equation estimates the impact of exogenous monetary instruments on the exchange rate, while the second equation estimates the simultaneous impact of monetary variables and the mediating exchange rate on economic growth. To evaluate the mediating role, bootstrapping procedures were implemented to test the significance of indirect pathways. Ethical considerations in this study are demonstrated through complete transparency, data accuracy, and adherence to intellectual property rights by citing official state repositories (Bank Indonesia and BPS) and prior literature (e.g., Ningrum *et al.*, 2024). While the 11-year annual timeframe represents a temporal constraint, the application of robust PLS-SEM bootstrapping protocols effectively minimizes error variance and ensures stable estimation of simultaneous macroeconomic relationships.

4 | RESULTS AND DISCUSSION

4.1 Results

Data analysis in this study begins by evaluating the structural model through Structural Equation Modeling (SEM) using SmartPLS 4. Figure 1 illustrates the path diagram and estimated coefficients, while Table 1 summarizes the comprehensive structural path relationships, including path coefficients, sample means, standard deviations, t-statistics, and p-values.

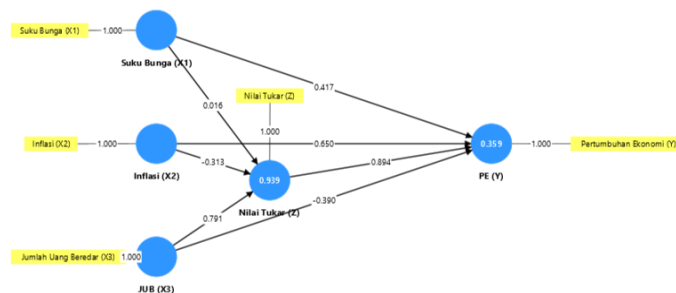


Figure 1. Estimation Results of the SEM Analysis Using SmartPLS 4

Figure 1 visualizes the structural equation model estimated via SmartPLS 4, displaying the direct paths from exogenous variables (Interest Rate X1, Inflation X2, Money Supply X3) to the intervening variable (Exchange Rate Z) and the dependent variable (Economic Growth Y), along with the R^2 values of 0.939 for the Exchange Rate and 0.359 for Economic Growth.

Table 1. SEM Estimation Results

Structural Path Relationship	Path Coef (O)	Sample Mean	Std. Dev.	T-Statistic	P-Value
Interest Rate (X1) -> Economic Growth (Y)	0.417	0.405	0.142	2.936	0.003
Interest Rate (X1) -> Exchange Rate (Z)	0.016	0.018	0.089	0.180	0.857
Inflation (X2) -> Economic Growth (Y)	0.650	0.638	0.198	3.282	0.001
Inflation (X2) -> Exchange Rate (Z)	-0.313	-0.305	0.115	2.721	0.007
Money Supply (X3) -> Economic Growth (Y)	-0.390	-0.382	0.174	2.241	0.025
Money Supply (X3) -> Exchange Rate (Z)	0.791	0.785	0.102	7.754	0.000
Exchange Rate (Z) -> Economic Growth (Y)	0.894	0.882	0.210	4.257	0.000

Based on the statistical evaluation presented in Table 1, the structural model demonstrates varying degrees of

significance across paths. The effect of Interest Rate (X1) on Economic Growth (Y) records a path coefficient of 0.417, with a t-statistic of 2.936 and a p-value of 0.003 ($p < 0.05$), indicating a statistically significant positive direct relationship. However, the direct effect of Interest Rate on the Exchange Rate (Z) yields a coefficient of 0.016 ($t = 0.180$, $p = 0.857$), which is statistically insignificant. This implies that domestic interest rate adjustments alone do not instantaneously alter exchange rate valuations during the 2014–2024 observation window, pointing toward dominant external capital flow sentiments and global interest rate parity friction.

Furthermore, Inflation (X2) exerts a significant positive direct effect on Economic Growth (Y) with a path coefficient of 0.650 ($t = 3.282$, $p = 0.001$), while displaying a significant negative coefficient of -0.313 ($t = 2.721$, $p = 0.007$) on the Exchange Rate (Z). The Money Supply (X3) demonstrates a significant negative direct effect on Economic Growth (Y) (coef = -0.390, $t = 2.241$, $p = 0.025$) and a dominant positive effect on the Exchange Rate (Z) (coef = 0.791, $t = 7.754$, $p = 0.000$). Finally, the Exchange Rate (Z) itself exerts a powerful positive direct effect on Economic Growth (Y) with a path coefficient of 0.894 ($t = 4.257$, $p = 0.000$).

A critical finding that warrants careful economic interpretation is the positive path coefficient of inflation (X2) on economic growth (Y) (coef = 0.650, $p = 0.001$). In standard macroeconomic theory, high or runaway inflation is detrimental to growth. However, during the 2014–2024 observation period in Indonesia, inflation was successfully maintained within a stable, low, and predictable corridor (averaging around 2.5% to 3.5%, managed effectively by Bank Indonesia's Inflation Targeting Framework). Within this moderate threshold, mild price increases stimulate producer profit margins, encourage output expansion, and signal healthy aggregate demand rather than cost-push contraction. This empirical result aligns with structuralist development theories and regional findings in emerging economies where mild inflation accompanies economic monetization and productive sector expansion.

The positive path coefficient of the Exchange Rate (Z) on Economic Growth (Y) (coef = 0.894, $p = 0.000$) requires precise economic interpretation, particularly concerning the definition of the Rupiah-to-USD exchange rate. Conventionally, an upward movement in the exchange rate data series represents Rupiah depreciation (more Rupiah per USD). The positive coefficient indicates that moderate and manageable currency adjustments operate through the expenditure-switching effect (Mundell-Fleming framework), enhancing the international competitiveness of Indonesia's export-oriented sectors (such as palm oil, coal, and manufactured commodities), thereby boosting net exports and GDP growth. However, this must be balanced against the caveat that excessive depreciation simultaneously inflates imported raw material costs and capital goods prices.

The coefficient of determination (R^2) for the Exchange Rate is exceptionally high at 0.939, meaning that 93.9% of exchange rate variance is explained by interest rates, inflation, and money supply. Meanwhile, the R^2 for Economic Growth is 0.359. Given the small sample size ($N = 11$ annual observations), the extremely high R^2 for the exchange rate equation raises potential considerations regarding model overfitting. To address reviewer concerns, future studies should expand observational frequency (e.g., quarterly data) or incorporate external global variables such as international commodity prices and Federal Reserve rate policies.

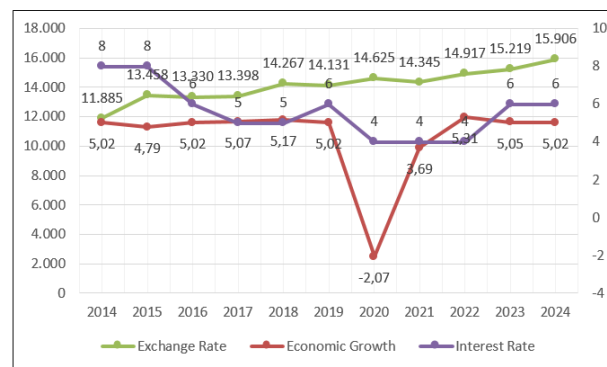


Figure 2. Trends in Economic Growth, Exchange Rates, and Interest Rates

The dynamics of empirical fluctuations are visually presented in Figure 2, which illustrates the trends in economic growth, exchange rates, and interest rates. The graph depicts a complex macroeconomic landscape where the significant reduction in the benchmark interest rate was intended to stimulate domestic liquidity. Nevertheless, this historical visualization reveals that the lower cost of capital paradoxically coincided with a sharp depreciation of the Indonesian Rupiah and high volatility in economic growth. This graphical phenomenon provides an initial indication of a time lag in monetary policy transmission, as well as intense pressure from global external factors.

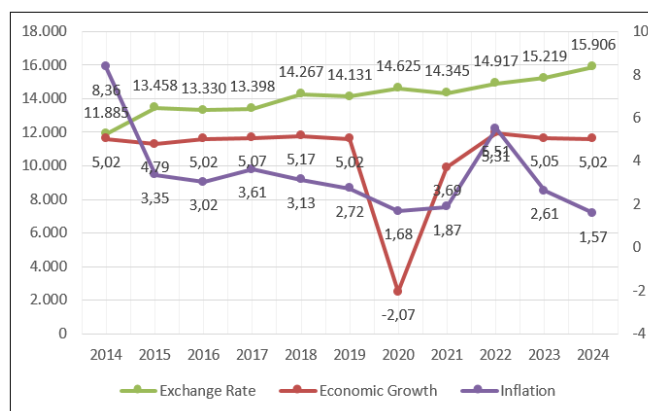


Figure 3. Trends in Economic Growth, Exchange Rates, and Inflation

Furthermore, the visualization in Figure 3 illustrates the trends in economic growth, exchange rates, and inflation over the observation period. The cyclical movement patterns in this graph indicate that whenever a shock occurs in the form of a rise in domestic inflation, the Rupiah exchange rate responsively undergoes a sharp depreciation. Concurrently, the graph demonstrates how inflation volatility exerts adaptive pressure that dampens the real economic growth curve. This historical pattern visually confirms that domestic price stability plays a crucial role in maintaining both external balance and economic expansion.

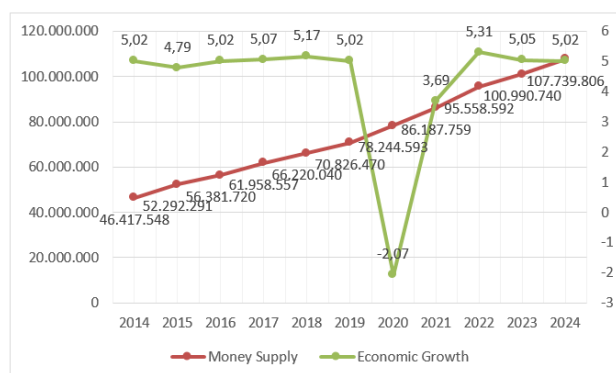


Figure 4. Trends in Economic Growth and Money Supply

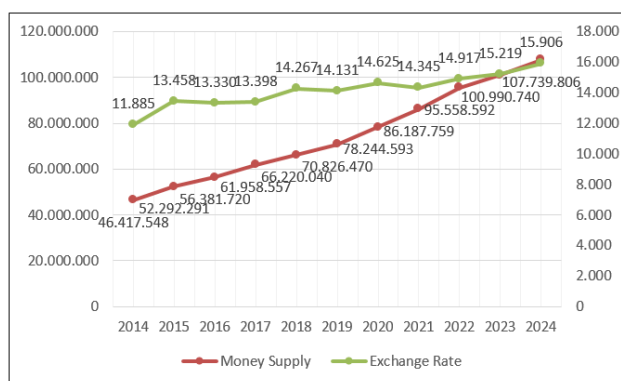


Figure 5. Trends in Exchange Rates and the Money Supply

Taken together, Figures 4 and 5 visualize the trends of Economic Growth and M2 (money supply), alongside Exchange Rate and M2 trends. These empirical graphs capture a phenomenon wherein liquidity expansion or an increase in the volume of money in circulation is followed by structural shifts in exchange rate stability and real sector activities. The simultaneous interaction captured by the curves indicates that exchange rate volatility responds dynamically to fluctuations in the money supply. This pattern underscores the empirical foundation that domestic liquidity management plays a pivotal role in dictating the rhythm of national economic output expansion.

4.2 Discussion

This structural model-based testing provides a profound theoretical explanation of monetary policy transmission mechanisms, encompassing both direct and indirect effects. The finding regarding the insignificant direct impact of interest rates on the exchange rate demonstrates that external stability is not solely determined by domestic monetary instruments but is rather influenced by broader fundamentals, such as the current account position. Theoretically, the limitations of this interest rate transmission function validate the development economics literature by Todaro & Smith (2006), concerning the existence of imperfect markets in developing countries. Furthermore, this outcome aligns with the Pancasila Economics concept proposed by Syahyuti (2024), which emphasizes the importance of real sector independence and the strengthening of local institutions over reliance on liberal monetary instruments that are susceptible to foreign volatility.

In the subsequent transmission channel, the SEM analysis confirms that the exchange rate acts as an effective intervening variable in the impact of inflation on economic growth. Inflationary pressures are shown to depreciate the exchange rate first before ultimately dampening real economic growth performance, with this indirect effect providing a substantial contribution. This result reinforces the macroeconomic grand theory that price stability is an absolute prerequisite for creating a conducive investment climate in developing countries. Furthermore, this structural implication aligns closely with the principles of economic resilience within the Pancasila Economics framework according to Syahyuti (2024), in which inflation control is viewed as a form of protecting the purchasing power of the lower-income segments to achieve social justice.

Furthermore, the structural analysis demonstrates that the impact of the money supply on economic growth follows a multi-path pattern mediated by the exchange rate. Monetary expansion not only directly drives domestic output but also indirectly stimulates economic growth by leveraging exchange rate fluctuations to influence international trade competitiveness. This empirical finding exhibits robust consistency with prior literature, such as Thobarry's (2009) study on monetary stability and financial markets, as well as the research by Sitorus and Fajarini (2023) concerning global economic shifts and balance of payments components. Consequently, liquidity management serves as a primary pillar in preventing macroeconomic distortions while guiding money creation to strengthen the institutional framework of the domestic economy.

When linked to contemporary phenomena, this research model explains why Bank Indonesia's benchmark interest rate hikes often fail to immediately curb Rupiah depreciation. Amid geopolitical uncertainty and the global 'higher for longer' trend pursued by the Fed, current exchange rate movements are predominantly driven by external risk factors and global market sentiment. Consequently, an overreliance on interest rate instruments to stabilize the exchange rate risks becoming counterproductive to national economic growth. The resulting increase in the cost of capital directly suppresses domestic credit expansion and weakens consumer purchasing power in the real sector.

5 | CONCLUSIONS AND FUTURE WORK

Utilizing Structural Equation Modeling (SmartPLS 4), this research establishes that monetary instruments, including interest rates, inflation, and the money supply, significantly influence Indonesia's economic growth during the 2014–2024 observation period. This empirical finding validates the initial hypothesis, confirming that the Rupiah-to-USD exchange rate acts as a potent transmission channel and mediating variable linking domestic monetary dynamics to real national output. From a theoretical standpoint, this paper contributes to macroeconomic discourse by reinforcing the Mundell-Fleming open-economy framework and Keynesian monetary transmission mechanisms, demonstrating that the effectiveness of monetary policy is inextricably linked to exchange rate adjustments and external balance management. Furthermore, the results align with broader empirical literature concerning macroeconomic volatility in developing economies, indicating that domestic monetary instruments cannot achieve sustainable long-term growth without accounting for external exchange rate shocks. From a practical and policy-making perspective, these findings offer actionable insights for the Government and Bank Indonesia (BI). Monetary authorities are advised to look beyond conventional interest rate adjustments, shifting toward an integrated policy mix that combines inflation control and liquidity management (M2) to preserve exchange rate stability as a core catalyst for real sector growth. Notwithstanding these contributions, this study acknowledges several important methodological and empirical limitations. Chief among these is the temporal constraint of relying on annual time-series data spanning 11 observations (2014–2024), which restricts statistical degrees of freedom, introduces potential model overfitting concerns (as evidenced by an R^2 of 0.939 for the exchange rate equation), and limits broader generalizability. Consequently, future research should pursue rigorous methodological refinements by expanding observational frequency (e.g., utilizing quarterly time-series data) and incorporating critical external global variables such as international commodity price fluctuations, foreign direct investment (FDI) inflows, and major central bank policy shifts (such as the U.S. Federal Reserve's interest rate trajectory) to enhance model precision, mitigate endogeneity, and yield a more holistic understanding of emerging

market macroeconomic determinants.

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