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The Influence of Macroeconomic Indicators on Foreign Exchange Reserves in Indonesia

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Abstract: This study aims to analyze the influence of macroeconomic indicators such as exports, imports, inflation, exchange rates, and the Bank Indonesia (BI) rate on foreign exchange reserves in Indonesia during the 2010-2023 period. The research methodology employed is multiple linear regression analysis and the Error Correction Model (ECM) with monthly time series data. The results indicate that exports, inflation, and exchange rates significantly affect Indonesia's foreign exchange reserves in the long run. Exports and exchange rates have a positive effect, while inflation also positively affects foreign exchange reserves. Conversely, the benchmark interest rate (BI Rate) has a significant adverse impact. In the short term, only inflation and exchange rate have a significant effect, negatively impacting foreign exchange reserves. This research contributes original value to the literature by integrating a broad set of macroeconomic indicators into a single, comprehensive model. This approach is seldom found in previous studies. Whereas earlier research typically assessed these variables in isolation or limited combinations, this study concurrently examines their collective impact within a consistent ECM framework over a 14-year monthly dataset. As such, this study enhances the current understanding of the short- and long-term macroeconomic dynamics affecting foreign exchange reserves and provides valuable insights for policymakers in formulating external sector strategies.

Keywords: Foreign Exchange Reserves; Macroeconomic Indicators; Error Correction Model; Long-Term Impact; Short-Term Impact
JEL Classification: E02; E10; E40; F10

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Introduction

In the era of growing globalization, economic stability is one of the main pillars that determine the strength and sustainability of a country's economy (Prasentianto, 2014). Economic stability plays a role in encouraging sustainable economic growth and maintaining the country's ability to face various global economic challenges. Foreign exchange reserves are an important indicator often used to measure economic stability. Foreign exchange reserves are a crucial component that serves as a buffer for state finances, maintains exchange rate stability, and supports the smooth running of international trade transactions.

Often defined as the accumulation of foreign currency assets held by the central bank, foreign exchange reserves play a very important role in maintaining macroeconomic stability. According to the IMF (2022), adequate foreign exchange reserves allow a country to weather external

shocks, such as commodity price fluctuations, global financial crises, or sharp changes in international capital flows. In addition, foreign exchange reserves also serve as a tool to maintain market confidence in a country's economic stability and currency exchange rate.

In Indonesia, foreign exchange reserves have shown significant development from 2010 to 2023, with the increase reflecting the government's efforts to strengthen the economy through effective monetary and fiscal policies. Data from Bank Indonesia shows that Indonesia's foreign exchange reserves increased from USD 96,207 million in 2010 to USD 146,384 million in 2023, although there were some fluctuations. These fluctuations are influenced by various macroeconomic factors, such as exports, imports, inflation, exchange rates, and Bank Indonesia's interest rate policy (Kurniawan & A'yun, 2022).

Exports and imports are the two main variables significantly affecting foreign exchange reserves. Research by Antari et al. (2023) shows that an increase in exports contributes positively to a rise in foreign exchange reserves because foreign exchange earnings from abroad increase. Conversely, increased imports drain foreign exchange reserves because more foreign exchange is used to meet domestic needs (Adhitya, 2021). In this case, the imbalance between exports and imports can cause a decrease in the trade balance, which hurts foreign exchange reserves (Fawaiq, 2023).

In addition, inflation and exchange rates also significantly influence foreign exchange reserves. High inflation can affect the purchasing power of the domestic currency, which in turn affects the exchange rate and foreign exchange reserves. Research by Simamora & Widanta (2021) shows that a stable exchange rate and controlled inflation are essential prerequisites for maintaining healthy foreign exchange reserves. When the exchange rate strengthens, imported goods become cheaper, reducing foreign exchange expenditure and increasing the country's foreign exchange reserves (Pratiwi et al., 2018).

The interest rate policy implemented by Bank Indonesia, known as the BI Rate, also directly impacts capital flows and foreign exchange reserves. An increase in the BI Rate tends to attract foreign investment, as higher yields attract foreign investors to invest their capital in rupiah-denominated assets (Purba et al., 2024). These capital inflows eventually increase foreign exchange reserves. Conversely, a decrease in the BI Rate can encourage capital outflows, reducing the country's foreign exchange reserves (Ratnaningtyas & Huda, 2024).

In this study, the relationship between Indonesia's foreign exchange reserves and macroeconomic variables such as exports, imports, inflation, exchange rate, and BI Rate will be analyzed in depth using econometric methods, including multiple linear regression and error correction model (ECM). This study will cover the period from 2010 to 2023 to provide a comprehensive picture of the development of Indonesia's foreign exchange reserves in a global and national context. This research extends the existing literature by integrating multiple macroeconomic indicators (exports, imports, inflation, exchange rates, and BI Rate) into a comprehensive model for predicting Indonesia's foreign exchange reserves, an approach rarely adopted in previous studies. Most earlier works examined these variables individually or in partial combinations. At the same time, this

study simultaneously incorporates them under the ECM framework with monthly data across 14 years. The findings reaffirm and refine the understanding of short-run and long-run relationships among these macroeconomic factors, thus offering new insights for policymakers and academic scholars in developing more effective strategies related to external reserves management.

An in-depth understanding of how these macroeconomic variables affect foreign exchange reserves provides essential insights for policymakers in designing effective economic strategies (Suripto Suripto, 2009) and theoretically contributes to developing better economic models. Thus, the results of this study are expected to be a reference for the government, academics, and economic practitioners to maintain economic stability and encourage sustainable economic growth in Indonesia.

Research Method

This research uses a descriptive quantitative design to numerically analyze the relationship between variables. The data sources in this study include secondary data from Bank Indonesia and the Central Statistics Agency (BPS), which are official institutions providing economic data in Indonesia. The data used is monthly time series data from 2010 to 2023, including variables of foreign exchange reserves, exports, imports, inflation, exchange rates, and BI rates.

This study uses several variables that are operationally defined as follows:

1. Foreign Exchange Reserves: Foreign exchange reserves are Bank Indonesia's dollar currency. This data is measured in millions of dollars and sourced from Bank Indonesia.
2. Exports: Exports refer to the amount of goods and services sold to the international market. They are measured in millions of dollars using Central Bureau of Statistics data.
3. Imports: Imports are goods and services from the international market. Like exports, imports are measured in millions of dollars, according to the Central Bureau of Statistics data.
4. Inflation: Inflation is defined as the general rate of increase in the prices of goods and services in the Indonesian economy from 2010 to 2023. Inflation data is measured in percent, and the data source is the Central Bureau of Statistics.
5. Exchange Rate: The exchange rate refers to the price of the Rupiah in dollars. The exchange rate data is measured in Rupiah and sourced from the Central Bureau of Statistics.
6. BI Rate: The BI Rate is the benchmark interest rate set by Bank Indonesia from 2010 to 2023. This data is measured in percent and sourced from the Central Bureau of Statistics.

The method of analysis used in this study is quantitative. To analyze the independent variables that affect economic growth in Indonesia using the error correction model (ECM) regression analysis method. The ECM method itself is used to explain whether or not there is a relationship between the independent variable and the dependent variable

in the long and short term. The tool used to process data is EViews. The ECM regression model used in this study is as follows:

a. Long-term equation :

$$Yt = \alpha + \beta 1X1t + \beta 2X2t + \beta 3X3t + \beta 4X4t + \beta 5X5t + \epsilon t$$

b. Short-term equation :

$$\Delta Yt = \gamma + \delta 1\Delta X1t + \delta 2\Delta X2t + \delta 3\Delta X3t + \delta 4\Delta X4t + \delta 5\Delta X5t + \lambda ECTt{-}1 + lvt$$

This study utilizes the Error Correction Model (ECM) because the research primarily focuses on analyzing the short-term dynamics and long-term equilibrium relationship among macroeconomic variables when the variables are already cointegrated. As stated by Engle & Granger (1987), ECM is appropriate when the variables are non-stationary at level (integrated of order one, I(1)) but become stationary after first differencing, and when there exists a confirmed long-term co-integration relationship among the variables. Moreover, ECM provides a framework that explicitly captures the speed of adjustment from short-term disequilibrium toward long-term equilibrium, making it highly suitable for research examining both short-run and long-run interactions simultaneously.

Result and Discussion

The Table 1 shows the results of the descriptive analysis of several economic variables. Foreign exchange reserves average at 11.66505 with a low standard deviation, indicating relatively high data stability. Exports and imports have an average of 9.648396 and 9.573033, with a standard deviation that is also relatively low, indicating that both move in a fairly narrow range. Inflation with a mean of 0.365952 and a high standard deviation indicates significant variability, including negative values, suggesting a possible deflationary period. The exchange rate, with a mean of 9.429603 and a slight standard deviation, also shows stability. However, the BI Rate has a larger variation of 5.662202 and a standard deviation of 1.289972, indicating fluctuations in monetary policy. The data reflects relatively stable economic conditions regarding foreign exchange reserves, exports, imports, and exchange rates, but shows greater inflation and interest rate variability.

Table 1 Descriptive analysis results

Variable	Obs	Mean	Std. Dev.	Min	Max	Unit of Variable
CashReserves	168	11.66505	0.154483	11.14998	11.89730	Million dollars
Exports	168	9.648396	0.215402	9.174661	10.23741	Million dollars
Imports	168	9.573033	0.199059	9.040572	10.00562	Million dollars
Inflation	168	0.365952	0.468219	-0.450000	3.290000	Percent
ExchangeRate	168	9.429603	0.192823	9.048762	9.703022	Dollar to Rupiah
BIRate	168	5.662202	1.289972	3.500000	7.750000	Percent

Table 2 Changes in the Logarithmic Form of Variables

Original Variable	Initial Unit	Logarithm of The Variable	Unit Changes
CashReserves_Million_Dollars	Million Dollars	CashReserves	Percent
Export_Million_Dollars	Million Dollars	Exports	Percent
Import_Million_Dollars	Million Dollars	Imports	Percent
ExchangeRate_Million_Dollars	Dollar to Rupiah	ExchangeRate	Percent

In Table 2, some key variables are converted from their original form to logarithmic form, with units changed from physical units, such as million dollars, and exchange rates from dollars to rupiah to percent. For example, foreign exchange reserves measured initially in millions of dollars are now represented in logarithmic form as 'cash reserves' and measured in percentages. The same is done for the export and import variables, converted from millions of dollars to logarithms and measured in percentages as 'exports' and 'imports'. The exchange rate, previously measured in dollars against the rupiah, was also converted to logarithms and measured in percentages as 'exchange rate'.

This transformation aims to overcome the problem of scale differences between variables and facilitate the interpretation of coefficients as elasticities in the regression model that show how much a percentage change in one variable is followed by a change in another variable. Using logarithms also helps reduce heteroscedasticity, or uneven variability, in the data (Suripto, 2020). In other words, this approach provides a more intuitive way to understand relative changes in economic variables.

Classical Assumption Test Results

This study uses the classic assumption test to determine how the independent variable affects the dependent variable. Ensuring the regression model meets the requirements and provides valid and accurate results is crucial. For the resulting regression model to be reliable, the data must meet some basic assumptions. Suppose the regression data meet all four classical hypothesis tests. In that case, the data can be eligible for proper regression analysis.

a. Normality Test

This test determines whether the data comes from a normally distributed population. The Kolmogorov-Smirnov test is used in this test, where data is considered normal if the significance value is more than 0.05. Normality is crucial because it affects the validity of statistical testing results in regression (Sugiyono, 2014).

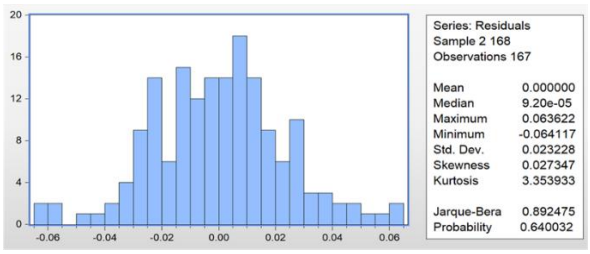

Figure 2 Normality Test

The Jarque-Bera test gives a value of 0.892475 with a probability of 0.640032. This high probability indicates we cannot reject the null hypothesis that the residuals follow a normal distribution. In other words, the residual distribution is normal. Overall, this analysis shows that the assumption of normality of residuals in the regression model is not violated. This near-normal distribution of residuals indicates that the regression model used is good enough and reliable for further analysis.

b. Autocorrelation Test

This test detects whether or not there is a correlation between the residuals of one observation and another. The Breusch-Godfrey Test detects autocorrelation, where a p-value above 0.05 indicates the absence of autocorrelation (Sugiyono, 2014).

Table 3 Autocorrelation Test Results

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.385621	Prob. F(2,158)	0.2532
Obs*R-squared	2.878608	Prob. Chi-Square(2)	0.2371

Based on the test results, it is known that the Obs*R-squared value is 2.878608 (>0.05); it can be concluded that the autocorrelation test assumption has been fulfilled or passes the autocorrelation test, so that the model estimation results can be considered valid and reliable.

c. Heteroscedasticity Test

This test ensures that the residual variance in the regression model is constant. If the variance changes, then heteroscedasticity can affect the regression results.

Table 4 Heteroscedasticity Test Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.448363	Prob. F(6,160)	0.8453
Obs*R-squared	2.761442	Prob. Chi-Square(6)	0.8381
Scaled explained SS	2.983369	Prob. Chi-Square(6)	0.8109

The Scaled explained (SS) value is 2.983369, with a probability (Prob. Chi-Square (6)) of 0.8109. Similarly, the value does not strongly indicate heteroscedasticity based on the test because the high probability value supports the hypothesis that heteroscedasticity does not affect the model.

d. Multicollinearity Test

This test is conducted to ensure no strong correlation between the independent variables. Testing uses VIF and Tolerance, where VIF above 10 or Tolerance below 0.1 indicates multicollinearity. If multicollinearity is found, corrective measures such as combining variables can be taken to improve model accuracy (Sugiyono, 2014). A VIF value below 10 indicates no significant multicollinearity (Sufren & Natanael, 2014).

Table 5 Multicollinearity Test Results

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
D(X1)	0.000826	2.327924	2.324099
D(X2)	0.000418	2.277211	2.275024
D(X3)	1.18E-05	1.027335	1.027328
D(X4)	0.006341	1.077863	1.061012
D(X5)	0.000122	1.229465	1.229138
ECT(-1)	0.000603	1.187964	1.187923
C	3.41E-06	1.018796	NA

The Uncentered VIF values for the independent variables and the intercept (C) are well below 10. Therefore, the model does not suffer from significant multicollinearity problems. The low Uncentered VIF values indicate that the independent variables in the model are not very closely connected, thus not affecting the stability of the regression coefficient estimates.

Unit Root Test

A unit root test, such as Augmented Dickey-Fuller (ADF) or Phillips-Perron (PP), is required to ensure that the variables are non-stationary at the level but stationary at first difference. The results of these tests will show whether the variables have a unit root (non-stationary) or not.

Table 6 ADF Stationarity Test Results

Variable	Unit Root Test					
	Level			1st Difference		
	ADF	Prob	Conclusion	ADF	Prob	Conclusion
	Intercept					
Cash Reserves	-3.190156	0.02	Stationary	-10.70000	0.00	Stationary
Exports	-1.708249	0.42	Not Stationary	-13.14059	0.00	Stationary
Imports	-2.375593	0.15	Not Stationary	-3.60614	0.00	Stationary
Inflation	-10.58384	0.00	Stationary	-12.48981	0.00	Stationary
Exchange rate	-1.097996	0.71	Not Stationary	-13.71435	0.00	Stationary
BI Rate	-1.851709	0.35	Not Stationary	-7.72386	0.00	Stationary

From the Augmented Dickey-Fuller (ADF) stationarity test results, it can be concluded that at the level, only the foreign exchange reserves and inflation variables are stationary, while the export, import, exchange rate, and BI rate variables are non-stationary. However, after the first differentiation, all variables become stationary.

Table 7 Philips-Perron Stationarity Test Results

Variable	Unit Root Test					
	Level			1st Difference		
	PP	Prob	Conclusion	PP	Prob	Conclusion
	Intercept					
Cash Reserves	-3.094826	0.028	Stationary	-10.81439	0.00	Stationary
Exports	-2.249620	0.189	Not Stationary	-21.90746	0.00	Stationary
Imports	-4.806579	0.000	Stationary	-23.78109	0.00	Stationary
Inflation	-8.994848	0.000	Stationary	-32.85703	0.00	Stationary
Exchange rate	-1.082166	0.722	Not Stationary	-13.71784	0.00	Stationary
BI Rate	-1.674502	0.442	Not Stationary	-7.860364	0.00	Stationary

The variables of foreign exchange reserves, imports, and inflation are stationary. In contrast, the variables of exports, exchange rate, and BI rate are not stationary. After the first difference, all variables are stationary. Thus, this condition qualifies for Error Correction Model (ECM) testing because ECM requires stationary variables at first differentiation to overcome the nonstationarity problem and to capture the relationship between short-term and long-term variables.

Co-integration Test

After confirming that the variables are stationary, the next step is to test for co-integration between the variables. Co-integration indicates a stable long-run relationship between the variables, even though they are non-stationary. A commonly used co-integration test is the Engle-Granger test. If the results of the co-integration test indicate the existence of a cointegrating relationship, then ECM can be applied.

Table 8 Co-integration Test Results

Variabel	Coef	Prob
ECT(-1)	-0.072068	0.0038

The coefficient value (Coef) of the Error Correction Term (ECT) variable is -0.072068, and the probability (Prob) is 0.0038. In the context of an ECM model with one month, the ECT coefficient of -0.072068 indicates that every month, about 7.21% of the deviation or imbalance will be corrected. If translated into days, this is equivalent to about 2.16 days. In other words, the model corrects the deviation towards the long-run equilibrium in about two days each month so that the system gradually returns to its proper path.

Error Correction Model (ECM) Test

The ECM model, according to Widarjono (2018), has several advantages, namely its ability to combine short-term and long-term analysis, handle spurious regression problems on non-stationary variables, accelerate convergence to long-term equilibrium, identify imbalances in the short term, and provide flexibility in developing econometric models without losing the accuracy of long-term relationship estimates.

Table 9 Long-term Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPORT	0.152201	0.066269	2.296722	0.0229*
IMPORT	0.113053	0.068424	1.652235	0.1004
INFLATION	-0.027923	0.014073	-1.984103	0.0489*
EXCHANGERATE	0.376343	0.037271	10.0974	0.0000*
BIRATE	-0.036475	0.006094	-5.985633	0.0000*
C	5.782278	0.488292	11.84184	0.0000
R^2	0.72155			
Prob(F-statistic)	0.000000			

The results of the long-term regression analysis show that the model used has a strong explanatory power, with an R^2 value of 0.721550. This indicates that the independent variables in the model can explain about 72.16% of the variation in foreign exchange reserves (CASHRESERVES). The Prob (F-statistic) value of 0.000000 reinforces this finding, indicating that the overall model is significant, meaning that at least one independent variable significantly affects the dependent variable.

The export variable (EXPORT) has a coefficient of 0.152201, which indicates that each increase in exports by one percent will increase foreign exchange reserves by 0.152201 percent. The probability value of 0.0229 means that this relationship is statistically significant at the 5% significance level, so it can be concluded that exports positively and significantly influence foreign exchange reserves in the long run. Meanwhile, the import variable (IMPORT) has a coefficient of 0.113053, which shows a positive relationship with foreign exchange reserves. However, with a probability value of 0.1004, this relationship is not statistically significant at the 5% significance level, so although an increase in imports tends to increase foreign exchange reserves, the effect does not prove significant in the long run.

The inflation variable (INFLATION) has a negative coefficient of -0.027923, which means that every one percent increase in inflation will decrease foreign exchange reserves by 0.027923 percent. With a probability value of 0.0489, this relationship is significant at the 5% significance level, so it can be concluded that inflation negatively and significantly affects foreign exchange reserves in the long run. The exchange rate variable (EXCHANGERATE) has a coefficient of 0.376343, indicating that an appreciation of the exchange rate by one percent will increase foreign exchange reserves by 0.376343 percent. This relationship is highly statistically significant with a probability value of 0.0000.

Furthermore, the BI Rate variable (BIRATE) shows a negative coefficient of -0.036475, which indicates that each increase in the benchmark interest rate by one percent will reduce foreign exchange reserves by 0.036475 percent. The probability value of 0.0000 means that this relationship is statistically significant, so it can be concluded that an increase in the benchmark interest rate significantly negatively affects foreign exchange reserves in the long run.

Table 9 Short-term Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔEXPORT	0.022445	0.028735	0.781119	0.4359
ΔIMPORT	0.005006	0.020434	0.244978	0.8068
ΔINFLATION	-0.008277	0.003441	-2.405395	0.0173*
ΔEXCHANGERATE	-0.496172	0.07963	-6.230969	0.0000*
ΔBIRATE	-0.01304	0.011061	-1.178881	0.2402
C	0.005741	0.001848	3.106934	0.0022
R^2	0.275478			
Prob(F-statistic)	0.000000			

The results of the short-term regression analysis show that this model has:
The R^2 value is 0.275478, which means that about 27.55% of the variability of the dependent variable can be explained by the independent variables in the model. This shows that this model has less explanatory power than the long-term model. The Prob (F-statistic) value of 0.000000 indicates that this model is significant, meaning that at least one independent variable significantly affects the dependent variable.

The export variable (ΔEXPORT) has a coefficient of 0.022445, which indicates that short-term export changes are associated with an increase in foreign exchange reserves by 0.022445 percent. However, the prob value of 0.4359 indicates that the relationship is not statistically significant at the 5% significance level. This means that export changes have no significant effect on reserves in the short term.

The variable (ΔIMPORT) has a coefficient of 0.005006, indicating that short-term changes in imports are associated with an increase in foreign exchange reserves by 0.005006 percent. The p-value of 0.8068, far above the 5% significance level, indicates that the relationship is not statistically significant. This shows that changes in imports in the short term do not significantly impact foreign exchange reserves.

The variable (ΔINFLATION) shows a negative coefficient of -0.008277, which indicates that an increase in inflation in the short term is associated with a decrease in foreign exchange reserves by 0.008277 percent. The p-value of 0.0173 indicates that this relationship is statistically significant at the 5% significance level. This means a significant negative impact on foreign exchange reserves in the short term.

The exchange rate variable (ΔEXCHANGERATE) has a negative coefficient of -0.496172, indicating that the short-term depreciation of the exchange rate is associated with a decrease in foreign exchange reserves by 0.496172 percent. The p-value of 0.0000 indicates that this relationship is highly statistically significant. This suggests that changes in the exchange rate have a powerful and significant impact on foreign exchange reserves in the short term, with the depreciation of the exchange rate significantly reducing foreign exchange reserves.

The variable (ΔBIRATE) has a negative coefficient of -0.013040, indicating that an increase in the BI Rate in the short term is associated with a decrease in foreign exchange reserves by 0.013040 percent. However, the p-value of 0.2402 indicates that this relationship is

not statistically significant at the 5% significance level. This means that changes in the BI Rate in the short term have no significant effect on foreign exchange reserves.

The Effect of Exports on Foreign Exchange Reserves

a. Long Term

International trade is an essential source of foreign exchange. This study is based on the initial hypothesis. This shows that any increase in exports will significantly strengthen foreign exchange reserves. The theory of absolute advantage (Adam Smith) states that a country that can produce a good at a lower cost than other countries will gain an advantage in international trade. Indonesia, for example, has an advantage in producing commodities such as palm oil, rubber, and coffee due to its abundant natural resources and relatively cheap labor. Using these advantages, Indonesia can export these commodities at affordable costs, increase export earnings, and strengthen foreign exchange reserves. In addition, David Ricardo emphasized that even if a country does not have an absolute advantage in producing a particular product, it can still benefit from international trade by focusing on goods that can be made at a more affordable opportunity cost. In this way, Indonesia can concentrate on producing goods with a comparative advantage, improve economic efficiency, expand its export base, and strengthen foreign exchange reserves through increased export earnings.

Increased exports also play an essential role in industrialization, transforming an economy from agriculture-based to industry-based. Industrialization is often driven by increased exports, as demand from international markets can encourage investment in manufacturing and infrastructure. When exports increase, the export sector's contribution to GDP increases, thus accelerating economic growth and providing more room for the government to collect tax revenues. This tax revenue can then be allocated to infrastructure development, education, healthcare, and other projects. Increasing export revenues means the government can also focus on diversifying the economy. Economic diversification is vital in reducing dependence on key export commodities vulnerable to price fluctuations in the global market. Diversification also enables the development of new sectors, such as information technology, financial services, and tourism, which can contribute significantly to export earnings. Exports are the mainstay of the Indonesian economy, especially in the long-term context. Policies such as providing trade incentives, improving the quality of export products, and expanding international trade agreements should be prioritized to ensure Indonesia can continue strengthening its foreign exchange reserves. The results of previous studies support these findings. For example, research by Adhitya (2021), Wijayanto (2022), and Simamora & Widanta (2021). This research is in line with the theory of absolute and comparative advantage, which emphasizes that countries that can produce goods and services with high efficiency and are globally competitive are better able to attract foreign exchange, strengthening the position of foreign exchange reserves in the long run. These results align with the study's conclusion, which states that a consistent increase in exports will strengthen the country's foreign exchange reserves in the long run.

b. Short Term

In this analysis, the hypothesis is under the research results, which show a positive relationship between the two variables. However, despite this relationship, the effect on foreign exchange reserves is not always significant, as various factors can hinder the positive impact of increased exports. The high volatility of the value of exports, which is influenced by fluctuations in global commodity prices, changes in exchange rates, and supply chain disruptions, can cause the value of foreign exchange generated from exports to vary, so that even though the volume of exports increases, the foreign exchange value received is not always significant enough to significantly strengthen foreign exchange reserves. Foreign exchange generated from exports is often used for other purposes, such as paying for imports and repaying foreign debt. Which in turn reduces the potential for increasing foreign exchange reserves. In addition, government intervention and monetary policy limit the positive impact of exports on foreign exchange reserves, especially if the central bank needs to stabilize the exchange rate through market intervention. The global economic cycle and international uncertainty also limit the positive impact of exports on foreign exchange reserves by affecting foreign exchange earnings from exports, especially if global demand for exported goods declines during economic uncertainty or recession. Thus, although the hypothesis that exports positively affect foreign exchange reserves is proven correct, the effect does not always have an impact in the short term. It is necessary to manage economic policy wisely to maintain macroeconomic stability. Research by Purba et al. (2024) aligns with the findings that although exports are essential, their impact on foreign exchange reserves can be more variable and less significant in the short term.

The Effect of Imports on Foreign Exchange Reserves

a. Long Term

The results show that imports have a positive, although insignificant, effect on foreign exchange reserves, so the initial hypothesis does not match the reality found. Factors that can explain the gap include imports that increase production capacity in Indonesia and the competitiveness of domestic products in the international market, which, although initially draining foreign exchange, can increase exports and strengthen foreign exchange reserves in the long run. In addition, imports of technology and machinery that support productivity can have a multiplicative effect on the economy, promote broader economic growth, and generate greater foreign exchange inflows from exports and investment. However, despite the positive effect, the results show that the impact is insignificant, most likely due to structural imbalances in the economy. The increase in production and export capacity may not be significant enough to offset foreign exchange expenditure on imports, resulting in a weak impact on foreign exchange reserves. In addition, global uncertainty and commodity price fluctuations may also affect this relationship, as changes in the price of imported raw materials or exchange rate volatility may reduce the potential increase in foreign exchange reserves despite increased domestic productivity. Its insignificant effect suggests that the impact of imports on foreign exchange reserves is more complex than previously hypothesized. Therefore, a balanced and strategic

economic policy is needed to manage imports effectively. This finding contradicts the hypothesis and previous studies such as Adhitya (2021) and Dananjaya et al. (2019). However, it aligns with research by Ratnaningtyas & Huda (2024).

b. Short Term

Although foreign exchange is spent on imports, faster foreign exchange inflows from exports can help maintain or even increase foreign exchange reserves. In the short term, companies and governments can implement more aggressive financial management strategies, such as accelerating exports or delaying import payments, so that foreign exchange reserves are not significantly impacted. However, the positive effect is not significant as many other factors limit the impact, such as high economic uncertainty due to global market volatility, exchange rate fluctuations, or sudden changes in economic policy. The time required to process raw materials or use imported capital goods into finished products and then export them can be longer than the short timeframe measured in the study. Therefore, although imports positively influence foreign exchange reserves, the impact is still insignificant in the short term, as the economic benefits of imports may not be fully realized. These results align with the findings of Purba et al. (2024) that the import regression coefficient is not statistically significant despite showing a positive relationship. Research variations may also cause the research focus to differ in methodology, analysis period, or economic conditions.

The Effect of Inflation on Foreign Exchange Reserves

a. Long Term

High inflation does bring a country's economy down, especially in the long run. In this context, uncontrolled inflation can result in a decline in people's purchasing power, which triggers a decline in domestic consumption. This decline in consumption has a negative impact on national production, which in turn can lower economic growth and reduce foreign exchange inflows from economic activities, including exports. High inflation also often leads to price instability and impairs international competitiveness. When domestic prices increase significantly, products become less competitive in the global market. The decline in demand will lead to a decrease in export volume, which means that foreign exchange inflows will also decline. The impact of long-term, uncontrolled inflation is not only limited to the decline in exports, but also on the overall stability of the economy. High inflation can lead to economic uncertainty, reducing investor confidence, both domestic and foreign.

When inflation cannot be controlled, investors may be concerned about the stability of the economy, and this possible financial loss will reduce foreign exchange reserves, which are crucial for a country's economic stability. Controlling inflation through tight monetary policy is essential to overcome the negative impact of inflation. Central banks, such as Bank Indonesia, should focus on keeping inflation within a manageable range through various monetary policy instruments. One instrument that can be utilized is the benchmark interest rate. In addition, controlling inflation also requires close coordination

with the government's fiscal policy to ensure that public spending is not too expansionary, which could trigger further inflation. Price stability is one of the main pillars in maintaining investor confidence. When inflation is low and stable, investors feel more secure in making investments, as there is less risk of price uncertainty. This confidence is crucial to ensure sustained capital inflows into the country. These capital flows will strengthen foreign exchange reserves, enhancing the country's economic position in the global market. In the long run, controlled inflation is also vital for maintaining people's welfare. This finding aligns with several previous studies that also found an adverse effect of inflation on foreign exchange reserves. For example, research by (2023) shows that inflation negatively and significantly affects foreign exchange reserves in the long run. In addition, research by Dananjaya et al. (2019) is supported by other studies such as Purba et al. (2024).

b. Short Term

Inflation can exert direct pressure on foreign exchange reserves through several interrelated economic mechanisms in a short period. One of the main mechanisms is a decrease in people's purchasing power. This can negatively impact domestic consumption. When domestic consumption declines, manufacturers may face a reduction in sales, reducing production output. This decline in output may reduce export capacity, as producers may not have enough goods to export or choose to shift their focus to the more lucrative domestic market. The government may face a policy dilemma when inflation is high and the exchange rate weakens. On the one hand, they may need to raise interest rates to curb inflation. Still, on the other hand, the result will be slowing economic growth and adding pressure on the labor market. High inflation in the short term may trigger expectations of higher inflation in the future. When consumers and producers expect higher inflation, they may start raising prices of goods and services faster than usual, accelerating the pace of inflation. These high expectations can create an inflationary spiral, where prices continue to rise rapidly, worsening the economic situation and reducing the stability of foreign exchange reserves. To address the inflation challenge in the short term, the government and central bank must act quickly and decisively.

Tight monetary policies, such as interest rate adjustments and liquidity controls, may be needed to stabilize prices and reduce pressure on foreign exchange reserves. In addition, effective communication from the central bank on inflation policy is vital to managing inflation expectations and preventing an inflationary spiral. Effective inflation control and price stability are critical to maintaining overall economic health, ensuring sustainable capital inflows, and protecting people's purchasing power. With the right policies, Indonesia can keep inflation within manageable limits, strengthen foreign exchange reserves, and ensure stable and sustainable economic growth.

This finding is similar to several previous studies that also found inflation has a negative impact on foreign exchange reserves. For example, research by Adhitya (2021) and Simamora & Widanta (2021) states that inflation has an adverse effect on Indonesia's foreign exchange reserves. In addition, research by Wahyudi et al. (2023) also found that inflation significantly negatively affects foreign exchange reserves in the long run. But it

differs from the findings of Purba et al. (2024) and Kumala & Rakhmanita (2023). Therefore, although most studies support the conclusion that inflation has a negative impact on foreign exchange reserves, there are differences in the significance of the effect, which may be influenced by different periods and diverse economic contexts.

The Effect of Exchange Rate on Foreign Exchange Reserves

a. Long Term

A flexible yet stable policy can help reduce uncertainty and maintain export competitiveness at the exchange rate. One way to achieve stability is to maintain strong economic fundamentals, including keeping inflation low, managing government debt wisely, and maintaining adequate foreign exchange reserves. In addition, the government also needs to consider economic diversification as a strategy to reduce dependence on products that are vulnerable to exchange rate fluctuations. Economic diversification can include developing new sectors less affected by exchange rate fluctuations, such as the technology industry, services, and tourism. By diversifying the economic base, countries can reduce the negative impact of exchange rate fluctuations on foreign exchange inflows and reserves. In addition, improving the competitiveness of domestic industries is also essential to ensure that exported goods remain competitive in the international market, even when the exchange rate fluctuates.

A strong and stable exchange rate is key to maintaining economic balance and strengthening foreign exchange reserves in the long run. This finding is in line with various previous studies. Antari et al. (2023) found that exchange rate stability is vital to increase the country's foreign exchange reserves, similar to the results showing that a stable exchange rate strengthens foreign exchange reserves. Research by Sukoco (2023) also revealed that the exchange rate affects Indonesia's foreign exchange reserves, consistent with the finding that exchange rate appreciation can increase foreign exchange reserves. Research by Purba et al. (2024) shows that the rupiah exchange rate positively affects foreign exchange reserves, supporting the conclusion that a strong exchange rate strengthens foreign exchange reserves. The findings of Laksono & Tarmidi (2021) also confirm that the exchange rate significantly affects foreign exchange reserves, which supports that a stable exchange rate is vital to increase foreign exchange reserves. In addition, Dananjaya et al. (2019) found a positive effect of the exchange rate on foreign exchange reserves, similar to the study results showing that exchange rate appreciation increases foreign exchange reserves. Finally, Jalunggono et al. (2020) also showed a significant effect of the exchange rate on foreign exchange reserves.

b. Short Term

Significant exchange rate strengthening often promotes capital outflows, as foreign investors may sell their assets denominated in the domestic currency to take advantage of the higher exchange rate and shift their funds to other more favorable markets. These capital outflows can pressure foreign exchange reserves as the central bank may need to use foreign exchange reserves to stabilize the exchange rate or meet currency exchange

demands. The adverse effect of the exchange rate on foreign exchange reserves can also be exacerbated by government pressure on the foreign exchange market. Higher economic uncertainty in the short term, such as financial crises or geopolitical tensions, can also lead to unexpected exchange rate fluctuations, further exacerbating the decline in foreign exchange reserves. Thus, although the initial hypothesis proposes that the exchange rate will have a positive impact on foreign exchange reserves, the results show that in the short term, the exchange rate has a significant adverse effect on foreign exchange reserves, indicating that this relationship is more complex and influenced by various unexpected factors. Research Antari et al. (2023) used the Error Correction Model (ECM). They found that exchange rate stability is crucial to increase foreign exchange reserves, supporting the hypothesis that a stable exchange rate can have a positive impact in the short term.

In contrast, research by Sukoco (2023) using the Autoregressive Distributed Lag (ARDL) model shows that the effect of exchange rates on foreign exchange reserves in the short term is not always consistent. In conditions of high global economic fluctuations, the impact can be harmful. Furthermore, research by Purba et al. (2024) found that the rupiah exchange rate has no significant effect on foreign exchange reserves in the short term, indicating that this effect may be weaker or even negative depending on the economic situation. Jalunggono et al. (2020) also revealed that although the exchange rate has a positive impact on foreign exchange reserves in the long run, in the short run, the results could be different due to market volatility and the monetary policy adopted. Meanwhile, research by Laksono & Tarmidi (2021) used the Error Correction Model (ECM) test and found that the exchange rate significantly affects foreign exchange reserves in the short term. Still, the impact is not always positive, and in some conditions, strengthening the exchange rate can reduce foreign exchange reserves. These studies show that in the short term, it is more complex and often shows a negative influence, depending on external factors and economic volatility.

The Effect of BI Rate on Foreign Exchange Reserves

a. Long-term

When interest rates rise, borrowing costs for businesses and consumers increase, which can depress domestic investment and consumption. This decline in domestic economic activity may reduce aggregate demand, thereby reducing production and exports and thus contributing to a decrease in foreign exchange inflows. In addition, although an increase in the BI Rate may attract short-term capital flows, it may lead to larger capital outflows in the long run if investors feel that the high interest rates are not balanced with the increased economic risks. Investors may be concerned that high interest rates reflect the central bank's efforts to address deep-seated inflation or financial instability issues, which may increase the perception of risk to the domestic economy. In this situation, investors may pull their capital out of the country in search of investments that are perceived to be safer, which may ultimately reduce foreign exchange reserves.

A decline in export competitiveness may reduce foreign exchange inflows from international trade, contributing to a decrease in foreign exchange reserves. In addition, currency appreciation may encourage increased imports as imported goods become cheaper, further depleting foreign exchange reserves. This negative influence can also be related to a more dominant global monetary policy. If interest rates in developed countries increase, foreign capital flows may be more likely to flow to those countries, regardless of the BI Rate hike. This may lead to capital outflows from Indonesia, which reduces foreign exchange reserves. Thus, while the initial hypothesis was that an increase in the BI Rate would have a positive impact on foreign exchange reserves through increased capital inflows, the results suggest that the relationship between the two is more complex than hypothesized, with various factors such as high borrowing costs, investor risk perceptions, exchange rate influences, and global monetary policy all playing a role in influencing a different outcome than expected. Several studies support this finding, such as studies by Purba et al. (2024) and Widia & Azizah (2021).

b. Short Term

The initial hypothesis was based on the assumption that an increase in the BI Rate, as the benchmark interest rate, would attract foreign capital inflows into the country. This increased foreign investment is expected to strengthen the country's foreign exchange reserves through increased foreign exchange inflows in the short term. However, the initial hypothesis and results do not match. First, an increase in the BI Rate in the short term may not be enough to attract significant foreign capital inflows, especially if global investors see higher risks or more attractive investment opportunities elsewhere. When international markets face uncertainty, such as commodity price fluctuations or geopolitical tensions, an increase in the BI Rate may not be appealing enough for investors to shift their capital to Indonesia. As a result, the expected capital inflows do not occur, and foreign exchange reserves do not increase significantly. A sudden increase in the BI Rate in the short term could have a negative impact on the domestic economy, such as increased borrowing costs for firms and consumers. This decline in economic activity may reduce production and exports, lowering foreign exchange inflows. Thus, even if the BI Rate rises, its negative impact on the domestic economy may reduce the potential increase in foreign exchange reserves. This adverse effect may also be related to the impact of interest rates on exchange rates in the short term. An increase in the BI Rate may lead to an appreciation of the domestic currency, which makes exports more expensive and less competitive in the international market.

As a result, foreign exchange inflows from exports may decline, and this may offset or even exceed the capital inflows that an increase in the BI Rate may generate. In addition, the insignificance of the BI Rate on foreign exchange reserves in the short term is due to the more decisive influence of global monetary policy, such as interest rates in developed countries, which may affect international capital flows more. Suppose global investors see more attractive opportunities in other countries. In that case, an increase in the BI Rate in Indonesia may not be enough to attract significant capital flows, meaning that the impact on foreign exchange reserves remains limited. The results of the initial hypothesis are inconsistent in the short run, indicating that the relationship between BI Rate and

foreign exchange reserves in the short run is more complex than hypothesized, with various factors such as investors' response to global risks, the impact of interest rates on the domestic economy, and exchange rate effects all contributing to a different result than expected. This finding aligns with the research results of Purba et al. (2024) and Ratnaningtyas & Huda (2024). In contrast, the result by Laksono & Tarmidi (2021) is not in line. This difference in results suggests that the effect of BI Rate on foreign exchange reserves is influenced by various other economic factors, including responses to global risks and complex market dynamics.

Conclusion

Based on the estimation results of the Error Correction Model (ECM), it can be concluded that in the long run, exports, inflation, and exchange rate variables significantly influence Indonesia's foreign exchange reserves. Exports and exchange rates have a positive and significant effect, which indicates that an increase in exports and exchange rate appreciation contributes to the rise in foreign exchange reserves. Meanwhile, inflation also shows a positive and significant effect in the long run, which indicates a positive correlation between the inflation rate and the accumulation of foreign exchange reserves in that period. In contrast, the BI Rate has a negative and significant effect on foreign exchange reserves, indicating that an increase in the benchmark interest rate tends to reduce foreign exchange reserves in the long run.

In the short term, inflation and exchange rate only significantly affect foreign exchange reserves. Inflation has a negative and significant effect, indicating that price increases in the short term tend to reduce foreign exchange reserves. The exchange rate also has a negative and significant effect, suggesting that rupiah depreciation directly impacts the decline of foreign exchange reserves in the short term.

References

Adhitya, B. (2021). Analisis Determinan Cadangan Devisa di Indonesia. *Jurnal Ilmiah Universitas Batanghari Jambi*, *21*(1), 184. https://doi.org/10.33087/jiubj.v21i1.1237

Antari, I. S. W., Al-Zani, M. K., & Saputra, I. A. (2023). Analisis Pengaruh Inflasi, Ekspor, Impor, dan Nilai Tukar terhadap Cadangan Devisa Negara. *Niqosiya: Journal of Economics and Business Research*, *3*(2), 247–258. https://doi.org/10.21154/niqosiya.v3i2.2557

Dananjaya, I. putu A. B., Jayawarsa, A. A. K., & Purnami, A. A. S. (2019). Pengaruh Ekspor, Impor, Kurs Nilai Tukar Rupian, Dan Tingkat Inflasi Terhadap Cadangan Devisa Indonesia Periode 1999-2018. *Warmadewa Economic Development Journal (WEDJ)*, *2*(2), 64–71.

Engle, R. F., & Granger, C. W. J. (1987). Co-Integration and Error Correction : Representation , Estimation, and Testing. *Econometrica*, *55*(2), 251–276.

Fawaiq, M. (2023). Indonesia's CPO Exports and Foreign Exchange Reserves: Evidence From Indonesia and Singapore. *Review of Economics and Finance*, *21*, 1973–1982.

Jalunggono, G., Cahyani, Y. T., & Juliprijanto, W. (2020). Pengaruh Ekspor, Impor Dan Kurs Terhadap Cadangan Devisa Indonesia Periode Tahun 2004 – 2018. *Open MenuJurnal*

Ekonomi, Bisnis, Dan Akuntansi, *22*(2). https://doi.org/10.32424/jeba.v22i2.1593

Kumala, R., & Rakhmanita, A. (2023). Pengaruh Ekspor Dan Impor Terhadap Cadangan Devisa Tahun 2018-2022. *Jurnal Ilmiah Wahana Pendidikan, Juli*, *9*(12), 571–579. https://doi.org/10.5281/zenodo.815742

Kurniawan, M. L. A., & A'yun, I. Q. (2022). Dynamic Analysis On Export, FDI and Growth in Indonesia: An Autoregressive Distributed Lag (ARDL) Model. *Journal of Economics, Business, & Accountancy Ventura*, *24*(3), 350–362. https://doi.org/10.14414/jebav.v24i3.2717

Laksono, T. Y. R. R., & Tarmidi, D. (2021). The Effect of Export, Import, and Public Education Expenditure on Foreign Exchange Reserves: A Geographical Perspective Study on Indonesia. *Review of International Geographical Education Online*, *11*(1), 456–468. https://doi.org/10.33403/rigeo.800582

Prasentianto, H. (2014). *Studi Empiris pada Perusahaan Property dan Real Estate*. Universitas Diponegoro.

Pratiwi, D. S., Busairi, A., & Junaidi, A. (2018). Pengaruh ekspor dan nilai tukar rupiah serta tingkat inflasi terhadap cadangan devisa indonesia. *Jurnal Ilmu Ekonomi Mulawarman (JIEM)*, *3*(4).

Purba, A. S., Tiawon, H., & Beatris, D. (2024). Aspects influencing the foreign exchange reserves of Indonesia. *Journal Magister Ilmu Ekonomi Universtas Palangka Raya : GROWTH*, *9*(2), 84–93. https://doi.org/10.52300/grow.v9i2.12366

Ratnaningtyas, A. H., & Huda, S. (2024). The Influence of Interest Rates, Inflation, Exchange Rates and Exports on Indonesia's Foreign Exchange Reserves. *Indonesian Journal of Business Analytics*, *3*(6), 2039–2054. https://doi.org/10.55927/ijba.v3i6.5727

Simamora, R. M. H., & Widanta, A. A. B. P. (2021). The Effect of Export Value, Exchange Rate, and Inflation on Indonesia's Foreign Exchange Reserves. *IJISET-International Journal of Innovative Science, Engineering & Technology*, *8*(5), 494–499.

Sufren, & Natanael, Y. (2014). *Belajar Otodidak SPSS Pasti Bisa*. PT. Elex Media Komputindo.

Sugiyono. (2014). *Metodologi penelitian kuantitatif kualitatif dan R&D*. Alfabeta.

Sukoco, F. M. (2023). Pengaruh Keterbukaan Ekonomi, Nilai Tukar, Penanaman Modal Asing Dan Inflasi Terhadap Cadangan Devisa Negara Indonesia. *Media Ekonomi*, *31*(1), 1–14. https://doi.org/10.25105/me.v31i1.17283

Suripto. (2020). Poverty viewed from the perspective of domestic production in Yogyakarta: the Solow growth model approach. *Int. J. Business and Globalisation*, *24*(2), 174–184.

Wahyudi, H., Suparta, I. W., & Palupi, W. A. (2023). Long-Term Impact of Inflation and Macroeconomic Variables on Foreign Exchange Reserves in the Organization of Islamic Corporation. *WSEAS Transactions on Business and Economics*, *20*, 1755–1768. https://doi.org/10.37394/23207.2023.20.155

Widarjono, A. (2018). *Ekonometrika Pengantar dan Aplikasinya Disertai Panduan Eviews*. UPP STIM YKPN.

Widia, S. S., & Azizah, H. M. (2021). Analisis Pengaruh Kurs Dolar Amerika Serikat Dan BI Rate Terhadap Cadangan Devisa Indonesia. *Jurnal Ilmiah Ekonomi*, *01*(31), Halaman 1-16.

Wijayanto, A. (2022). Analisis Pengaruh Ekspor Dan Impor Terhadap Cadangan Devisa. *Yos Soedarso Econ. Jouenal*, *4*(1), 12–27.