Analysis of exchange rates in the economic uncertainty era

Tiara Salim [a,1*], Aris Soelistyo [a,2]

[a] Economic Development, Faculty of Economics and Business, Muhammadiyah University of Malang, Indonesia
[1] tiaraaraits@gmail.com*; [2] aris_s@umm.ac.id

* corresponding author

ARTICLE INFO

ABSTRACT

The exchange rate, an essential macroeconomic indicator, reflects the economy's strength. In 2023, global economic uncertainty poses a risk to the health of a country's economy, particularly impacting the exchange rate, which is crucial for global economic transactions. This study examines how exports, inflation, interest rates, GDP, and a dummy variable for economic uncertainty affect the rupiah's value against the USD. The study employs the Error Correction Model (ECM) and tests based on classical assumptions to conduct this analysis. Understanding the indicators that influence fluctuations in the rupiah exchange rate is critical in planning effective economic policies, so this research is essential to provide in-depth insight into how short-term and long-term influences on the exchange rate are affected by independent variables as well as contributing to the understanding of policy in predict exchange rates. This research concludes that exports, inflation, and GDP are the factors that dominate this research in designing policies to maintain the stability of the Rupiah currency against the USD in facing the threat of economic uncertainty. The implication of the study that government needs to strengthen exports and maintain the stability of price to control inflation.

1. Introduction

The exchange rates are a macroeconomic indicator reflecting the economic strength (Kamaruddin & Saskara, 2019). Thus, the emergence of the threat of global economic uncertainty in 2023 will affect a country's economy, including Indonesia's, and its economic stability, especially the currency exchange rate, which holds significant importance in the global economy. The exchange rate is an indicator of a nation's economic stability. The trigger for global economic uncertainty is the recession in several countries caused by financial market instability, the impact of COVID-19, and the very high increase in inflation due to the Russia-Ukraine war (Hariyani & Prasetio, 2023). The global economy is raising uncertainty after the COVID-19 pandemic, the Russian-Ukrainian conflict, and the Israeli-Palestinian war. These developments pose additional challenges by affecting global commodity prices and market forecasts indirectly (Diakonova et al., 2023), as well as having a direct effect on the markets for goods and services, capital, and foreign exchange (forex) (Assel et al., 2023). In addition, the impact of the Israel and Palestinian conflict will trigger investors to switch to safer assets, which will strengthen the United States Dollar (USD) in the short term. This condition led to pressure of the Rupiah against the USD and resulted in the depreciation. According to financial literature, interest rates and inflation are vital factors related to exchange rates (Agustin & Anis, 2021) (Ramadhani et al., 2023). Study from Li et al (2023) stated the policy of increasing the interest rates often leads to high inflation. Forcing the Central Bank to keep the economy at an equilibrium point and keep inflation at a low level by increasing interest rates, as noted by Bernika et al (2023) argued to keep inflation, the central bank (BI) hold the BI 1-Day Reserve Repo Rate (BI7DRR) at 5.75 percent, set

the lending facility interest rate at 6.50 percent, and maintained the deposit facility interest rate at 5.00 percent. Global uncertainty tend to rise will affect to the domestic economy (Kurniawan et al., 2022).
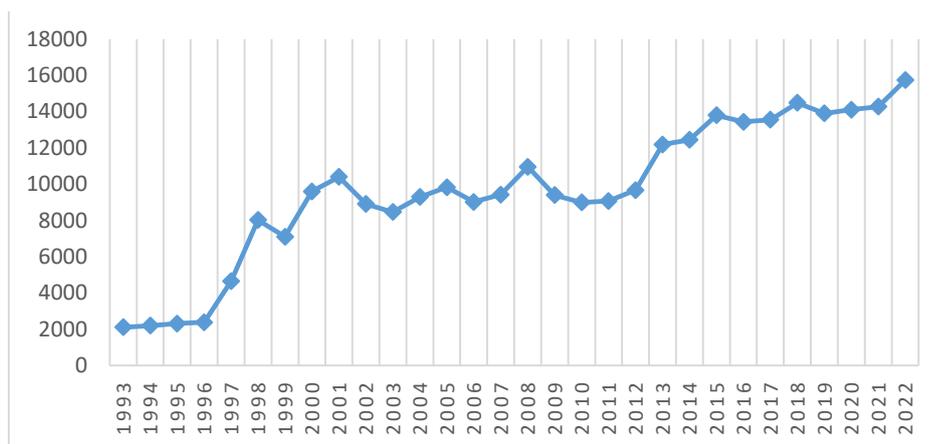

Figure 1. Average Exchange Rate (rupiah-USD)

Figure 1 shows the Rupiah exchange rate has depreciated in recent years. From 1993 to 2022, the most robust middle exchange rate against the USD occurred in 1993, with an exchange rate of IDR 2,110. The weakest exchange rate against the USD occurred in 2022, around IDR 15,731; as of October 2023, the exchange rate had weakened 54 points or 0.35 percent. The Rupiah is expected to continue to weaken against the US dollar due to pressure on global sentiment and capital outflows in the stock and bond markets, which are considered to have a significant impact. The decline in the Rupiah's value results in higher costs for imported raw materials, leading to a rise in production costs. Consequently, this undermines the global market competitiveness of domestic products, adversely affecting export activities (He & Zhao, 2022). Such a downturn in exports weakens the exchange rate with foreign currencies. In the third quarter of 2023, Indonesia witnessed its economic expansion slow down to 4.94%, a decrease from the 5.17% growth observed in the preceding quarter. Examining the exchange rate is pivotal when evaluating an economy's performance (Hassan et al., 2017). Monetary policy, which can influence the exchange rate through interest rates on capital flows and export supply and demand, allows monetary policy to control the rupiah currency's strength effectively to anticipate the spillover impact on global finance. Song et al (2022) argued policy pressures threaten the vulnerability of developing countries' currency exchange rates, and economic certainty policies can also result in a more prolonged recession (Aprilia & Malia, 2022). Fluctuations in exchange rates show the amount of volatility that occurs in a country's currency against foreign currencies (Wang et al., 2022).

The Central Bank of Indonesia is in a dilemma, seeing this condition. Investment will be hit when interest rates increase (Shaukat et al., 2019). If central bank does not raise interest rates, capital flows will return to the US dollar, and the rupiah stability will weaken. Contraction in the trade sector will strengthen the volatility of capital flows, weaken the financial system, and worsen economic instability (Murdipi et al., 2023). To see the extent to which exporters absorb future exchange rate fluctuations depending on their markets (Fracasso et al., 2022), especially oil exporters (H. Zhu et al., 2023). Traumatized by the 1998 crisis, the weakening of the exchange rate could cause a balance sheet effect. This means that the debt burden denominated in US dollars will increase, and capital costs will become expensive because they come from imports. The higher inflation will threaten the stability of the rupiah currency. Thus study from Batabyal & Killins (2021) stated a policy of periodically targeting inflation control is needed. Improving policy effectiveness to enhance the steadiness of the rupiah exchange rate and a sustainable economy (Kabundi & Mlachila, 2019) and responding to challenges that arise in the face of economic uncertainty. Purchasing Power Parity Theory (PPP) is often utilized to identify the relationship between exchange rates, which are affected by economic variables, explained by where the cost of the same item or products in two distinct nations would be assessed with the same currency. Kisswani & Elian (2021) prove that linear ARDL exhibits asymmetric influence in both the short term in some currencies and symmetrically in others. Indonesia operates on a floating currency system since it operates on a floating currency system. The system makes predicting exchange rate fluctuations more challenging (Hakim & Pangestuti, 2013). This is due to the influence of market expectations on the forex market's supply and demand forces. According to Soelistyo (2022) the supply-demand mechanism is the core method for achieving market

equilibrium. Consequently, the supply-demand law emerges as a pivotal economic mechanism in a free market, guiding the production decisions of suppliers and the preferences of consumers. An increase in costs leads to a higher quantity supplied, whereas, under the assumption of all else being equal (ceteris paribus), a decrease in costs causes a decrease in the quantity supplied, establishing a direct relationship between price and supply. The Rupiah's exchange rate stability is affected by the global currency's supply and demand dynamics, particularly with the United States Dollar, underscoring the significance of bilateral trade (Abbasi, 2020).

Policies must respond to these conditions to keep the rupiah exchange rate stable. BI needs to implement a combination of policies using macroprudential instruments and exchange rates. The macroprudential policy aims to manage systemic risk in the financial sector by liquidity, capital, and risk monitoring requirements. Mao (2022) argued an effective way to avoid the impact of fluctuations is by maintaining exchange rate stability, which can hamper economic development and affect export-import competitiveness, capital flows, inflation, etc. Synchronization between macroprudential policies and exchange rates can contribute to financial stability. The rupiah exchange rate aligns with fundamental values by strengthening stability policies—the impact of the increasingly strong USD currency amidst high economic uncertainty. Macroeconomic involvement is very strong in causing exchange rate fluctuations (Wijaya, 2020). Recently, the use of exchange rates has been involved in synchronizing macroeconomic variables, namely foreign exchange reserves (Hasyim, 2018), economic growth (Bato et al., 2017), money supply (Adhista, 2022), the balance of payments (Nuraeni & Ismiyatun, 2021), net exports (Mustika et al., 2015). Previous research from Cholifah & Khoirudin (2022) and Wuri (2018) found that exchange rate involvement is closely related to macroeconomics through demand-supply, namely exports, inflation, and interest rates. This finding emphasizes that the demand-supply relationship for the currency determines exchange rates. The dollar currency has become the world exchange rate standard and is used by Indonesia for economic activities. Smallwood (2019) finds it attractive that there is no substantial evidence that exports are negatively impacted when exchange rates are not mentioned. Then, there is the finding from Long et al (2022) that monetary policy is pressured to reduce interest rates to increase the economic impact on China.

A study by Türel & Orhan (2022) found that inflation positively contributes to the currency, but interest rates negatively affect the currency. This finding contradicts research conducted by Alawiyah et al (2019) and Algifari & Rohman (2022) which shows that interest rates have a significant and beneficial influence on foreign exchange rates, while inflation has a negligible negative impact. Then, according the study from Bigerna (2024) stated in the long term, inflation affect the value of the currency. Ardiyanto & Ma'ruf (2014) states that exports have no short-term or long-term impact on the currency. However, the findings of Alam et al (2017) examine the correlation between Pakistan's exports and currency exchange rate fluctuations. The results have both positive and negative impacts. Meanwhile, study from Permatasari (2017) stated that exports did not affect Indonesia's exchange rate from 2012 to 2015. Study from Zhu et al (2022) the FMOLS test was employed to examine the dynamics between exports and exchange rates, uncovering that exports influence exchange rates significantly in the long run, though not in the immediate term. Uysal & Mohamoud (2018) demonstrated a positive correlation between exports and exchange rates in East African nations. According to Dąbrowski et al (2022) global disturbances elicited significant reactions from exporters, particularly in the oil sector, and Chien et al (2020) findings affect the stability of bilateral trade exchange rates.

A study by Mao Takongmo & Lebihan (2021) explored the correlation between GDP and Rupiah currency spanning from 2014 to 2020 utilizing multiple linear regression and quantitative analysis methods. The study concluded that GDP does not singularly influence the exchange rate. Conversely, the ECM test conducted by Misra & Gupta (2017) with GDP as the independent variable, revealed a notable effect of GDP on the exchange rate in India. The study also highlighted economic uncertainty as a pivotal dummy variable due to its significant role in exchange rate fluctuation. Khalid et al (2023) this research explore the influence of the actual unequal exchange rate gap on Turkey's economic development. Song et al (2022) examine the correlation between monetary policy and market exchange rates. Economic policy is poised to generate a substantial spillover impact on market currency under considerable systemic risk. According to Pastorek (2023) economic policy does not significantly affect the Euro area. Bush & López (2021) Analyze how advertising influences currency fluctuations in Mexico and find that domestic political analysis positively affects exchange rate volatility. This gap shows the need for research focusing more on policy responses to uncertainty, especially in the world economy and its impact on exchange rates.

Conducting this research is crucial for examining the dynamics of the Rupiah to the USD and investigating the contributing factors under economic unpredictability to mitigate the weakening exchange rates due to global conflicts and uncertainty. Regarding the research contribution, past studies primarily examined the fluctuations of floating exchange rates and their consequences, often employing the Ordinary Least Squares (OLS) method. This study introduces a novel using the Error Correction Model (ECM). A regression method allows for studying short-term and long-term dynamics between interrelated variables. Further, it is easier to comprehend the responsiveness of the rupiah currency and the interrelationship of various macroeconomic factors. Selection of other models, such as VECM, ARDL, and ARCH-GARCH, are not involved in this research. The VECM model, although effective in dealing with cointegration and modeling correcting short- and long-run relationships, may be inflexible. The VECM model was also developed specifically for non-stationary data (Azzahra & Kurniawan, 2023). The ECM model is effective in identifying long-term balance relationships and short-term. ECM is also the simplest model to analyze the dynamics of exchange rates. Then, it involves dummy variables, which are qualitative and quantified as novelty and indicators to measure economic uncertainty and provide deeper insight into how economic uncertainty affects the dynamic of exchange rates in specific contexts.

The inconsistent findings from various studies induce this research to seek to bridge the knowledge gaps in exchange rate variability, mainly focusing on the Indonesian Rupiah's value against the US dollar. The investigation will investigate the effects of exports, inflation, interest rates, GDP, and economic volatility on Indonesia's exchange rate dynamics. This study covers 30 data from 1993 to 2022, employing the Error Correction Model (ECM) for its analytical framework. This study aims to explore the short-term fluctuations of the rupiah exchange rate and its path towards a long-term equilibrium, assessing its broader economic consequences in Indonesia. The research specifically aims to a). analyze the short-term impact of exports, inflation, interest rates, GDP, and economic uncertainty on the rupiah exchange rate; b). Investigate the long-term effects of the variables on the rupiah exchange rate. The ECM model is instrumental in accurately capturing the immediate and enduring effects, thereby facilitating a comprehensive understanding of the factors influencing Rupiah's exchange rate movements. The insights are vital to constructing effective economic strategies, as the exchange rate itself does not directly resolve specific issues but serves as a critical tool within a broader economic policy framework to manage and shape the economy's various elements.

2. Method

This study uses a time-series data from 1993-2022. The analysis is based on secondary data from the World Bank, the Indonesian Ministry of Trade, and the Central Statistics Agency. It applies the Error Correction Model (ECM) analysis, which includes stationarity test, cointegration and stability tests, along with the error correction model, Partial Adjustment Model (PAM), and classical assumption tests such as normality, autocorrelation, multicollinearity, and heteroscedasticity tests (Romero Tellaeche & Aliphat, 2023). The ECM was first initially introduced by Sargan and subsequently refined by Henry, the ECM gained widespread acceptance through the efforts of Engle & Granger (1987) In this study, the ECM is employed to explore how independent variables interact and influence the dependent variable, facilitating the dynamic transition from short-term fluctuations to long-term equilibrium. The model effectively addresses the issue of spurious regression, a common problem in time series analysis arising from non-stationarity, as highlighted by Sasikarani et al (2022).

The economic uncertainty variable uses a dummy variable which is measured using indicators of economic instability and stability that cover all aspects of the economy, with a scale code of 1 = the Indonesian economy is unstable and scale 0 = the Indonesian economy is stable from 1993 to 2022. This dummy variable can be used to represent conditions of economic uncertainty. Because it is difficult to measure economic uncertainty directly, the use of dummy variables makes it possible to predict the value of the dependent variable based on one or more independent variables, where one of the independent variables used is dummy (Rahmi & Siregar, 2022). Cointegration between variables Y and X suggests a long-term association. Short-term economic behaviors might exhibit shared discrepancies. Should disparities arise, rectifications are required. The Error Correction Term (ECT) model serves to amend such disparities, acting as a differentiator in the short-term context. The validity of the ECM model is established when significant and negative values of the ECT coefficient back the cointegrated variables (Widodo, 2020). The model was adjusted based on the cointegration test results, by incorporating the ECT variable as follows:

$$LnY_t = \beta_0 + \beta_1 LnEX_t + \beta_2 LnInf_t + \beta_3 Lnr_t + \beta_4 LnGDP_t + \beta_5 dummy_t + e \quad (1)$$

Where Y is the rupiah exchange rate; β_0 is a constant; β_1- β_5 are coefficients; Ln is logarithm natural EX is export; Inf is inflation; r is interest rate; GDP is Gross Domestic Product; $dummy$ is dummy economic uncertainty where 0 is certainty period and 1 uncertainty period; t is the period, and e is the disturbance error in the model.

$$\Delta Y_t = a_0 + a_1 \Delta LnX_{1_t} + a_2 \Delta LnX_{2_t} + a_3 \Delta LnX_{3_t} + a_4 \Delta LnX_{4_t} + a_5 \Delta LnX_{5_t} \quad (2)$$
$$+ a_6 ECT_t + e$$

Where Y is the rupiah exchange rate; a_0 is a constant; a_1 - a_6 are coefficients; Ln is logarithm natural X_1 is export; X_2 is inflation; X_3 is interest rate; X_4 is GDP; X_5 is dummy economic uncertainty; t is the period; e is the disturbance error in the model and ECT is the error correction term. Partial Adjustment Models (PAM) are models that involve a broader set of variables to test long-term economic phenomena and evaluate the consistency of empirical models with economic theory. The PAM criteria require the lag coefficient of the dependent variable to be in the range $0 < \beta < 1$, and β must be statically significant, which indicates a positive coefficient (Chin et al., 2020). The equation for partial adjustment model in the short term as follows:

$$ER_t^* = \beta_0 + \beta_1 X_{1_t} + \beta_2 X_{2_t} + \beta_3 X_{3_t} + \beta_4 X_{4_t} + \beta_5 X_{5_t} + \beta_6 ER_{t-1} + e \quad (3)$$

Where ER is the rupiah exchange rate; β_0 is a constant; β_1- β_6 are coefficients; Ln is logarithm natural X_1 is export; X_2 is inflation; X_3 is interest rate; X_4 is GDP; X_5 is dummy economic uncertainty; t is the period; e is the disturbance error in the model and ER_{t-1} is the rupiah exchange rate t-1.

3. Results and Discussion

This study applies the augmented dickey-fuller (ADF) approaches as the unit root test to determine whether there is a unit root problem in the time-series data and comparing the ADF statistical value with the critical value or Mackinnon statistic (alpha 5%). Table 1, the stationarity test using the Augmented Dickey-Fuller (ADF) method, not all variables have stationarity at level or I(0). However, after applying the first difference or I(1), variables including the rupiah exchange rate, export, inflation, interest rate, GDP, and the dummy economic uncertainty become significant, with their ADF statistical values is higher than critical value of 5 percent. This implies that at the first difference level, all variables used in this study is stationary.

Table 1. ADF Stationery Test Result

Variables	Level	First Difference
Y	-2.453	-3.590**
LnEX	-0.562	-4.559***
LnInf	-4.216***	-8.792***
Lnr	0.654	-6.599***
LnGDP	-4.035***	-5.461***
dummyEU	-4.766***	-6.046***

Source: Data processed

Johansen test used in this study to determine the stationarity of the cointegration regression residuals (Suripto et al., 2023). It can identify long-term regressions and the residuals and error correction term (ECT) values. The residuals need to exhibit a significant value that is less than the threshold of 5% (0.05). Once it is established that the data or variables are cointegrated, the next step involves moving on to the ECM Test phase. Table 2 shows the trace statistic 134.1772 is far from the critical value of > 5% (95.75366). Maximum eigenvalue statistics shows 51.36516 > critical value 5% (40.07757), it was concluded that the five variables, namely the export, inflation, interest rate, GDP, and economic uncertainty dummy were in the balance between long-term economic variables or all variables used in this study has cointegrated. After carrying out the cointegration test, the next step to find out whether this research can use the ECM model or not can be seen through the probability of the unit root test on the ECT residue provided it must be stationary. Level unit root test results can be

obtained where the probability of residual ECT is 0.0000, so this research can through to ECM analysis model.

Table 2. Result of Johansen Cointegration

Hypothesized of CE(s)	Eigenvalue	Trace Statistics	0.05 critical value	Prob
None*	0.840302	134.1772	95.75366	0.0000
At most 1*	0.733763	82.81201	69.81889	0.0032
At most 2	0.540323	45.75774	47.85613	0.0777
At most 3	0.344462	23.99530	29.79707	0.2006
At most 4	0.250329	12.17093	15.49471	0.1489
At most 5*	0.136322	4.103551	3.841465	0.0428

Source: Data processed

Stability test by evaluating the roots of the model on the characteristic of polynomial. Monitoring changes in these roots can provide insight into the stability of the model over time (Khoirudin & Kurniawan, 2023). Table 3 shows the model is stable that all the inverse root points of all variables lies in the unit circle and all variables have roots of characteristic polynomial modulus value is smaller than 1.

Table 3. Result of Stability Test

Hypothesized	Eigenvalue
-0.309939 - 0.809052i	0.866388
-0.309930 + 0.809052i	0.866388
0.660218 – 0.421538i	0.783315
0.660218 + 0.421538i	0.783315
0.238403 – 0.726456i	0.764574
0.238403 + 0.726456i	0.764574
-0.425714 – 0.603026i	0.738155
-0.425714 + 0.603026i	0.738155
0.048178 – 0.708644i	0.710280
0.048178 + 0.708644i	0.710280
-0.692788	0.692788
-0.188161	0.188161

Source: Data processed

The diagnostic tools of time-series dinamis is acceptable, than the residual of ECT variables need to test of stationarity. The stationery test of ECT to prove that value of ECT has value of means and variance not change over time. Table 4 shows that ADF test of ECT is higher than critical value of 5 percent or I(0), it means that value of ECT has means and variance not change over time.

Table 4. ECT Stationerity Test

Variable	ADF Test t-statistics	Critical Value 5%	Prob.
ECT	-6.317	-2.972	0.0000

Source: Data processed

Table 5 shows in the short-term analysis, the export coefficient is -0.175 it means that increase in exports by 1% will cause a decrease in the value of the rupiah against the USD of 0.175 percents. Considering that the probability value is 0.499 is higher than 5 percent it means that negative affect of exports on the exchange rate is insignificant in the short run. Then, in the long-run analysis, the export value coefficient is 0.706, indicate that 1% increase in exports will elevate the rupiah's exchange rate against the USD by 0.706 percent. The positive effect of exports on the exchange rate in long-run estimation has value of probability 0.0027, which is below the 5 percent it means that export affect to exchange rate in long-run. The correlation between export performance and exchange rates is evident in the long term, with no immediate impact observed in the short term. The data reveals a positive correlation over time, suggesting that a rise in export levels will likely lead to an exchange rate appreciation. Therefore, it is essential that increasing export supply activity in the long term can increase demand for the national currency, thus strengthening the value of the rupiah (Sumiyati, 2020). The interaction between export volumes and exchange rates influences Indonesia's economic expansion, underscoring the potential effects of currency fluctuations on trade activities (Cholifah &

Khoirudin, 2022). increasing the value of exports can maintain the stability of the trade balance, and exports that are greater than imports will affect GDP, which causes the exchange rate to increase. The results of short-term estimates indicate an insignificant and negative coefficient attributed to the susceptibility of the foreign exchange market to short-term fluctuations. According to Keynesian theory, export alterations directly influence individual incomes, subsequently impacting economic expansion and the rupiah's exchange rate (Soelistyo, 2022).

Table 5. Result of Error Correction Model (ECM)

Variables	Long-run Estimation	Short-run Estimation
C	1.474	0.085
	(0.499)	(2.678)**
LnEX	0.706	-0.175
	(3.347)***	(-0.686)
LnInf	0.017	0.095
	(0.156)	(2.448)**
Lnr	-0.164	0.001
	(-0.558)	(0.010)
LnGDP	-0.060	-0.005
	(-2.987)***	(1.132)
dummyEU	-0.169	0.072
	(0.947)	(1.132)
ECT(-1)		-0.207
		(-2.370)**
	Another Result	
R-Squared	0.722	0.556
F-stat	12.452	4.595
	Classical Assumption	
Normality Test	0.667	
Autocorrelation Test	0.050	
Heteroskedasticity Test	0.244	
Multicolinearity Test	Value of VIF is < 10 for all variables independent	

Source: Data processed

Increase in inflation by 1 percent lead to increase in the value of the rupiah against the USD of 0.095 percent, and the probability value of inflation is < 5 percent, it means that inflation affect to exchange rate in short term estimation. In the long-run, the inflation coefficient is 0.017, which indicates that an increase in inflation of 1% will cause an increase in the rupiah exchange rate against the USD of 0.017 percent and the probability value of inflation in long-run estimation is higher than 5 percent that inflation do not affect to exchange rate in long-run estimation. In the short-run, inflation impacts the exchange rate, causing currency depreciation, as evidenced by a significant positive relationship. This impact means that a higher inflation rate under certain conditions can increase the exchange rate in the short term due to the perception of increased economic growth or the anticipation of an increase in interest rates by the central bank. As a result, if inflation indicates robust economic expansion, it may draw foreign investment, boosting demand and thereby strengthening the currency's exchange rate (Algifari & Rohman, 2022). Inflation's considerable positive influence means that as a nation's currency strengthens, its goods become pricier than those abroad (Bato et al., 2017). The interest rate variables has no affect to exchange rate in the short and long run estimation. Ignoring the probability value The interest rate that shows the results does not affect the short-term or long-term. The positive directional coefficient is not significant in the short term, indicating that a decrease in interest rates will lead to a lower exchange rate. The positive coefficient is in line with the Interest Rate Parity theory that a reduction of a country's interest rate will result in a depreciation of its currency exchange rate and vice versa (Kabundi & Mlachila, 2019). In the long term, the interest rate coefficient shows a negative coefficient, indicating that the central bank's frequent policy adjustments to interest rates, which means regulating the rupiah's value against foreign currencies, do not have a practical impact on fluctuations in the exchange rate and means that the interest rate is determined by the demand and supply of money in market than fluctuation of exchange rate (Shaukat et al., 2019).

In the long-run estimation, GDP has a significant and negative effect on the exchange rate, indicating that an increase in GDP causes a decrease in the exchange rate. However, in the short term,

GDP has no impact on the exchange rate, which means that robust economic growth does not necessarily guarantee a steady escalation in the exchange rate. A higher exchange rate and the consequent rupiah depreciation will influence imported products' and raw materials' expenses (Hassan et al., 2017). An increase in economic growth is not balanced with balanced production, which can cause high inflation, indirectly reducing the currency's purchasing power. Seeing the fact that when a country experiences stable economic growth, prices will increase as an appreciation of its currency (Wijaya, 2020). Then economic growth, which increases imports of goods and services, can also cause a balance sheet deficit, which can put pressure on the currency exchange rate. In the short term, the coefficient also shows an insignificant negative direction. Economic growth can also make investors react in anticipation of market direction. When investors assess GDP too high and trigger a response from the central bank, this will lead to speculative actions by selling currency so that the exchange rate will be depressed in the short term (He & Zhao, 2022). The finding in line with Cholifah & Khoirudin (2022). Study from Misra & Gupta (2017) explain that GDP significantly and positively influences the exchange rate in India, suggesting that a high GDP attracts foreign investment, boosts inflows of foreign capital, and leads to an appreciation of the rupee. Conversely, when there is a depreciation in the exchange rate, there is usually a corresponding decrease in economic growth.

Dummy variables are a common tool to analysis of uncertainty during period used in this study. Table 5 shows uncertainty does not have a major impact on the exchange rate, both in the short and long term. In detail, the uncertainty coefficient is negative in the long-run estimation and positive in the short-run. It means that the rupiah value is vulnerable to various conditions of economic uncertainty. For example, when short-term uncertainty occurs, market participants often gravitate towards more stable and secure currencies to safeguard against risk, potentially leading to a temporary currency appreciation. Then, prolonged economic uncertainty can affect the domestic economy and make it more vulnerable to economic stability in financial markets. Contras the finding from Song et al (2022) that uncertainty plays important role in causing exchange rate fluctuations. Other variables more dominantly influence exchange rate movements than the threat of economic uncertainty. The threat of economic uncertainty raises concerns among the public so that people will take steps to secure the value of their wealth. Bank Indonesia projects that global uncertainty will remain high until the end of this year. It anticipates this impact by prioritizing and emphasizing the importance of ensuring the long-term resilience and sustainability of the IDR currency.

Table 6. The Result of Partial Adjustment Model (PAM)

Variables	Short-run	Long-run
LnEX	0.139108	$\frac{0.139108}{1-0.824077} = 0.168804$
LnInf	0.087140	$\frac{0.087140}{1-0.824077} = 0.105742$
Lnr	0.004875	$\frac{0.004875}{1-0.824077} = 0.005915$
LnGDP	-0.011589	$\frac{-0.011589}{1-0.824077} = 0.014063$
dummyEU	0.110621	$\frac{0.110621}{1-0.824077} = 0.134236$
LnER(-1)	0.824077	
C	-0.104203	

Source: Author Calculation

Table 6 shows in the short-run estimation that LnER(-1) has coefficient 0.824077 and t-stat 11.22 or higher than t-table it means that lag in exchange rate has affect to exchange rate itself. This indicates that the PAM model criteria are fulfilled, with the coefficient β lying between 0 and 1 and exhibiting a positive sign (Ringle et al., 2023). Furthermore, the PAM test shows that a 1 percent increase in exports will enhance the rupiah exchange rate by 0.139108 percent, the result shows that in the long run, the effects of exports on the exchange rate are higher than their short-run impacts not only exports but all variables independent used in this study has strong affect to exchange rate in the long-run estimation than in the short-run. GDP has different results between short-run and long-run estimations. For the short-run estimation, a 1 percent increase in GDP causes a 0.011589 decrease in the rupiah exchange rate, indicating that GDP's short-term effect is less pronounced than its long-term effect.

4. Conclusion

This study analyzes the main factors affecting the exchange rate, including economic uncertainty as a dummy variable. The study used ECM to analyze the effect of macroeconomic variables to

exchange rate for short and long run estimation. The findings of the research, a). In the long-run estimation show that exports have a significant impact on the exchange rate but, in the short-run, don't affect the exchange rate; b). Conversely, inflation has a positive effect on the exchange rate in the short term but has no effect in the long term. If inflation continues to increase, it will cause the currency's purchasing power to decrease, thus making investors choose countries with lower inflation in the short term; c). GDP has a significant impact only in the long run; and d). The interest rate variable and economic uncertainty dummy in this study did not show directly significant results due to other factors that were more dominant factors affect to the exchange rate. The implication of the study that the government must encourage export activities to strengthen the currency and increase the country's foreign exchange reserves and maintain stability of domestic price.

Acknowledgment

Declarations

References

Abbasi, G. (2020). Exchange rate volatility with third-country risk impact: A bilateral analysis of Pakistan with major trading partners. *Pakistan Social Sciences Review*, *4*, 29–46. doi: 10.35484/pssr.2020(4-IV)03

Adhista, M. (2022). Analysis of exports, imports, and amount of money supply (M2) against rupiah exchange rate. *GROWTH Jurnal Ilmiah Ekonomi Pembangunan*, *2*(8), 73–92.

Agustin, S. P., & Anis, A. (2021). Pengaruh guncangan variabel moneter terhadap nilai tukar dan inflasi di Indonesia. *Jurnal Kajian Ekonomi Dan Pembangunan*, *3*(3), 49–64. doi: 10.24036/jkep.v3i3.12369

Alam, S., Ahmed, Q. M., & Shahbaz, M. (2017). Exchange rate volatility and Pakistan's exports to major markets: A sectoral analysis. *Global Business Review*, *18*(6), 1507–1519. doi: 10.1177/0972150917713083

Alawiyah, T., Haryadi, & Amzar, Y. V. (2019). Pengaruh inflasi dan jumlah uang beredar terhadap nilai tukar rupiah dengan pendekatan model struktural VAR. *E-Journal Perdagangan Industri Dan Moneter*, *7*(1), 51–60. doi: 10.22437/pim.v7i1.8339

Algifari, A., & Rohman, I. Z. (2022). Dampak tingkat bunga dan laju inflasi terhadap kurs: Bukti dari Indonesia. *Capital: Jurnal Ekonomi Dan Manajemen*, *6*(1), 187–197. doi: 10.25273/capital.v6i1.13693

Aprilia, R., & Malia, R. (2022). Balance of payments and exchange rates in ASEAN countries: Granger causality test. *Optimum: Jurnal Ekonomi Dan Pembangunan*, *12*(1), 1–15.

Ardiyanto, F., & Ma'ruf, A. (2014). Pergerakan nilai tukar rupiah terhadap dolar Amerika dalam dua periode penerapan sistem nilai tukar. *Jurnal Ekonomi Dan Studi Pembangunan*, *15*(2), 127–134.

Assel, M. R., Hanoeboen, B. R. A., Laitupa, A. A., & Saptenno, F. (2023). Forecasting macroeconomic variables and their effect on poverty in Maluku province. *Journal of Economics, Business, & Accountancy Ventura*, *25*(3), 322–331. doi: 10.14414/jebav.v25i3.3451

Azzahra, N., & Kurniawan, M. L. A. (2023). Structural analysis of import oil and gas in Indonesia. *Jurnal Ekonomi Pembangunan*, *21*(2), 130–140. doi: 10.22219/jep.v21i02.28043

Batabyal, S., & Killins, R. (2021). Economic policy uncertainty and stock market returns: Evidence from Canada. *Journal of Economic Asymmetries*, *24*. doi: 10.1016/j.jeca.2021.e00215

Bato, A. R., Taufiq, M., & Putri, E. R. (2017). Analisis pengaruh variabel makro ekonomi terhadap nilai tukar rupiah tahun 2006-2015. *LAA MAISYIR: Jurnal Ekonomi Islam*, *4*(2), 74–95. doi: 10.20473/vol4iss20177pp587-598

Bernika, J., Raflis, & Kuswanda, G. F. (2023). Pengambilan keputusan berbasis nilai pada kriteria sosial yang resilien terhadap ketidakpastian ekonomi global. *Jurnal Rekayasa Lingkungan Terbangun Berkelanjutan*, *1*(2), 257–262.

Bigerna, S. (2024). Connectedness analysis of oil price shocks, inflation, and exchange rate for the MENA region countries. *Resources Policy*, *88*, 104344. doi: 10.1016/j.resourpol.2023.104344

Bush, G., & López, N. G. (2021). Uncertainty and exchange rate volatility: Evidence from Mexico. *International Review of Economics and Finance*, *75*, 704–722. doi: 10.1016/j.iref.2021.04.029

Chien, M. S., Setyowati, N., & Cheng, C. Y. (2020). Asymmetric effects of exchange rate volatility on bilateral trade between Taiwan and Indonesia. *The Singapore Economic Review*, *65*(04), 857–888. doi: 10.1142/S021759082050006X

Chin, W., Cheah, J. H., Liu, Y., Ting, H., Lim, X. J., & Cham, T. H. (2020). Demystifying the role of causal-predictive modeling using partial least squares structural equation modeling in information systems research. *Industrial Management & Data Systems*, *120*(12), 2161--2209. doi: 10.1108/IMDS-10-2019-0529

Cholifah, S. N., & Khoirudin, R. (2022). Analisis indikator makro terhadap kurs di Indonesia. *Tirtayasa EKONOMIKA*, *17*(1), 71–86. doi: 10.35448/jte.v17i1.13635

Dąbrowski, M. A., Papież, M., Rubaszek, M., & Śmiech, S. (2022). The role of economic development for the effect of oil market shocks on oil-exporting countries. Evidence from the interacted panel VAR model. *Energy Economics*, *110*. doi: 10.1016/j.eneco.2022.106017

Diakonova, M., Ghirelli, C., Molina, L., & Pérez, J. J. (2023). The economic impact of conflict-related and policy uncertainty shocks: The case of Russia. *International Economics*, *174*, 69–90. doi: 10.1016/j.inteco.2023.03.002

Engle, F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation and testing. *Econometrica*, *55*(2), 251–276. doi: 10.2307/1913236

Fajrah, N., & Zetli, S. (2020). Evaluasi pentingnya lokasi sentra oleh-oleh untuk pariwisata Kota Batam. *Meningkatkan Publikasi Ilmiah Civitas Akademika Universitas Pada Masa Pandemi Covid-19. Vol. 3, 2020.*, 120–125.

Fracasso, A., Secchi, A., & Tomasi, C. (2022). Export pricing and exchange rate expectations under uncertainty. *Journal of Comparative Economics*, *50*(1), 135–152. doi: 10.1016/j.jce.2021.07.001

Hakim, N., & Pangestuti, I. R. D. (2013). Harga minyak dunia terhadap kurs rupiah per-dolar Amerika Serikat tahun 2002-2012. *Diponegoro Journal of Management*, *2*(2), 364–375.

Hariyani, R., & Prasetio, T. (2023). Persepsi mahasiswa mengenai manajemen keuangan pribadi dalam menghadapi ancaman resesi ekonomi di Indonesia. *PERSPEKTIF: Jurnal Ekonomi & Manajemen Akademi Bina Sarana Informatika*, *21*(1), 53–59. doi: 10.31294/jp.v21i1.15406

Hassan, A., Abubakar, M., & Dantama, Y. U. (2017). Determinants of exchange rate volatility: New estimates from Nigeria. *Eastern Journal of Economics and Finance*, *3*(1), 1–12. doi: 10.20448/809.3.1.1.12

Hasyim, H. (2018). Analisis faktor-faktor yang mempengaruhi perubahan nilai tukar di Indonesia tahun 2006-2018. *Jurnal Al-Iqtishad*, *14*(2), 63–88. doi: 10.24014/jiq.v14i2.6835

He, C., & Zhao, X. (2022). An empirical study on the relationship between american stock market and exchange rate under the COVID-19. *Proceedings of the 2022 7th International Conference on Financial Innovation and Economic Development (ICFIED 2022)*. doi:

10.2991/aebmr.k.220307.422

Huang, Q., & Zhang, W. (2022). Economic performance evaluation of tourism in Pearl River Delta based on AHP model. *Mathematical Problems in Engineering*, *Vol. 2022*, 1328291. doi: 10.1155/2022/1328291

Kabundi, A., & Mlachila, M. (2019). The role of monetary policy credibility in explaining the decline in exchange rate pass-through in South Africa. *Economic Modelling*, *79*, 173–185. doi: 10.1016/j.econmod.2018.10.010

Kamaruddin, R. I., & Saskara, I. A. N. (2019). The influence of world stock index, BI rate and fed rate through IHSG on exchange rates in Indonesia for the period of 2006-2015. *Russian Journal of Agricultural and Socio-Economic Sciences*, *93*(9), 216–226. doi: 10.18551/rjoas.2019-09.23

Khalid, W., Civcir, I., & Özdeşer, H. (2023). The asymmetric effects of third-country exchange rate volatility on Turkish-German commodity trade. *Panoeconomicus*, *70*(2), 1–30. doi: 10.2298/PAN220624015K

Khoirudin, R., & Kurniawan, M. L. A. (2023). A time-varying of property residential price in Indonesia: A VAR approach. *Jurnal Ekonomi & Studi Pembangunan*, *24*(1), 69–80. doi: 10.18196/jesp.v24i1.17750

Kisswani, K. M., & Elian, M. I. (2021). Analyzing the (a)symmetric impacts of oil price, economic policy uncertainty, and global geopolitical risk on exchange rate. *The Journal of Economic Asymmetries*, *24*, e00204. doi: 10.1016/j.jeca.2021.e00204

Kurniawan, M. L. A., A'yun, I. Q., & Perwithosuci, W. (2022). Money demand in Indonesia: Does economic uncertainty matter? *Jurnal Ekonomi Dan Studi Pembangunan*, *23*(2), 231–244. doi: 10.18196/jesp.v23i2.15876

Li, J., Meng, X., Zhang, L., & Zhou, T. (2023). Heterogeneous international monetary transmissions: The role of inflation. *Journal of International Money and Finance*, *138*. doi: 10.1016/j.jimonfin.2023.102935

Long, S., Zhang, R., & Hao, J. (2022). Asymmetric impact of Sino-US interest rate differentials and economic policy uncertainty ratio on RMB exchange rate. *Journal of International Financial Markets, Institutions and Money*, *78*. doi: 10.1016/j.intfin.2022.101570

Mao Takongmo, C. O., & Lebihan, L. (2021). Government spending, GDP and exchange rate in zero lower bound: Measuring causality at multiple horizons. *Journal of Quantitative Economics*, *19*(1), 139–160. doi: 10.1007/s40953-020-00213-z

Mao, W. (2022). Analysis on changes in exchange rate of Egypt over past decades. *Proceedings of the 2022 7th International Conference on Financial Innovation and Economic Development (ICFIED 2022)*. doi: 10.2991/aebmr.k.220307.388

Misra, P., & Gupta, J. (2017). USD-INR exchange rate movements: An empirical analysis of macroeconomic determinants. *Amity Journal of Economics*, *2*(1), 23–34.

Murdipi, R., Baharumshah, A. Z., & Law, S. H. (2023). Portfolio capital flows and economic growth: Do institutional factors matter? *Research in International Business and Finance*, *66*, 102019. doi: 10.1016/j.ribaf.2023.102019

Mustika, C., Umiyati, E., & Achmad, E. (2015). Analisis pengaruh ekspor neto terhadap nilai tukar rupiah terhadap dolar Amerika Serikat dan pertumbuhan ekonomi di Indonesia. *JURNAL PARADIGMA EKONOMIKA*, *10*(2), 292–302. doi: 10.22437/paradigma.v10i2.3673

Nuraeni, E., & Ismiyatun. (2021). Krisis ekonomi global era pandemi COVID-19 (Studi kasus: Menurunnya nilai tukar rupiah terhadap dolar Amerika Serikat periode februari-maret 2020). *SPEKTRUM Jurnal Ilmu Politik Hubungan Internasional*, *18*(2), 50–68. doi: 10.36985/ekuilnomi.v2i2.113

Pastorek, D. (2023). Euro area uncertainty and Euro exchange rate volatility: Exploring the role of transnational economic policy. *Finance Research Letters*, *58*, 104351. doi:

10.1016/j.frl.2023.104351

Permatasari, Y. T. (2017). Pengaruh variabel makro terhadap nilai tukar rupiah atas dolar AS periode 2012-2015. *Jurnal Ekonomi Syariah Teori Dan Terapan*, *4*(7), 587–598. doi: 10.20473/vol4iss20177pp587-598

Rahmi, N., & Siregar, S. (2022). Pengaruh kinerja perekonomian dalam penanggulangan kemiskinan: Perbandingan antara daerah berbasis pertambangan dan daerah perkotaan (Studi kasus Kabupaten Tabalong dan Kota Banjarmasin). *JIEP Jurnal Ilmu Ekonomi Dan Pembangunan*, *5*(2), 536–547. doi: 10.20527/jiep.v5i2.6955

Ramadhani, H., Sofian, M. Y., & Anggraini, S. D. (2023). Analisis perubahan kurs rupiah terhadap mata uang asing dalam menghadapi resesi tahun 2023. *Jumek: Jurnal Manajemen Dan Ekonomi Kreatif*, *1*(1), 100–112. doi: 10.59024/jumek.v1i1.34

Rengganis, E., Nurdin, Riani, Astuti, Marni, Zabidi, Yasrin, & Poerwanto, E. (2023). Pendampingan penyediaan sarana air bersih di desa wisata Stone Park Bukit Pertapan Turunan Girisuko Panggang Gunungkidul. *J-ABDI: Jurnal Pengabdian Kepada Masyarakat*, *2*(9), 6213–6219. doi: 10.53625/jabdi.v2i9.4839

Ringle, C. M., Sarstedt, M., Sinkovics, N., & Sinkovics, R. R. (2023). A perspective on using partial least squares structural equation modelling in data articles. *Data in Brief*, *48*, 109074. doi: 10.1016/j.dib.2023.109074

Romero Tellaeche, J. A., & Aliphat, R. (2023). Estimation of the aggregate import demand function for Mexico: a cointegration analysis. *Journal of Economics, Finance and Administrative Science*, *28*(56), 372–385. doi: 10.1108/JEFAS-08-2020-0302

Sasikarani, M., Andrian, T., & Ciptawaty, U. (2022). Pengaruh kartu kredit, dana float dan suku bunga kebijakan terhadap velocity of money di Indonesia. *E-Journal Field of Economics, Business and Entrepreneurship*, *1*(2), 131–139. doi: 10.23960/efebe.v1i2.16

Shaukat, B., Zhu, Q., & Khan, M. I. (2019). Real interest rate and economic growth: A statistical exploration for transitory economies. *Physica A: Statistical Mechanics and Its Applications*, *534*, 122193. doi: 10.1016/j.physa.2019.122193

Smallwood, A. D. (2019). Analyzing exchange rate uncertainty and bilateral export growth in China: A multivariate GARCH-based approach. *Economic Modelling*, *82*, 332–344. doi: 10.1016/j.econmod.2019.01.014

Soelistyo, A. (2022). Macro-econometric model: Keynesian-monetarist synthesis of the international balance of payments (The Indonesian case). *Journal of Economics, Business, & Accountancy Ventura*, *25*(1), 61–75. doi: 10.14414/jebav.v25i1.2606

Song, L., Tian, G., & Jiang, Y. (2022). Connectedness of commodity, exchange rate and categorical economic policy uncertainties — Evidence from China. *North American Journal of Economics and Finance*, *60*. doi: 10.1016/j.najef.2022.101656

Sumiyati, E. E. (2020). Factors affecting manufacturing exports. *Journal of Economics, Business & Accountancy Ventura*, *23*(2). doi: 10.14414/jebav.v23i2.2303

Suripto, Novayadi, N., Sukarniati, L., & Kurniawan, M. L. A. (2023). Analysis of factors affecting foreign exchange reserves in Indonesia. *International Journal of Applied Business and International Management (IJABIM)*, *8*(3), 72–92. doi: 10.32535/ijabim.v8i3.2462

Türel, M. Y., & Orhan, A. (2022). Asymmetries in exchange rate pass-through in Turkey: A threshold VAR analysis. *Prague Economic Papers*, *31*(3–4), 276–295. doi: 10.18267/j.pep.806

Uysal, Ö., & Mohamoud, S. A. (2018). Determinants of export performance in East Africa countries. *Chinese Business Review*, *17*, 168–178. doi: 10.17265/1537-1506/2018.04.002

Wang, Y., Wang, L., Pan, C., & Hong, S. (2022). Economic policy uncertainty and price pass-through effect of exchange rate in China. *Pacific Basin Finance Journal*, *75*. doi: 10.1016/j.pacfin.2022.101844

Widodo, A. (2020). Measuring cyclical behavior of islamic and conventional financing: Evidence from Indonesian dual banking system. *Journal of King Abdulaziz University: Islamic Economics*, *33*(2), 173–192.

Wijaya, E. (2020). Analisis faktor-faktor yang mempengaruhi nilai tukar rupiah periode 1999Q1-2019Q2. *Jurnal Samudra Ekonomi Dan Bisnis*, *11*(2), 197–209. doi: 10.33059/jseb.v11i2.1919

Wuri, J. (2018). Fluktuasi kurs valuta asing di beberapa negara Asia Tenggara. *EXERO Journal of Research in Business and Economics*, *1*(1), 1–22. doi: 10.24071/exero.v1i1.1659

Zhu, H., Li, S., & Huang, Z. (2023). Frequency domain quantile dependence and connectedness between crude oil and exchange rates: Evidence from oil-importing and exporting countries. *Quarterly Review of Economics and Finance*, *90*, 1–30. doi: 10.1016/j.qref.2023.05.001

Zhu, W., Ahmad, F., Draz, M. U., Ozturk, I., & Rehman, A. (2022). Revisiting the nexus between exchange rate, exports and economic growth: further evidence from Asia. *Economic Research-Ekonomska Istrazivanja*, *35*(1), 7128–7146. doi: 10.1080/1331677X.2022.2059692