The Analysis of the Effects of Interest Rates, Money Supply, Inflation, and World CPO Prices on the Indonesian Rupiah Exchange Rate during the Period of 2015–2024.

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Abstract

The movement of the Indonesian rupiah exchange rate against the United States dollar during the 2015–2024 period has affected national macroeconomic stability. This condition has contributed to a decline in public purchasing power, economic uncertainty, and export competitiveness. This study aims to analyze the effect of interest rates, money supply, inflation, and world CPO prices on the rupiah exchange rate in Indonesia during the 2015–2024 period. The study uses monthly time series data obtained from Bank Indonesia, the Central Statistics Agency (BPS), and the World Bank, analyzed using the Error Correction Model (ECM) method with the assistance of E-Views 12 software. The results show that interest rates have a significant positive effect in the long run. The money supply has a significant positive effect on the exchange rate in both the long and short run. Inflation does not have a significant effect, while world CPO prices considering Indonesia accounts for approximately of global CPO production as the world's largest producer have a significant negative effect during the study period, indicating their role in strengthening the exchange rate through increased foreign exchange earnings. The F-statistic results also indicate that all independent variables simultaneously have a significant effect on the exchange rate.

Keywords: *Exchange Rate, Interest Rate, Money Supply, Inflation, Global CPO Prices, Error Correction Model (ECM).*

INTRODUCTION

The exchange rate is one of the key macroeconomic indicators that reflects a country's economic stability, as it influences international trade, investment, inflation, and economic growth. In the global trading system, the United States dollar serves as the world's primary international currency, making its fluctuations highly influential on the exchange rates of developing countries, including Indonesia (Utami & Islami, 2021). According to Dornbusch's Overshooting Model, the exchange rate is determined by economic fundamentals in the long run; however, in the short run, it may deviate from its equilibrium level (overshooting) due to

slower adjustments in domestic prices compared with the rapid adjustment of financial markets. Consequently, changes in monetary variables, such as interest rates and the money supply, may affect the exchange rate differently in the short run and the long run (Dornbursch, 1976).

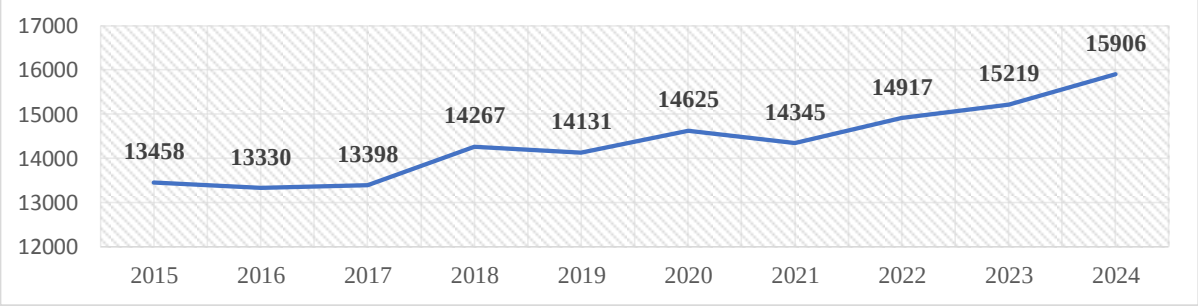


Figure 1. The Movement of the Indonesian Rupiah Exchange Rate Against the United States Dollar, 2015–2024
Source: Bank Indonesia 2026

As shown in Figure 1, the Indonesian rupiah exchange rate against the United States dollar exhibited a fluctuating trend during the 2015–2024 period. In 2015, the rupiah depreciated to nearly IDR 14,700 per USD due to the global economic slowdown and the increase in the Federal Reserve's policy interest rate, which triggered capital outflows from emerging economies, including Indonesia (International Monetary Fund, 2015). The exchange rate gradually stabilized in 2016 but continued to fluctuate throughout 2017–2021 as a result of the normalization of U.S. monetary policy, the COVID-19 pandemic, and the slowdown in international trade activities. Subsequently, during 2022–2024, the rupiah came under renewed depreciation pressure, reaching approximately IDR 16,000 per USD, driven by further increases in the Federal Reserve's interest rate, the Russia–Ukraine conflict, and heightened global geopolitical uncertainty (Gunawan et al., 2025). These developments indicate that movements in the rupiah exchange rate are influenced not only by monetary factors but also by real-sector factors affecting capital flows, international trade, and foreign exchange earnings.

Based on these phenomena, this study examines interest rates, money supply, inflation, and global crude palm oil (CPO) prices as determinants of the rupiah exchange rate. The selection of these variables is based on three theoretical perspectives. Dornbusch's Overshooting Model explains that changes in interest rates and the money supply affect the exchange rate through the monetary policy transmission mechanism.

Previous empirical studies have produced inconsistent findings regarding the determinants of the rupiah exchange rate. Mail et al (2024) found that the money supply has a significant effect on the rupiah exchange rate, whereas Handayani (2022) reported that its effect is significant only in the long run. Similarly, Berliana (2025) found that inflation does not have a significant effect on the exchange rate, while Khamidah & Sugiharti (2022) concluded that the impact of inflation depends on the time horizon considered. On the other hand, Aprina (2014) demonstrated that crude palm oil (CPO) prices influence the exchange rate through increased export foreign exchange earnings, whereas other studies suggest that the effect of commodity prices depends on international trade conditions. These inconsistent findings indicate that the determinants of the exchange rate remain an unresolved empirical issue, particularly when monetary and real-sector factors are examined simultaneously.

The novelty of this study lies in the integration of three theoretical frameworks, Dornbusch's Overshooting Model, Purchasing Power Parity (PPP), and Commodity Currency Theory, into a single analytical framework to explain the dynamics of the Indonesian rupiah exchange rate. Unlike previous studies, which generally focus on either monetary factors or real-sector factors separately, this study simultaneously examines the effects of interest rates, the money supply, inflation, and global crude palm oil (CPO) prices using the Error Correction Model (ECM). This approach enables the distinction between long-run and short-run effects over the 2015–2024 period, which encompasses several major global economic shocks, including the normalization of U.S. monetary policy, the COVID-19 pandemic, and geopolitical conflicts. Therefore, this study is expected to provide a more comprehensive understanding of the determinants of the rupiah exchange rate while offering valuable insights for the formulation of exchange rate stabilization policies in Indonesia.

RESEARCH METHODOLOGY

Data collection is a crucial and strategic stage in research, as it aims to obtain reliable and accurate data (Ghazali, 2018). This study employs secondary data obtained from Bank Indonesia, Statistics Indonesia (BPS), and the World Bank Commodity Price database. The study uses monthly time-series data covering the period from 2015 to 2024. The collected data were compiled and processed to address the research objectives through several analytical stages, including the stationarity test, cointegration test, Error Correction Model (ECM) estimation, classical assumption tests, and statistical tests. The ECM model was specified using natural logarithm (ln) transformations to reduce excessive variation in the data and improve model estimation (Ghazali, 2018).

1. **Long-Run ECM Estimation Model**

$$\mathrm{LN}NT_t = \beta_0 + \beta_1\ \mathrm{I}1_t + \beta_2\ \mathrm{L\,N\,JUB}2_t + \beta_3\ \mathrm{INF}3_t + \beta_4\ \mathrm{L\,N\,PCPO}P4_t + e_t$$

2. **Short -Run ECM Estimation Model**

$$\Delta\mathrm{LN}NT_t = \beta_0 + \beta_1\ \mathrm{I}\,1_t + \beta_2\ \mathrm{L\,N\,JUB}2_t + \beta_3\ \mathrm{L\,N\,INF}3_t + \beta_4\ \mathrm{L\,N\,PCPO}P4_t + \beta_5 ECT_{t-1} + e_t$$

RESULTS AND DISCUSSION

Unit Root Test

Table 1. Unit Root Test

Variabel	ADF LEVEL		ADF 1 DIFFERENCE	
	T-Statistic	Prob	t-Statistic	Prob
NT	-2.292209	0.1762	-12.0600	0.00
M2	-0.617066	0.8615	-15.7437	0.00
I	-2.14847	0.8615	-4.61894	0.00
INF	-2.44233	0.1325	-5.97272	0.00
PALMOP	-1.70352	0.4269	-8.01877	0.00

*Source: EViews 12 (processed by the authors)** Indicates stationarity.*

Based on the results of the stationarity test, all variables were found to be non-stationary at the level form. Therefore, the analysis was continued using the first difference transformation. The results indicate that all variables became stationary at the first difference level, as evidenced by probability values below the 0.05 significance level. It can therefore be concluded that all variables used in this study are stationary at the first-difference level.

Kointegration Test

Table 2. Kointegration Test

Hypothesized	0,05 Critical Value	Prob	Conclusion
Residual	69.818	0.0054	Cointegration

*Source: EViews 12 (processed by the authors); ** Indicates stationarity.*

The Johansen cointegration test produced a probability value of 0.0054, which is lower than the 0.05 significance level. This result indicates the existence of a long-run cointegration relationship (long-run equilibrium) among the variables.

Therefore, the analysis was continued using the Error Correction Model (ECM) to examine the short-run dynamics among the variables included in this study.

Error Correction Model (ECM)

Table 3. Long-Run ECM Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
I	0.006207	0.002592	2.394200	0.0183
LNM2	0.288636	0.013063	22.09491	0.0000
INF	0.192333	0.201991	0.952185	0.3430
LNCPO	-0.075808	0.012625	-6.004419	0.0000
C	5.520403	0.170351	32.40612	0.0000

R-squared	0.846660	**Mean dependent var**	9.570262
Adjusted R-squared	0.841326	**S.D. dependent var**	0.061818
S.E. of regression	0.024625	**Akaike info criterion**	-4.529368
Sum squared resid	0.069733	**Schwarz criterion**	-4.413223
Log likelihood	276.7621	**Hannan-Quinn criter.**	-4.482201
F-statistic	158.7414	**Durbin-Watson stat**	1.853561
Prob(F-statistic)	0.000000		

Source: EViews 12 (processed by the authors)

The long-run ECM equation is specified as follows:

$$NT_t = 5.520403 + 0.006207I_t + 0.288636\text{JUB}_t + 0.192333INF_t - 0.075808PALMOP_t + \varepsilon_t$$

Based on the estimation results, the coefficient of determination (R^2) is 0.846660, indicating that 84.67% of the variation in the Indonesian rupiah exchange rate against the U.S. dollar is explained by the independent variables, namely the interest rate, money supply, inflation, and world CPO prices. The remaining 15.33% is attributed to other factors outside the model.

The estimated coefficient of the interest rate is 0.006207, implying that a 1% increase in the interest rate is associated with a 0.006207% increase in the rupiah exchange rate, ceteris paribus. The money supply has a coefficient of 0.288636, suggesting that a 1% increase in the money supply leads to a 0.288636% increase in the rupiah exchange rate, holding other variables constant.

The inflation coefficient is 0.192333, implying that a 1% increase in inflation is associated with a 0.192333% increase in the rupiah exchange rate. However, this relationship is not statistically significant, as the probability value (0.3430) exceeds the 5% significance level. In contrast, the coefficient of world CPO prices is −0.075808, indicating that a 1% increase in world CPO prices is associated with a 0.075808% decrease in the rupiah exchange rate, ceteris paribus.

Table 4. Short-Run ECM Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(I)	0.006993	0.009701	0.720805	0.4725
D(LNM2)	0.668349	0.136920	4.881314	0.0000
D(INF)	0.531161	0.322936	1.644786	0.1028
D(LNCPO)	-0.089740	0.026849	-3.342423	0.0011
C	-0.001956	0.002027	-0.964890	0.3367
ECT(-1)	-0.450506	0.077721	-5.796434	0.0000

R-squared	0.399395	**Mean dependent var**	0.002075
Adjusted R-squared	0.372820	**S.D. dependent var**	0.024755
S.E. of regression	0.019605	**Akaike info criterion**	-4.976960
Sum squared resid	0.043432	**Schwarz criterion**	-4.836836

Log likelihood	302.1291	**Hannan-Quinn criter.**	-4.920060
F-statistic	15.02872	**Durbin-Watson stat**	1.888146
Prob(F-statistic)	0.000000		

Source: EViews 12 (processed by the authors)

The Short-run ECM equation is specified as follows:

$$NT_t = -0.001956 + 0.006993I_t + 0.668349JUB_t + 0.531161INF_t - 0.089740PALMOP_t - 0.450506ECTt + \varepsilon t$$

Based on the estimation results, the error correction term (ECT) coefficient is negative and statistically significant (p = 0.0000), confirming the validity of the ECM specification. The coefficient of determination (R^2) is 0.399395, indicating that 39.94% of the variation in the Indonesian rupiah exchange rate against the U.S. dollar is explained by the independent variables, namely the interest rate, money supply, inflation, and world CPO prices, while the remaining 60.06% is explained by factors outside the model. Although the coefficient of determination is relatively modest, this is generally acceptable in economic research. As noted by Jeffrey (1976), a relatively low adjusted R^2 does not necessarily indicate a poor model, as the coefficient of determination should not be considered the sole measure of model quality.

The estimated coefficient for the change in the interest rate is 0.006993, implying that, ceteris paribus, a 1% increase in the interest rate is associated with a 0.006993% increase in the rupiah exchange rate. However, this relationship is not statistically significant, as indicated by a probability value of 0.4725. The coefficient for the change in the money supply is 0.668349, suggesting that a 1% increase in the money supply is associated with a 0.668349% increase in the rupiah exchange rate. Similarly, the coefficient for the change in inflation is 0.531161, indicating that a 1% increase in inflation is associated with a 0.531161% increase in the rupiah exchange rate. Nevertheless, this effect is not statistically significant, with a probability value of 0.1028. In contrast, the coefficient for the change in world CPO prices is −0.089740, indicating that a 1% increase in world CPO prices is associated with a 0.089740% decrease in the rupiah exchange rate. Furthermore, the estimated ECT(-1) coefficient of −0.450506 indicates that approximately 45.05% of the short-run disequilibrium is corrected toward the long-run equilibrium in each period, implying a relatively moderate speed of adjustment.

Classical Assumption Tests

Normality Test

The normality test results indicate that the long-run model has a Jarque–Bera statistic of 1.299322 with a probability value of 0.522223, while the short-run model has a Jarque–Bera statistic of 0.388207 with a probability value of 0.823573. Since the probability values exceed the 5% significance level, the residuals of both the long-run and short-run models are normally distributed.

Multicollinearity Test

The Variance Inflation Factor (VIF) values for all independent variables in both the long-run and short-run models are below 10, indicating the absence of multicollinearity among the explanatory variables.

Heteroskedasticity Test

The heteroskedasticity test results show probability values of 0.1041 for the long-run model and 0.0840 for the short-run model, both of which exceed the 5% significance level. These findings indicate that the models are free from heteroskedasticity, implying that the residuals exhibit constant variance (homoskedasticity).

Autocorrelation Test

The Breusch–Godfrey LM test yields Chi-square probability values of 0.4416 for the long-run model and 0.1913 for the short-run model. Since both probability values are greater than 0.05, the null hypothesis of no serial correlation cannot be rejected, indicating that the regression residuals are free from autocorrelation.

Hypothesis Tests

F-Test

The joint significance (F-test) results indicate that the long-run model produces an F-statistic of 158.7414 with a probability value of 0.0000, while the short-run model produces an F-statistic of 15.02872 with a probability value of 0.0000. Since the F-statistics exceed the critical F-value (2.845) and the corresponding probability values are below the 5% significance level, the null hypothesis is rejected. Therefore, the interest rate, money supply, inflation, and world CPO prices jointly have a statistically significant effect on the Indonesian rupiah exchange rate against the U.S. dollar over the 2015–2024 period.

T-Test

The partial test results indicate that, in the long run, the interest rate has a positive and statistically significant effect on the Indonesian rupiah exchange rate against the U.S. dollar, with a coefficient of 0.006207, a t-statistic of 2.394200 (greater than the critical value of 1.980), and a p-value of 0.0183. This finding is not entirely consistent with the Monetary Approach to Exchange Rate Theory, which suggests that higher interest rates attract capital inflows and strengthen the domestic currency. In the Indonesian context, however, the impact of interest rate changes becomes evident only after monetary policy is implemented consistently over time. During the 2015–2024 period, the BI 7-Day Reverse Repo Rate fluctuated from approximately 7.52% in 2015 to 3.50% in 2021 before increasing to 6.00% in 2023–2024 in response to global financial pressures. These findings suggest that the transmission of monetary policy requires time to influence investment decisions, capital flows, and exchange rate stability.

In the short run, the interest rate does not have a statistically significant effect on the rupiah exchange rate, with a coefficient of 0.006993, a t-statistic of 0.720805, and a p-value of 0.4725. This result suggests that short-term interest rate adjustments are not immediately reflected in the foreign exchange market, as exchange rate movements are more strongly influenced by external shocks. For instance, although Bank Indonesia increased the BI 7-Day Reverse Repo Rate from 4.25% to 6.00% in 2018, the rupiah continued to depreciate from approximately IDR 13,500/USD to more than IDR 15,000/USD, primarily due to interest rate hikes by the Federal Reserve, the appreciation of the U.S. dollar, and capital outflows. This finding is consistent with (Robba, 2025) who argues that the effect of interest rates on exchange rates is more pronounced in the long run because monetary policy transmission requires time. Similarly, (Grace et al., 2022) reported that short-run interest rate changes have no significant effect on exchange rates, as market sentiment and global economic conditions dominate short-term exchange rate dynamics.

The results further indicate that the money supply (M2) has a positive and statistically significant effect on the rupiah exchange rate in the long run, with a coefficient of 0.288636, a t-statistic of 22.09491, and a p-value of 0.0000. This finding supports the Monetary Approach to Exchange Rate Theory, which argues that an expansion in the money supply increases liquidity and exerts depreciation pressure on the domestic currency. Over the study period, Indonesia's money supply increased steadily from approximately IDR 4,548 trillion in 2015 to more than IDR 9,000 trillion in 2024. This sustained increase in liquidity expanded

the amount of money circulating in the economy, stimulated demand for foreign currencies, and consequently placed downward pressure on the rupiah.

Similarly, the money supply exerts a positive and statistically significant effect in the short run, with a coefficient of 0.668349, a t-statistic of 4.881314, and a p-value of 0.0000. This finding indicates that changes in liquidity can rapidly affect exchange rate movements. During the COVID-19 pandemic (2020–2021), Bank Indonesia adopted an accommodative monetary policy, resulting in a sharp increase in the money supply from approximately IDR 6,900 trillion to more than IDR 7,800 trillion. The resulting liquidity expansion increased demand for foreign currencies and contributed to depreciation pressures on the rupiah. This finding is consistent with (Brzoza-brzezina et al., 2021) who argued that monetary expansion increases exchange rate pressure through higher liquidity, and with (Thamrin et al., 2025), who found that money supply significantly affects the rupiah exchange rate by increasing the supply of domestic currency.

Inflation exhibits a positive but statistically insignificant effect on the rupiah exchange rate in the long run, with a coefficient of 0.192333, a t-statistic of 0.952185, and a p-value of 0.3430. This result does not support the Purchasing Power Parity (PPP) Theory, which predicts that higher inflation leads to currency depreciation. Throughout the 2015–2024 period, Indonesia's inflation rate remained relatively well controlled within Bank Indonesia's target range of 3 ± 1%, except in 2022 when inflation reached 5.51% due to fuel price adjustments and rising food prices. Inflation subsequently declined to approximately 2.61% in 2024, suggesting that inflationary fluctuations were insufficient to significantly affect the rupiah's long-run fundamentals.

Likewise, inflation has no statistically significant effect in the short run, with a coefficient of 0.531161, a t-statistic of 1.644786, and a p-value of 0.1028. This finding suggests that short-term inflation changes do not immediately influence exchange rate movements, which are instead driven largely by external factors, including the appreciation of the U.S. dollar, changes in the Federal Reserve's policy rate, and international capital flows. For example, although inflation increased substantially in 2022, the depreciation of the rupiah during that period was driven primarily by global monetary conditions rather than domestic inflationary pressures. These findings are consistent with Bagus et al (2023)and Muzakky (2015) both of whom reported that inflation has a limited influence on the rupiah exchange rate because exchange rate movements are simultaneously affected by various macroeconomic factors.

The results also show that world CPO prices have a negative and statistically significant effect on the rupiah exchange rate in the long run, with a coefficient of −0.075808, a t-statistic of −6.004419, and a p-value of 0.0000. This finding supports the Commodity Currency Theory, which argues that rising export commodity prices increase foreign exchange earnings and strengthen the currencies of commodity-exporting countries. World CPO prices displayed an upward trend during 2015–2024, particularly in 2021–2022, when global demand increased while supply was disrupted by the COVID-19 pandemic and the Russia–Ukraine conflict. As one of the world's largest CPO exporters, Indonesia benefited from higher export revenues and a larger trade surplus, thereby contributing to the appreciation of the rupiah.

In the short run, world CPO prices also have a negative and statistically significant effect on the rupiah exchange rate, with a coefficient of −0.089740, a t-statistic of −3.342423, and a p-value of 0.0011. This

result indicates that fluctuations in CPO prices can immediately affect the exchange rate through changes in export earnings. In 2022, world CPO prices exceeded US$1,700 per metric ton, leading to higher Indonesian CPO exports and a substantial trade surplus. The resulting increase in foreign exchange earnings strengthened the domestic supply of foreign currency and supported the appreciation of the rupiah. This finding is consistent with Wahyuni (2021) and Amelia (2018) ddwho concluded that export commodity prices are important determinants of exchange rates because they directly influence export performance and the trade balance of commodity-exporting countries

CONCLUSION

Based on the Error Correction Model (ECM) estimation, the results indicate that, in the long run, the interest rate, money supply, and world CPO prices have statistically significant effects on the Indonesian rupiah exchange rate against the U.S. dollar, whereas inflation does not. In the short run, only the money supply and world CPO prices significantly affect the exchange rate, while the effects of the interest rate and inflation are statistically insignificant. The negative and statistically significant error correction term confirms the validity of the ECM specification, indicating that approximately 45.05% of short-run disequilibrium is corrected toward the long-run equilibrium in each period

Overall, the findings suggest that the dynamics of the rupiah exchange rate during the 2015–2024 period were influenced by both monetary and real-sector factors. These results highlight the importance of policy coordination between Bank Indonesia and the government in maintaining monetary stability through effective money supply management, strengthening the transmission of monetary policy, maintaining inflation stability, and enhancing the competitiveness of export commodities, particularly palm oil, to support long-term exchange rate stability.

RECOMMENDATION

1. Strengthen foreign exchange market interventions by optimizing the Export Proceeds (DHE) policy to increase domestic foreign exchange reserves and stabilize the exchange rate.
2. Promote financing for productive sectors that support exports, improve import efficiency, and enhance overall economic resilience.
3. Maintain price stability through consistent inflation management, transparent monetary policy communication, and stronger coordination among relevant institutions.
4. Enhance export competitiveness by increasing value-added production, diversifying export markets, and fostering a more conducive business environment.
5. Future research should extend the observation period, incorporate additional macroeconomic variables and examine policy differences across government administrations to provide broader macroeconomic policy recommendations.

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