



Determinants of Macroeconomic Effects on the Stability of Indonesia's Foreign Exchange Reserve

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Abstract. This research aimed to analyze and test the effect of exports, imports, rupiah exchange rates to the dollar, interest rates, inflation, and investment on the stability or state of Indonesia's foreign exchange reserve. This examination resorts to quantitative methods with the ECM (Error Correction Model) analysis method using the Eviews 9 data processing application. The data from 1997–2021 was sourced from the Statistics Agency and the Central Bank of Indonesia. The calculation of this study using an alpha of 0.05 or 5% is that exports, in the short term, have a positive and significant consequence on Indonesia's foreign exchange reserve. However, in the long term, exports have a positive but insignificant effect on Indonesia's foreign exchange reserve. In the short term, Imports have a negative and insignificant effect on Indonesia's foreign exchange reserve. In contrast, imports have a positive and insignificant effect on Indonesia's foreign exchange reserve in the long term. The rupiah exchange rate, both in the short- and long-term, has a positive and significant effect on Indonesia's foreign exchange reserve. Interest rates, both short-term and long-term, have a negative and significant effect on Indonesia's foreign exchange reserve. Inflation in the short term has a positive and significant effect on Indonesia's foreign exchange reserve. However, in the long term, inflation negatively and significantly affects Indonesia's foreign exchange reserve. Short- and long-term foreign investment boosts Indonesia's foreign exchange reserves.

Keywords: Foreign Exchange Reserves · Export · Import · Exchange Rates · Interest Rates · Inflation · Foreign Direct Investment

1 Introduction

Indonesia is a country that seeks to increase human resources to meet little needs by driving the economic development sector to cover the needs of the community [1]. International trade occupies an important role in a country because, with an international market, every country can exchange resources already owned by the country (Sonia & Setiawina, n.d.). Heller (1968) expressed her opinion, stating that the variability of international trade is an appropriate calculation for the demand for foreign exchange reserves.

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Foreign exchange is a source of financing for international spending and national development. Foreign exchange reserves are an indicator that can be used to measure a country's international trade so that it can be known how resilient or weak a country's economy is [1]. In addition, the country's foreign exchange reserve buffers against current account weakness [2]. Since foreign exchange reserves are a source of funds for the country that will subsequently be used for international financing transactions, they are considered the most important indicators of the country's economy, especially in the export and import industries.

Such a large source of Indonesia's foreign exchange reserve can be traded to other countries (Hariyani et al., 2010). Foreign exchange reserves for a country have goals and benefits as well as the benefits of wealth for an individual (Gandhi, 2006). A stable amount of foreign exchange reserves is evidence for achieving monetary and macroeconomic stability in a country (Priadi et al., 2008). The more foreign exchange reserves owned by a country, the higher its chances of conducting economic transactions in the international arena, which will impact its currency [3]. However, Indonesia is still very dependent on other countries, as seen from the higher import value of exports in recent years and the foreign debt that continues to increase annually. When a country's imports are higher than its exports, it indicates a high need for foreign currency, which weakens the domestic currency and causes inflation, affecting the country's economy. It can be due to people consuming fewer domestic products because of higher prices, thus reducing domestic demand.

However, from 2007 to 2008, the amount of Indonesia's foreign exchange reserve decreased. It started with the bankruptcy of an investment bank in the United States called Lehman Brothers Holding Incorporation, which impacted the rupiah exchange rate shock. The same thing also occurred in 2019 due to the pandemic disaster that hit all countries, so the Indonesian economy, including the amount of Indonesia's foreign exchange reserve, experienced a slump. The deficiency of foreign exchange reserves, if high exports cannot support them, will make foreign debt an option to meet the country's foreign exchange needs.

Several studies mention and explain the opposite, stating that exports have no relationship to foreign exchange reserves in Indonesia [4] and [5]. In addition, imports also have a significantly positive impact on the foreign exchange reserve of Indonesia [6]. Contrary to the conclusion of research conducted by Septian Angga Pratama, which revealed that imports significantly negatively affected Indonesia's foreign exchange reserve [5]. In addition to the variables that support the addition of foreign exchange reserves, the interest rate has a different impact. Meanwhile, interest rates do not affect Indonesia's foreign exchange reserve [7]. Meanwhile, the rupiah exchange rate positively impacts Indonesia's foreign exchange reserve [6] and [7]. The rate is also related to inflation, so when inflation rises, it allows the number of reserves to fall [8]. Foreign direct investment has an insignificant effect on Indonesia's foreign exchange reserve [9] and [10].

Based on the description, the foreign exchange reserve is important for the country's financial health. Their presence must be utilized as well as possible so that international transactions can run smoothly. To maintain the stability of the foreign exchange reserve, it is necessary to understand the macroeconomic factors involved, such as exports, imports,

the rupiah exchange rate, interest rates, inflation, and foreign investment. Thus, the author is interested in conducting a study titled "Determination of Macroeconomic Effects on the Stability of Indonesia's Foreign Exchange Reserve".

2 Literature Review

2.1 Definition of Foreign Exchange Reserve

Foreign exchange reserves are a factor in national deposits, so their movement signals the international market about the credibility of a country's monetary policy and creditworthiness. A foreign exchange reserve can also be referred to as a "stock of foreign currencies suspended by the central bank that can be used as a means of international transactions" [11]. All international transactions originating from the foreign exchange reserve are under the responsibility of the Bank of Indonesia, so their transactions are recorded in the bank's balance of payments [12]. Therefore, a country's foreign exchange reserve is suitable to be chosen as a measuring parameter for a country's economic and trade development.

The foreign exchange reserve is foreign exchange held by the Bank of Indonesia to fulfill obligations related to foreign countries and development financing [13]. Thus, in a country with weak and low foreign exchange, its economic resilience will experience strong dependence and a weakening of the country's foreign exchange reserve.

2.2 The Effects of Exports on Foreign Exchange Reserve

Export is the activity of selling products or goods to other countries. Net exports have a positive value and significantly affect the size of the foreign exchange reserve [14]. It means exports, the main commodity, can affect foreign exchange income. Exports also indicate interest from other countries in products or goods produced in Indonesia, making it possible to increase foreign exchange reserves. A similar statement was also made by Dinda AB Permana, who stated that exports positively and significantly affect foreign exchange reserves [15].

2.3 The Effects of Imports on Foreign Exchange Reserve

Import is the activity of ordering products from one country to another and occurs due to a lack of domestic production, resulting in the country having to buy goods or services from other countries [16]. Therefore, imports indirectly affect or impact the quantity of Indonesia's foreign exchange reserve.

2.4 The Effects of Rupiah Exchange Rate on Foreign Exchange Reserve

Changes in the exchange rate will positively impact foreign exchange because the more foreign exchange a country owns, the greater that country's ability to participate in international economic activities will be influenced by the country's currency's stable value [17]. Because foreign exchange reserves are closely related to the international market, the role of the rupiah exchange rate is very large. If the amount of the rupiah exchange rate increases, the potential for an increase in Indonesia's foreign exchange reserve will be even greater.

2.5 The Effects of Interest Rates on Foreign Exchange Reserve

The BI Rate is an interest rate policy set by the Bank of Indonesia and disseminated to the public. The interest rate is a fee the borrower must pay on the loan he receives and is a reward for the lender for his funds. Therefore, with a high-interest rate, it will be able to increase the demand for money and vice versa. On the other side, if the interest rate is low, it is likely to lower the exchange rate [18].

2.6 The Effects of Inflation on Foreign Exchange Reserve

According to Ningsih and Waspada (2018), inflation is an event where a continuous increase in the price of goods will reduce the public's desire to consume these goods. If the cost of goods and services is increasingly expensive, it will cause traffic jams in that country's economy. Inflation can have both positive and negative effects [19]. In addition, inflation positively affects foreign exchange reserves [10].

2.7 The Effects of Foreign Direct Investment on Foreign Exchange Reserve

Foreign Direct Investment (FDI) is defined by Isayeva (2012) as the investment of assets from abroad that enter domestic structures, equipment, and organizations. Foreign investment has an especially important role in the economy. Foreign investment has an insignificant effect on Indonesia's foreign exchange reserve [9]. Therefore, foreign investment can encourage increased economic growth.

3 Research Methods

The research method used was quantitative with the Error Correction Model (ECM) Eviews 9 technique. Eviews was a tool that could be used to process statistical and econometric data. Meanwhile, secondary data was obtained from the Statistics Agency and the Bank of Indonesia from 1997–2021. Several stages must be carried out in processing data with the ECM model. These stages were in the form of a data stationarity test, a cointegration test, and the ECM test. Therefore, the econometric analysis model is as follows:

Short-term equation:

Where: CD = Indonesia's foreign exchange reserve (US\$ Million), Ex = Exports (Million US\$), Im = Imports (Million US\$), exchange rate (KURS) = Rupiah Exchange Rate (IDR/US\$), Birate = Interest Rate (%), INF = Inflation (%), PMA = Foreign Investment (Billion Rupiah), ϵ_t = Error Term, β_0 = Constant, and $\beta_1 \dots \beta_{13}$ = Independent variable regression coefficient.

4 Results and Discussion

4.1 ECM Test Result

4.1.1 Stationary Test

Stationary testing of each time series is a common requirement that must be performed for regression results to have a good impact on the model. Stationarity test output using the ADF test with constants and trends can be seen in Table 1. All data in this calculation

Table 1. Stationary Test

Variable	Prob.	Prob.
D(BIRATE)	0.0000	0.0496
D(EX)	0.9577	0.0017
D(IM)	0.2261	0.0000
D(INF)	0.0000	0.0000
D(KURS)	0.8565	0.0000
D(PMA)	0.9522	0.0001
D(CD)	0.9938	0.0004

Source: Secondary data processed (2022)

Table 2. Cointegration Test Outcomes

		value	Prob.
ADF test		-5.254031	0.0000
Alpha on level stage:	0,01	-2.674290	
	0,05	-1.957204	
	0,05	-1.608175	

Source: Data processed (2022)

were initially non-stationary at the level stage and then stationary at the later stage, namely the *first difference*.

4.1.2 Cointegration Test

Cointegration is useful for testing whether or not the data tested tend to work in the long term. Here are the cointegration test outcomes:

According to the results of Table 2 showing the data have a long-term tendency, as evidenced by the value of prob. $0.0000 < 0.05$.

4.1.3 ECM Test Outcomes

The ECM test analyzes how dependent variables affect long-term and short-term independent variables. This study used alpha 5% or 0.05. In the test analysis of the classical assumptions listed in Table 1. It is explained that the probability values of the classical assumption test on the normality, autocorrelation, heteroskedasticity, and linearity tests were $26.75397 > 0.05$, $0.68340 > 0.05$, $0.9476 > 0.05$, and $0.0681 > 0.05$, which means that this research model has normal properties, is free from symptoms of autocorrelation and heteroskedasticity, and is a precise model (Tables 3 and 4).

Table 3. ECM Test Estimation Outcomes

Error Correction Model (ECM)			
Var	Coefficient	Std. Error	Prob.
Constant	-1.618613	3.225093	0.6248
DLog(EX)	0.594628	0.168599	0.0042
DLog(IM)	-0.089741	0.084498	0.3091
DLog(KURS)	0.186326	0.050946	0.0033
D(BIRATE)	-0.047948	0.008969	0.0002
D(INF)	0.013444	0.003165	0.0011
DLog(PMA)	0.022140	0.139544	0.8766
Log(EX(-1))	0.027238	0.134692	0.8431
Log(IM(-1))	-0.016515	0.132204	0.9027
Log(KURS(-1))	-0.532655	0.215032	0.0291
BIRATE(-1)	-0.615292	0.280802	0.0489
INF(-1)	-0.615038	0.265937	0.0393
Log(PMA(-1))	-0.510732	0.277122	0.0902
ECT	0.614301	0.268798	0.0413
Test Outcomes			
R-squared	0.861227		
Adjusted R-squared	0.710890		
F statistic	5.728632		
Prob f stat	0.002361		
DW	1.689744		
Classic Assumption Test Outcomes			
Jarque Bera	26.75397		
Breusch Godfrey	0.68340		
White	0,9476		
Ramsey Reset	0,0681		

Source: Secondary data processed (2022)

4.2 Discussion

In the short term, related regression calculations using the ECM method revealed that the export regression coefficient was 0.594628, with a t-stat probability of $0.0042 < 0.05$). It can be interpreted that in the short term, exports have a positive and significant consequence for Indonesia's foreign exchange reserve. Meanwhile, the export regression coefficient was 1.044339 with a t-stat probability value ($0.8431 > 0.05$). In the long term, exports have a positive but insignificant effect on Indonesia's foreign exchange reserve.

Table 4. The Value of the Long-term Coefficient and Probability of the Independent

Variable	ECM	
	Long-term	Probability
EX	1.044339	0.8431
IM	0.973116	0.9027
KURS	0.132909	0.0291
BIRATE	-0.00161	0.0489
INF	-0.0012	0.0393
PMA	0.168597	0.0902
ECT	-	-

This research is in line with Safitri Yunella and Dewi Zaini, who explained that exports significantly positively affect foreign exchange reserves [1]. The higher the exports carried out by a country, the more its foreign exchange reserve will increase [2, 3].

The export increase demonstrates the absence of reliance on one country by another. It means the country's foreign exchange reserves are becoming more stable. A decrease in production causes exports of goods to decrease, so the income obtained will be lower than before, and less will be stored in the form of foreign exchange reserves. Goods with high export capabilities can demonstrate the existence of the Indonesian state in the international scope, reflecting the stability of Indonesia's foreign exchange reserve. Therefore, exports significantly impact Indonesia's foreign exchange reserve [4] and [5]. In addition, the source of foreign exchange reserves received by the country is greater than other activities outside of exports, such as foreign loans, grants, interest, or foreign investment.

In related regression calculations in the short term, the import regression coefficient was -0.089741 with a t-stat probability value ($0.3091 > 0.05$), which can be interpreted as meaning imports have a negative and not significant effect on Indonesia's foreign exchange reserve. However, the results of regression analysis in the long term found an import regression coefficient of 0.973116 with a t-stat probability value ($0.9027 > 0.05$), so it can be interpreted that imports have a positive but insignificant effect on Indonesia's foreign exchange reserve. This research is in line with Siti Amalia and Crisanty Sutriyanyingtyas Titik, who explained that imports have an insignificant effect on foreign exchange reserves [6].

Meanwhile, over the short term, high and continuous import activities can reduce the stability of Indonesia's foreign exchange reserve. Because if the national income

is high, but the ability to produce certain products is low, import activities will automatically continue to rise in Juneantara and Buddha (2012). However, it is contrary to research conducted by Gusti Ngurah S A I and Nyoman D S, which states that imports on Indonesia's foreign exchange reserve have a positive and significant effect [7].

According to the table of regression analysis results using the short-term ECM method, the mean rupiah exchange rate regression coefficient was 0.186326 with a t-stat probability value of $0.0033 < 0.05$. Therefore, the rupiah exchange rate positively and significantly affects Indonesia's foreign exchange reserve. Meanwhile, the long-term regression analysis results found that the rupiah exchange rate regression coefficient was 0.132909 with a t-stat probability value of $(0.0291 < 0.05)$, so it can be interpreted that the rupiah exchange rate has a positive and significant effect on Indonesia's foreign exchange reserve. The higher the Indonesian rupiah exchange rate, the more likely it is to increase foreign exchange reserves [8–10]. That means that the existence of the rupiah's exchange rate against the dollar must be maintained and stabilized. However, other studies contradict these results and suggest that the exchange rate negatively affects Indonesia's foreign exchange reserve [11].

The greater the possibility of a stable rupiah exchange rate, the greater the chances for Indonesia's foreign exchange reserve stability. Thus, the Indonesian government needs to make an effort to increase Indonesia's exports to maintain and improve the exchange rate of the Indonesian rupiah against the dollar. However, this study contradicts Andriyani et al. (2020), who claim that the exchange rate significantly negatively impacts foreign exchange reserves [12].

In a related calculation of regression analysis with the short-term ECM method, it was found that the interest rate regression coefficient was -0.047948 with a t-stat probability value of $(0.0002 < 0.05)$. It can be interpreted that the interest rate has a negative and significant effect on Indonesia's foreign exchange reserve. Meanwhile, the results of the regression analysis in the long-term found that the interest rate regression coefficient is -0.00161 with a t-stat probability value of $(0.0489 < 0.05)$, so it can be that the interest rate has a negative and significant effect on Indonesia's foreign exchange reserve. Therefore, interest rates negatively affect Indonesia's foreign exchange reserve [9].

The increase in interest rates by the Bank of Indonesia will make foreign investors less interested in placing their investments in Indonesia. It is because rising interest rates can increase the costs needed to invest and the amount of money that investors must spend. In addition, with the increase in interest rates, people will prefer to put their money into savings instead of investing. Furthermore, Indri Rahmawati and Etty R's research also shows that interest rates significantly negatively affect foreign exchange reserves [13]. When interest rates fall, Indonesia's foreign exchange reserves rise because many people carry out savings and loan activities. Vice versa, if interest rates rise, Indonesians are less likely to make transactions that involve interest rates [14].

Related regression calculations using the short-term ECM method found an inflation regression coefficient of 0.013444 with a t-stat probability value of ($0.0011 < 0.05$), which can be interpreted as in the short-term inflation has a positive and significant effect on Indonesia's foreign exchange reserve. Meanwhile, the long-term regression analysis results found that the inflation regression coefficient was -0.0012 with a t-stat probability value of ($0.0393 < 0.05$), so it can be interpreted that inflation has a negative and significant effect on the foreign exchange reserve of Indonesia. Therefore, the research results are similar to those of Surya Rahmawati and Suriani Suriani. They stated that inflation negatively impacts foreign exchange reserves over the long term [15]. High imports will reduce savings in the form of reserves to finance imports due to the highest demand for foreign products. This research is similar to that of Benny, Chowdhury et al., and Indriany et al. The increase in imports caused the trade balance deficit to affect the foreign exchange reserve's stability negatively [16–18].

Related to the table analysis results using the short-term ECM method, it was found that the regress adjuvant of foreign direct investment was 0.022140 with a t-stat probability value ($0.8766 > 0.05$). It indicates that short-term foreign investment has a positive but insignificant effect on Indonesia's foreign exchange reserve. Meanwhile, the regression analysis results in the long term found the regression coefficient of foreign investment to be 0.168597 with a t-stat probability value of ($0.0902 > 0.05$), so it can be interpreted that foreign investment has a positive but insignificant effect on Indonesia's foreign exchange reserve. Early research outputs were similar to those of Ramadhanty Nadya and Ruddy Syafrudin. They explained that foreign investment had an insignificant effect on the state of Indonesia's foreign exchange reserves [19] and [18]. Therefore, FDI can encourage increased economic growth.

5 Conclusion

The results of regression analysis using the ECM and validity tests of the significance effect (α) of (0.05) explain that in the short term, exports, the rupiah exchange rate, and inflation have a positive and significant effect on foreign exchange reserves. In contrast, interest rates negatively and significantly affect Indonesia's foreign exchange reserve. Meanwhile, imports have a negative, insignificant effect on Indonesia's foreign exchange reserve, and foreign direct investment has a positive effect on Indonesia's foreign exchange reserve. However, in long-term estimates of the rupiah exchange rate, it has positively and significantly affected Indonesia's foreign exchange reserve. In contrast, interest rates and inflation have a negative and significant effect on foreign exchange reserves.

Furthermore, exports, imports, and foreign direct investment have a positive but insignificant effect on Indonesia's foreign exchange reserve. This research provides an understanding that it is significant to know the macroeconomic factors that affect the movement and stability of foreign exchange reserves in the long term and short term. Therefore, they can make alternatives when encountering problems related to foreign exchange reserves in the future.

The study's limitations are the limited data obtained (the year used was only 27 years) and the frequent use of independent variables. Suggestions for further research are to increase the number of years for this type of time series data or update the research variables with current problems in Indonesia.

6 Research Contributions

The research results are expected to contribute as follows:

For the student community, it is expected to improve knowledge and can be used to increase students' literacy. For the government, the research benefits are to see how macroeconomics affects the stability of foreign exchange reserves so that obstacles can be overcome immediately. Furthermore, it is hoped that this research will guide our study and provide reinforcing information about factors affecting Indonesia's foreign exchange reserve.

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