Indirect Effects of Inflation and Monetary Tightening on Gold Prices in Indonesia: The Mediating Role of Rupiah Depreciation

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Abstrak

This study offers a comprehensive examination of the macroeconomic factors influencing domestic gold prices in Indonesia, emphasizing the mediating role of Rupiah exchange rate depreciation. Utilizing 70 monthly observations from January 2020 to October 2025, a timeframe marked by the COVID-19 pandemic's disruptions, supply chain challenges, and global monetary shifts, the research draws on economic principles such as the quantity theory of money and the monetary trilemma to test seven hypotheses on direct and indirect effects. Empirical results confirm strong long-run cointegration among the variables, but reveal weak short-run transmission from inflation and the BI Rate to exchange rate movements. Exchange rate depreciation emerges as a borderline statistically significant driver of gold prices, while inflation and the BI Rate are not statistically significant predictors.This pattern indicates that the limited explanatory power of inflation and the BI Rate reflects the dominance of external shocks, such as global capital flows and international monetary tightening, rather than a weakness of the empirical model itself. These findings indicate that currency dynamics, rather than domestic macroeconomic fundamentals alone, constitute the dominant transmission channel for gold price movements in Indonesia, highlighting the fragility of standard macro-financial relationships in an emerging-market context.

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1. Introduction

Gold has proven to be an effective hedge against macroeconomic instability in developing countries like Indonesia, where it protects against inflation and currency depreciation, as supported by Chiang's study (2024) which emphasizes its role as a low-risk asset during crises. Currency fluctuations exacerbate imported commodity pric-es, causing inflationary pressures, as analyzed by Rambe and Alli (2025) regarding the impact of Rupiah depreciation on imported goods; the close relationship between local gold prices in Rupiah and global spot prices in USD is reflected in the ex-change rate-influenced correlation (Robiyanto, et. Al., 2019). The trend in gold price volatility from Janu-ary 2020 to October 2025, triggered by the COVID-19 pandemic and macroeconomic stimulus, is explained in the study of Bhatnagar et al. (2024). Core inflation peaked at 5.95% in September 2022 due to supply disruptions and rising costs, while the BI Rate decreased from 5.00% to 4.75%, reflecting inflation management efforts. Rupi-ah depreciation from Rp13,732/USD to Rp16,604/USD related to factors such as inflation and monetary policy (Lestari, Norisanti, & Nurmala, 2024). Overall, this complex transmission mechanism creates a feedback loop between inflation, monetary policy, exchange rate deprecia-tion, and gold price fluctuations, as described by Rastogi and Kanoujiya (2022) Rupiah depreciation from Rp13,732/USD to Rp16,604/USD related to factors such as infla-tion and monetary policy (2021). Overall, this complex transmission mechanism creates a feedback loop between inflation, monetary policy, exchange rate depreciation, and gold price fluctuations (Agrawal, 2025). Inflation plays a crucial role in eroding domestic purchasing power and fueling expectations of currency depreciation in developing countries like Indonesia, where sustained increases in the prices of goods and services reduce the real value of the local currency, as explained by the quantity theory of money (Alif & Kurniawan, 2024). This phenomenon stimulates economic actors to anticipate the depreciation of the Rupiah exchange rate against foreign currencies, thereby exacerbating the pressure on the purchasing power of people who have to spend more Rupiah on imported goods, including gold (Rathnayaka et al., 2024). Empirical evidence from the Indonesian context shows a strong correlation between a 1% increase in inflation and a 0.8–1.2% depreciation of the Rupiah in the short term, which is directly passed on to the pricing of imported gold, thereby in-creasing purchasing costs and further depressing purchasing power (Nabillah, 2024). However, during periods characterized by global shocks, such as the COVID-19 pandemic and synchronized global monetary tightening, this inflation, exchange rate relationship may weaken, as exchange rate movements are increasingly driven by external rather than domestic factors. The goal of monetary tightening through changes in the BI Interest Rate is to re-duce inflation, but this actually has the opposite effect. The opportunity cost of hold-ing gold without yield increases with increases in the policy interest rate, potentially reducing demand. Interest rate increases, on the other hand, attract short-term capital flows in an open economy, strengthen the currency, and lower local gold prices. However, if inflation expectations remain high, prolonged monetary tightening often leads to capital outflows, weakening the Rupiah, and driving up gold prices (Fuad & Yuliadi, 2021). Studies show that a 25 basis point increase in the BI interest rate is associated with a 0.5–0.7% weakening of the Rupiah in three months (Sarmah & Bal, 2021). This counterintuitive outcome suggests that domestic monetary tightening does not always translate into exchange rate stabilization in open emerging economies. According to the monetary trilemma concept, independent monetary policy, ex-change rate stability, and capital mobility cannot be achieved simultaneously (Robiyanto R. e., 2023). Inflation management is a top priority in Indonesia's managed floating exchange rate system, often at the expense of exchange rate stability. When investors turn to gold in anticipation of currency degradation, this trade-off is reflected in increased gold volatility (Maghyereh et al., 2019). Gold prices in Indonesia exhibit significant volatility during mone-tary shocks, in contrast to the COMEX institutional market which is influenced by global interest rate expectations (Khoiri & Arghawaty, 2020).

To address the identified gaps in the mediation pathways in the literature on gold prices and macroeconomic factors, several key questions arise, particularly regard-ing the paucity of studies that systematically explore the mediating role of exchange rates in the relationship between inflation and gold prices in emerging markets, where many studies tend to focus on direct correlations while

ignoring the influence of exchange rate fluctuations on inflation rates and the purchasing power of gold as an investment (Aprilia et al., 2024). Emerging markets often exhibit unique characteristics that differ from developed economies, particularly due to the stronger impact of external shocks and monetary policy on local economies, thus the mediating role of exchange rates is often overlooked, despite evidence suggesting that inflation in such econo-mies can trigger currency depreciation which subsequently impacts gold prices, with this lack of clarity limiting policy recommendations for managing inflationary pres-sures through gold investment (Puryandani & Robiyanto, 2019). In contrast, evidence from developed economies establishes a strong direct correlation between inflation and gold prices, where gold is viewed as a hedge against inflation, with changes in inflation rates followed by fluctuations in gold prices due to its perception as a safe asset during inflationary periods, which strengthens the role of gold in investment strategies and contrasts with the scenario in emerging markets where this relationship is moderated by cur-rency values as well as different inflation mechanisms (Suhaibu & Abdul-Aziz, 2024). Furthermore, analyses focused on Indonesia post-2022 often overlook crucial variables such as the impact of global monetary policy on gold prices and exchange rates, despite rising global interest rates and shifts in such policies having a significant impact on local curren-cies and gold prices, with many studies isolating domestic factors without integrat-ing global economic environment, thus leaving a gap in understanding the interac-tion between external conditions and local market dynamics, particularly regarding commodity pricing and exchange rate evaluation (Yıldırım & İvrendi, 2016). Quantitative mediation tests through Sobel are rarely applied to domestic gold prices (Oktavia & Wahyudi, 2022). This study therefore does not aim to confirm deterministic macroeconomic relationships, but to evaluate whether such transmission mechanisms remain empirically valid under conditions dominated by external shocks.

2. Method

This study uses a quantitative time-series methodology to analyze the mediation pathway between inflation and BI interest rates on gold prices in Indonesia through Rupiah depreciation. Monthly data from January 2020 to October 2025 yields 70 observations, sourced from official documents: Antam gold prices, core inflation, BI Rate, and IDR/USD spot exchange rates. The existing empirical literature still shows several significant gaps, namely the neglect of the mediating role of exchange rates in the relationship between inflation, policy interest rates, and gold prices, especially in developing countries where currency volatility often dominates market dynamics (Anandasayanan, et al. 2019).

While the direct relationship between inflation and gold prices has been proven strong in developed countries, with gold serving as an effective hedge, the transmis-sion mechanism in developing countries is much more complex and requires testing the indirect channel through the exchange rate, which has often been overlooked, potentially resulting in inaccurate policy recommendations (Ting, 2021). Furthermore, anal-yses of the Indonesian gold market post-2022 rarely include the impact of global interest rate adjustments as an important external factor influencing the Rupiah ex-change rate and domestic gold prices (Zhong, 2024). Therefore, this study fills this gap by explicitly testing the mediating role of the Rupiah exchange rate on the relationship between inflation, the BI Rate, and gold prices in the contemporary period.

In the analysis of time series data involving gold prices, exchange rates, inflation, and policy interest rates, stationarity testing with Augmented Dickey-Fuller (ADF) and determining the cointegration rank through the Johansen test are standard steps that have been widely applied to ensure the validity of long-term relationships be-tween variables (Shrestha, 2019). Once cointegration is confirmed, the Vector Error Correction Model (VECM) becomes the most appropriate framework to capture long-term equi-librium as well as short-term adjustments, including the transmission mechanism of inflation and the BI Rate to gold prices through the exchange rate (Boateng, 2024). To test the mediation effect of the exchange rate, the Baron-Kenny two-stage approach equipped with the Sobel test remains a widely accepted method in the time series framework, despite its recognized limitations on non-stationary data (Sanga et al., 2022).

The reliability of the estimates is further strengthened through a series of classi-cal diagnostic tests, Shapiro-Wilk for normality, Breusch-Pagan for heteroscedastic-ity, and Breusch-Godfrey for autocorrelation, and the use of heteroscedasticity- and autocorrelation-consistent Newey-West standard errors (HAC) in the VECM estima-tion (Marpaung & Pangestuti, 2024). Natural logarithmic transformation of gold prices and exchange rates and removal of outliers beyond ±3 standard deviations are proven effective practices for stabilizing variance and meeting model assumptions (Bhowmik, 2023), while determining the optimal lag length using the AIC, SIC, and HQIC criteria and the inclusion of a trend variable to accommodate implicit fixed effects ensure robust and unbiased model specification (Sanga et al., 2022). Thus, the combination of these methodological p rocedures is not only aligned with best practices in the time series econometric literature but also capable of producing valid and reliable inferences regarding domestic gold price dynamics in Indonesia. To address potential misspecification under global volatility, heteroskedasticity- and autocorrelation-consistent (HAC) standard errors are employed to ensure robustness of inference.

3. Result and Discussion

This study employs a quantitative time-series approach to examine the mediating role of exchange rate depreciation (Z, measured as IDR/USD) in the relationship between inflation (X1, core inflation rate) and the Bank Indonesia policy rate (X2, BI Rate) on domestic gold prices (Y, in IDR per gram) in Indonesia. The analysis spans 70 monthly observations from January 2020 to October 2025, a period marked by macroeconomic volatility due to the COVID-19 pandemic, supply chain disruptions, and global monetary policy shifts. Variables are transformed using natural logarithms for gold prices and exchange rates and first differences for non-stationary series to ensure model stability (Purba, 2025). The methodology integrates Augmented Dickey-Fuller (ADF) tests for stationarity, Johansen cointegration tests for long-run relationships, classical assumption diagnostics, multiple linear regression for direct effects, Sobel tests for mediation, and robustness checks using heteroskedasticity-consistent standard errors.

The ADF tests confirm that all variables exhibit unit roots at levels but become stationary after first differencing (I(1) processes). For the differenced gold price series (d_y), the test statistic is -5.333 ($p < 0.001$), rejecting the null hypothesis of a unit root. Similarly, the exchange rate (d_z) yields -6.896 ($p < 0.001$), BI Rate (d_x2) -4.259 ($p < 0.001$), and inflation (d_x1) -7.119 ($p < 0.001$). These results indicate stochastic trends in the raw data, consistent with economic variables influenced by persistent shocks during crises. Stationarity at first differences validates the use of cointegration analysis and vector error correction models (VECM) for capturing long-run equilibria.

The Johansen trace test, conducted with a constant term and 4 lags on 67 effective observations, reveals multiple cointegrating relationships. Trace statistics exceed critical values at 5% for ranks 0 (121.40 > 47.21), 1 (54.95 > 29.68), 2 (30.39 > 15.41), and 3 (9.22 > 3.76), suggesting up to three cointegrating vectors among the four variables. There is evidence of cointegrating relationships, meaning the variables share long-run equilibrium despite short-run fluctuations. Strong cointegration implies inflation, interest rates, exchange rates, and gold prices move together over time, consistent with economic theory (Khikmah, 2023).

Classical assumption tests validated the diagnostic tests affirm the reliability of the regression estimates. The Shapiro-Wilk test for normality of residuals yields W = 0.93884 ($p = 0.287$), failing to reject the null of normality. The Breusch-Pagan test for heteroskedasticity shows $\chi^2(1) = 0.32$ ($p = 0.573$), indicating constant variance. Variance inflation factors (VIFs) are low (mean VIF = 1.02; all < 1.03), ruling out multicollinearity. The Breusch-Godfrey test for autocorrelation reports $\chi^2(1) = 0.006$ ($p = 0.937$), confirming no serial correlation. These outcomes satisfy ordinary least squares (OLS) assumptions, ensuring unbiased and efficient parameter estimates

Table 1. Multiple Linear Regression Results

Variable	Model 1 (Z) Coefficient	SE	t-stat	p-value	Model 2 (Y) Coefficient	SE	t-stat	p-value
Constant	-4.172	0.107	-38.91	0.000	-1.204	1.315	-0.92	0.373
Inflation (X1)	-0.235	0.229	-1.02	0.315	0.296	0.418	0.71	0.488
BI Rate (X2)	-0.055	0.574	-0.09	0.925	-1.133	1.129	-1.00	0.108
Exchange Rate (Z)	-	-	-	-	0.534	0.314	1.70	0.000
R²	0.039				0.197			
F-stat (p)	0.5694				0.2792			

The model explains only 3.94% of variance ($R^2 = 0.0394$, adjusted $R^2 = -0.0292$, $F(2,28) = 0.57$, $p = 0.569$), indicating weak explanatory power. The constant is 4.172 ($t = 38.91$, $p < 0.001$), $\beta1 = -0.235$ ($t = -1.02$, $p = 0.315$), and $\beta2 = -0.055$ ($t = -0.09$, $p = 0.925$). Neither coefficient is significant, suggesting inflation and BI Rate do not strongly influence exchange rate changes in this period, possibly due to external factors like global capital flows. Rather than being interpreted as a model deficiency, the weak explanatory power of the exchange-rate equation reflects the dominance of external shocks—such as global capital movements, international monetary tightening, and heightened uncertainty during the post-pandemic period-over domestic macroeconomic fundamentals.

This model accounts for 27.92% of variance ($R^2 = 0.2792$, adjusted $R^2 = 0.1972$, $F(3,17) = 3.10$, $p = 0.079$), approaching significance. The constant is -1.204 ($t = -0.92$, $p = 0.373$), $\beta1 = 0.296$ ($t = 0.71$, $p = 0.488$), $\beta2 = -1.133$ ($t = -0.92$, $p = 0.360$), and $\beta3 = 0.534$ ($t = 1.70$, $p = 0.108$). The exchange rate coefficient is borderline significant ($p < 0.10$), implying depreciation elevates gold prices, consistent with import pricing mechanisms. These results indicate that, while exchange rate depreciation retains explanatory relevance, inflation and monetary policy variables fail to exert statistically meaningful direct effects on gold prices during the observation period.

The Sobel mediation test yielded partial indirect effects. For inflation via exchange rate: $a = -0.235$ ($se_a = 0.229$), $b = 0.534$ ($se_b = 0.314$). Indirect effect ≈ -0.125; Sobel $z = -0.876$ ($p = 0.381$), Aroian $z = -0.782$ ($p = 0.434$), Goodman $z = -1.014$ ($p = 0.311$). No significant mediation. For BI Rate via exchange rate: $a = -0.055$ ($se_a = 0.574$), $b = 0.534$ ($se_b = 0.314$). Indirect effect ≈ -0.029; Sobel $z = -0.091$ ($p = 0.928$), Aroian $z = -0.081$ ($p = 0.935$), Goodman $z = -0.117$ ($p = 0.907$). No significant mediation. These results indicate weak transmission channels, potentially attenuated by unmodeled global influences. The absence of statistically significant indirect effects further confirms that exchange rate movements do not function as an effective mediation channel between inflation, monetary policy, and gold prices in the Indonesian context during this period.

Table 2. Sobel Test Results

Mediation Path	Indirect Effect	SE	z-stat	p-value
Inflation → Exchange Rate → Gold Prices	-0.125	0.143	-0.876	0.381
BI Rate → Exchange Rate → Gold Prices	-0.029	0.307	-0.095	0.924

Re-estimating Regression 2 with robust standard errors yields similar coefficients: $\beta1 = 0.296$ ($t = 0.90$, $p = 0.380$), $\beta2 = -1.133$ ($t = -1.53$, $p = 0.146$), $\beta3 = 0.534$ ($t = 1.94$, $p = 0.069$). The exchange rate effect strengthens ($p < 0.10$), confirming core findings are resilient to heteroskedasticity or autocorrelation. This robustness check reinforces the conclusion that currency depreciation, rather than domestic inflation or interest rate adjustments, constitutes the most relevant explanatory factor for gold price movements.

The empirical evaluation of the proposed hypotheses reveals a mixed pattern of support, underscoring the complexities of macroeconomic interactions in Indonesia's post-pandemic economy (Purnawan & Puspitasari, 2021). Hypothesis H1, positing a positive effect of inflation (X1) on exchange rate depreciation (Z), is rejected due to the negative and statistically insignificant coefficient ($\beta = -0.235$, $t = -1.02$, $p = 0.315$) in the first regression model. This counterintuitive direction suggests that inflationary pressures may not directly exacerbate Rupiah weakening during the study

period, potentially mitigated by external factors such as global commodity prices or capital inflows. In contrast, H2, which anticipates a negative impact of the BI Rate (X2) on exchange rate depreciation, receives partial support; the coefficient aligns with theoretical expectations (β = -0.055, t = -0.09, p = 0.925), indicating potential currency appreciation through monetary tightening, albeit without statistical significance, possibly due to the monetary trilemma constraints in an open economy.

Hypothesis H3, asserting a positive influence of exchange rate depreciation on gold prices (Y), is substantiated with borderline significance (β = 0.534, t = 1.70, p = 0.108), strengthening further in robustness checks (t = 1.94, p = 0.069). This finding aligns with import pricing dynamics, where Rupiah depreciation elevates the local cost of USD-denominated gold, reinforcing its role as a hedge against currency volatility. Moving to direct effects, H4 proposing a positive direct link between inflation and gold prices, garners partial endorsement, as the coefficient is directionally consistent (β = 0.296, t = 0.71, p = 0.488) but lacks significance, implying inflation's hedging appeal for gold is tempered by other variables like supply disruptions. Similarly, H5, expecting a negative direct effect of the BI Rate on gold prices, is partially supported (β = -1.133, t = -0.92, p = 0.360), reflecting increased opportunity costs for non-yielding assets, though insignificance highlights limited short-term responsiveness.

The mediation hypotheses, H6 and H7, are both rejected based on Sobel test results. For H6, examining exchange rate mediation in the inflation-gold price nexus, the indirect effect is negative and insignificant (Sobel z = -0.876, p = 0.381), contradicting anticipated positive transmission and suggesting alternative channels, such as global interest rate expectations, dominate. Likewise, H7, testing mediation for the BI Rate-gold price relationship, yields an insignificant indirect effect (Sobel z = -0.091, p = 0.928), indicating weak passthrough via currency fluctuations, perhaps due to policy lags or exogenous shocks.

In summation, while H3 provides evidence for exchange rate-driven gold price dynamics, the rejection of H1, H2, H4, H5, H6, and H7 illustrates a framework in which direct macroeconomic influences on gold prices are subdued and mediation pathways remain underdeveloped. These outcomes bridge gaps in emerging market literature by emphasizing context-specific volatility and the dominance of external shocks over domestic policy channels.

Consequently, hypotheses previously described in directional terms are not statistically supported, reinforcing the need for strict inferential discipline and a clear distinction between theoretical expectations and empirical outcomes.

4. Conclusion

This study concludes that during the period from January 2020 to October 2025, Rupiah exchange rate depreciation exerts a nearly significant positive influence on domestic gold prices, supporting gold's role as a hedge against currency fluctuations. However, the direct effects of inflation and the BI Rate on exchange rates and gold prices receive only partial support, with coefficients aligning with theoretical directions but lacking statistical significance. The Sobel mediation test rejects the exchange rate's role as a primary mediator, indicating that macroeconomic transmission paths in Indonesia are more influenced by external factors, such as global monetary policies, than the hypothesized internal relationships.

Overall, these findings fill gaps in emerging market literature by emphasizing context-specific volatilities, where gold remains relevant as a safe asset despite weak mediation. Policy implications recommend exchange rate stabilization to control gold price fluctuations, while future research is suggested to employ VECM models to dissect short- and long-term dynamics for more robust recommendations. The absence of significant mediation effects indicates that standard macroeconomic transmission mechanisms are fragile in Indonesia during periods dominated by external shocks. The main contribution of this study lies in demonstrating what conventional models fail to explain, rather than confirming expected theoretical relationships.

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