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ANALYSIS OF THE EFFECT OF INTEREST RATES, MONEY SUPPLY, AND EXCHANGE RATES ON INDONESIA'S FOREIGN EXCHANGE RESERVES IN 2006-2021

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Abstract. This study aims to analyze the effect of interest rates, money supply, and exchange rates on foreign exchange reserves in Indonesia from 2006-2021. The dependent variables in this study are Indonesia's foreign exchange reserves, while the independent variables are interest rates, money supply, and exchange rates. To see the influence of independent variables on dependent variables, researchers conducted an assessment using secondary data based on time series. The data used include Foreign Exchange Reserves, Interest Rates (SBI), Money Supply, and Exchange Rate (KURS) obtained from Bank Indonesia (BI), the world bank, and the Central Statistics Agency (BPS). The analysis method used is the Partial Adjustment Model (PAM). The results of this study show that the Money Supply and Exchange Rate has a positive effect on Indonesia's Foreign Exchange Reserves, while interest rates do not affect Indonesia's Foreign Exchange Reserves.

Keywords: Foreign exchange reserves, interest rates, money supply, exchange rate.

INTRODUCTION

Indonesia is a developing country whose government actively seeks to improve the welfare of the people in all fields. A country's ability to conduct international trade and its economy can be measured in part of its foreign exchange reserves. The inability to make payments for international trade is caused by a lack of foreign exchange reserves, as well as exchange rate volatility, which has resulted in a trade balance deficit and a decrease in the rupiah exchange rate (Agustina, 2018).

Indonesia's economic development shows increasing integration with the world economy. This is a consequence of the implementation of an open economic system in whose activities is always related and inseparable from the phenomenon of international relations. The most frequent phenomenon is when the shortage of foreign exchange reserves owned by a country is caused by a higher import value than the export value.

In the implementation of development, the main source of development funding is foreign exchange reserves which are also national savings. The accumulation of foreign exchange reserves is obtained from international trade activities, both export, and import, as well as capital flow activities. Apart from being a source of development funding, foreign exchange reserves are also used as a means of transaction in international trade. The transaction tool used is a strong currency that is widely accepted as proof of international payments. (Yudha, A. EL, & Hadi, 2009)

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Foreign exchange reserves are the net position of foreign assets of the government and foreign exchange banks, which must be maintained for international transactions. Foreign exchange is required to finance imports and repay foreign debt (Masitha & Pangidoan, 2020). The main purpose of foreign exchange reserves is to facilitate the government in conducting market interventions to stabilize the exchange rate. Furthermore, to optimize foreign exchange reserves, Bank Indonesia always emphasizes the importance of good governance.

Foreign exchange reserves can be used as an important indicator of how far the country can conduct international trade and show the country's economic gains and losses. Bank Indonesia (BI) recorded that Indonesia's foreign exchange reserves were USD at the end of June 2019 at US$123.8 billion, an increase of US$3.5 billion compared to the previous year of the previous month. With high foreign exchange reserves, the country has great potential in conducting international economic and financial transactions (Sonia, A. P., &Setiawan, n.d.)

According to Mundell dan Johnson (Nopirin, 2000), several factors can affect the level of foreign exchange reserves, namely the inflation rate, real income, domestic interest rates, domestic credit, and money laundering. While according to (Madura, 2009) The level of foreign exchange reserves can be affected by the rate of inflation, national income, government restrictions, and exchange rates.

Table 1. Indonesia's Foreign Exchange Reserves for 2006-2021(Million US$)

Year	Foreign Exchange Reserves (Million US$)
2006	42.579,04
2007	56.935,74
2008	51.640,63
2009	66.118,92
2010	96.210,98
2011	110.136,60
2012	112.797,63
2013	99.386,83
2014	111.862,59
2015	105.928,85
2016	116.369,60
2017	130.215,33
2018	120.660,97
2019	129.186,46
2020	135.897,00
2021	144.905,38

Table 1 shows that Indonesia's foreign exchange reserves tend to fluctuate every year. In 2006 foreign exchange reserves amounted to 111,862.59 million US$ and decreased in 2015 to 105,928.85 million US$ as well as being the smallest foreign exchange reserves obtained by Indonesia during the 2014-2021 period. Meanwhile, the largest foreign exchange reserves occurred in 2021 amounting to 144,905.38 million US$.

The rise and fall of Indonesia's foreign exchange reserves from 2012-2019 were due to an increase in government spending in the context of servicing foreign debt. Foreign debt repayment is caused by loans from international financial bodies, one of which is the IMF as

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the International Monetary Fund. The continuous decline in Indonesia's foreign exchange reserves can endanger a country's economy, the scarcity of foreign exchange reserves causes it not to allow to import capital goods in development efforts. External financial resources (both grants and loans) can play an important role in trying to supplement the shortage of resources in the form of foreign exchange or domestic savings so that the flow of capital from abroad will affect foreign exchange reserves. (Pratiwi et al., 2018).

Based on the background that has been presented, it can be interpreted that to maintain foreign exchange reserves at a safer level, it is necessary to know the factors that affect Indonesia's foreign exchange reserves. Therefore, this study aims to determine and analyze the effect of SBI interest rates, money supply, and exchange rates on Indonesia's foreign exchange reserves. This research is expected to provide benefits in the form of information on Indonesia's foreign exchange reserves so that it can be used as a reference to increase Indonesia's foreign exchange reserves

RESEARCH METHOD

This study, it used a secondary type of data whose data source came from outside parties. In this study, data sources were obtained from the Central Statistics Agency (BPS) and Bank Indonesia (BI). To analyze the effect of interest rates, money supply, and exchange rates on Indonesia's foreign exchange reserves, a partial adjustment model (PAM) regression analysis is used. The long-term model is as follows:

$$CD_t^* = \beta_0 + \beta_1 \ln(SB_t) + \beta_2 \ln(JUB_t) + \beta_3 \ln(KURS_t) + \varepsilon_t$$

where:

CD	:	Foreign Exchange Reserves, US$
SB	:	Interest Rate, %
JUB	:	Money Supply, Rp.Miliyar
KURS	:	Exchange Rate, US$
ln	:	Natural logarithm operation
β_0	:	Long-term constant
$\beta_1 \ldots \beta_4$	:	Long-term regression coefficient
ε	:	*Long-term term error*

Through the process of substitution, setting and parameterizing the behavior of partial adjustment expressed in the equation:

$$(CD_t - CD_{t-1}) = \delta(CD_t^* - CD_{t-1})$$

Obtained short-term model or PAM estimator model as follows :

$$CD_t = \alpha_0 + \alpha_1 \ln(SB_t) + \alpha_2 \ln(JUB_t) + \alpha_3 \ln(KURS_t) + \lambda CD_{t-1} + \nu_t$$

where:

λ	:	$(1-\delta)$
δ	:	Adjustment coefficient
α_0	:	$\delta\beta_0$; short-term constant
$\alpha_1 \cdots \alpha_3$	:	$\delta\beta_1 \cdots \delta\beta_3$; short-term regression coefficient
ν	:	$\delta\varepsilon$; short-term term errors.

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RESULT AND ANALYSIS

1.1 Analysis Results

Table 1
Econometric Model Estimation Results

$$\widehat{InCD}_t = 6{,}80086 - 0{,}00167 In\,(SB_t) + 0{,}82438 In\,(JUB_t) - 1{,}16181\,ln\,(KURS)$$
$$(0{,}947) \qquad\qquad (0{,}016)^{**} \qquad\qquad (0{,}019)^{**}$$
$$+ 0{,}274002\,In(CD)_{t-1}$$
$$(0{,}0870)^{***}$$

$R^2 = 0{,}9779$; DW-Stat. = 1,9015; F-Stat. = 110,840; Prob. F-Stat. = 0,000

Uji Diagnosis
(1) Multikolinieritas (VIF)
      ln(SB) = 9,005; ln(JUB) = 70,962; ln(KURS) = 21,343;
      CD_{t-1} = 13,0132
(2) Normalitas Residual
      JB(2) = 1,1839; Prob. JB(2) = 0,553
(3) Otokorelasi
      $\chi^2(3) = 1{,}6957$; Prob. $\chi^2(3) = 0{,}6379$
(4) Heteroskedastisitas
      $\chi^2(12) = 14{,}906$; Prob. $\chi^2(12) = 0{,}246$
(5) Linieritas
      $F(2, 8) = 2{,}93413$; Prob. $F(2, 8) = 0{,}1107$

1.1 Source: BI&BPS, processed. **Description:** *Significant on $\alpha = 0.01$; **Significant on $\alpha = 0.05$; Significant on $\alpha = 0.10$. The number in parentheses is an empirical probability (p value)**Subsection (4)**

Koefisien Koefisien CD (*l*) regression coefficient, seen at 0.274002 with a p-value or static empirical probability (significance) t of 0.0870 (<0.10), meaning that the adjustment coefficient (*d*) will be eligible $0 < d < 1$ and significant. These two conditions suggest that the estimated model is a PAM model, which can present the existence of a long-term theoretical relationship between dependent variables and independent variables, which was chosen to compile the econometric model in this study.

Based on the definition of short-term parameters, from the calculation of the long-term estimated model of PAM as follows:

$$\widehat{CD}_t^* = 9{,}3688 - 0{,}0023\,ln\,(SB_t) + 1{,}1356\,ln(JUB_t) - 1{,}6005\,ln\,(KURS_t)$$

with adjustment time or adjustment time is:
$$AT = \frac{1}{0{,}7259} = 1{,}37760\ \text{year}$$

From the diagnostic tests in Table 1, it can be seen that the probabilities of statistical Normality Residual, Otokorelation, Heteroskedasticity, and Linearity tests, each one is worth 0.553 (> 0.10), 0.637 (> 0.10), 0.246 (> 0.10) and 0.110 (> 0.10) tests show that the estimated model has a normal residual distribution, free from problems of otokorelation and heteroskedasticity, with exact model specifications (linear). The entire VIF value > 10, except for ln(SB), which is 9.005 which means that only the variable interest rate does not cause the multicollinearity problem in the model.

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The goodness of fit statistic implies that the model exists, as seen from the static empirical probability value tik F, which is 0.0000 (< 0.01), with or moderate ra¬mal power, which is 0.997. That is, overall the independent variables Interest Rate, Money Supply, and Exchange Rate can lead to a 68.3 percent variation or the rise and fall of the Return on Equity variable.

Separately, only the variables Money Supply and Exchange Rate, which influence Foreign Exchange Reserves, masing with empirical probabilities t of 0.016 (< 0.05) and 0.019 (< 0.05), respectively. Variable Interest Rates do not affect Foreign Exchange Reserves, as they have an empirical probability of 0.947 (> 0.10).

The Money Supply has a pendek term regression coefficient of 0.824381 and a long-term regression coefficient of 1.1356. The pattern of the relationship between the money supply and foreign exchange reserves is logarithm-logarithm (log-log). This means that if the Money Supply increases by 1 percent, Indonesia's Foreign Exchange Reserves will increase by 0.824381 percent in the short term, and by 1.1356 percent in the long term. Conversely, if the Money Supply decreases by 1 percent, then Indonesia's Foreign Exchange Reserves will decrease by 0.0082438 in the short term, and by 0.011356 in the long term.

The short-term regression coefficient of the rupiah exchange rate is -1.161812, the long-term regression coefficient is -1.6005. The pattern of the relationship between the exchange rate and foreign exchange reserves is logarithm-logarithm (log-log). This means that in the short term if the rupiah exchange rate rises by 1 percent, Indonesia's foreign exchange reserves will decrease by 1.1611812 percent, and in the long run, it will decrease by 1.6005 percent. Conversely, if the rupiah exchange rate falls by 1 percent, in the short term Indonesia's foreign exchange reserves will increase by 1.1611812 percent, and in the long term, it will increase by 1.6005.

By the adjustment time of 1.37760 years, the long-term effect of the money supply and exchange rate on Indonesia's Foreign Exchange Reserves will only be achieved within 1.37760 years.

1.2 Model Goodness Test
1.1. 2 Model Existence

Models exist when all independent variables simultaneously influence dependent variables. The formulation of the hypothesis of the model existence test in this study is H0: $\alpha1 = \alpha2 = \alpha3 = \lambda = 0$, which means that all regression coefficients are worth 0, so that interest rates, money supply, and exchange rates together do not affect Indonesia's Foreign Exchange Reserves. Meanwhile, Ha: $\alpha1 \neq 0 \mid \alpha2 \neq 0 \mid \alpha3 \neq 0 \mid \lambda \neq 0$, which means that there is at least one regression coefficient that is not worth zero, so that together, the interest rate, money supply, and exchange rate affect Indonesia's Foreign Exchange Reserves.

*H*0 is not rejected if probability F > α and H0 is rejected if probability F < α. Based on Table 1, it can be seen that the statistical F probability value on the model estimate is 0.0000 which means less than α 0.05; the H0 value is rejected, so together, the interest rate, money supply, and exchange rate affect Indonesia's foreign exchange reserves

1.2.2 Interpretation of the Coefficient of Determinants (R^2)

Based on the results of the estimate, it is known that the coefficient of determination (R2) is 97.7%. Thus, 97.7% of the variation in Indonesia's Foreign Exchange Reserves was due to variations in interest rates, money supply, and exchange rates, while the other 2.3% was due to other variables outside the model.

1.3 Effect Validation Test

The influence validity test (t-test) aims to test whether each of the independent variables has a real effect on the dependent variables. H0 of the t-test states $\delta\beta i = 0$, which means that the ith independent variable does not affect the dependent variable; whereas Ha expresses $\delta\beta i > 0$, which means that the ith independent variable has a positive effect on the dependent variable. H0 is not rejected when the statistical t probability > α 0.05, and H0 is rejected when the statistical t probability value $\leq \alpha$ 0.05. The results of the influence validation test can be seen in Table 2.

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Based on Table 2, it is known that the variables that have a real effect on Indonesia's foreign exchange reserves are the money supply and exchange rate, while the interest rate has no effect

Table 2. Independent Variable Influence Validity Test Results

Variable	Coefficient	Sig.t	Conclusion
Interest	$\delta\beta1$	0,947	$\delta\beta1$ insignificant
Money Supply	$\delta\beta2$	0,016	$\delta\beta2$ Significant pada α 0,05
Exchange rate	$\delta\beta3$	0,019	$\delta\beta3$ Significant pada α 0,05

Source: Table 1

1.4 Economic Interpretation
1.4.1 Effect of Interest Rates on Foreign Exchange Reserves

Based on the results of the t-test, it is known that interest rates have no effect on Indonesia's foreign exchange reserves, which means they do not conform to the research hypothesis that interest rates have a positive effect on Indonesia's foreign exchange reserves. This is due to the possibility of other factors outside this model that affect foreign exchange reserves such as the large number of foreign investors who invest in Indonesia which will increase Indonesia's foreign exchange reserves.

The results of this study are in line with the research conducted by (Putra, 2013), where this study SBI was declared to have no effect on inflation. But different results in the study (Rizky z.c & Hafizal Islami, 2018) This is not in line with the results of the research conducted.

1.4.2 Effect of Money Supply on Foreign Exchange Reserves

Based on the results of the t test, it is known that the money supply has a positive effect on Indonesia's foreign exchange reserves, which means it is in accordance with the research hypothesis. shows that the money supply will increase, the Foreign Exchange Reserves will increase. Theoretically, this mechanism occurs because if the money supply increases, relatively domestic prices become cheaper than foreign prices. If foreign exchange reserves increase, the money supply should also increase, because the existing foreign exchange reserves are usually spent on expenses that same year and exchanged for rupiah.

The results of this study are not in line with the research conducted by (Hidayat et al., 2018) in his research entitled "The Effect of Inflation and Interest Rates and Exchange Rates and Money Supply on Stock Returns" in his research Hidayat found that the variable money supply was shown to have no negative and significant effect on changes in foreign exchange reserves.

1.4.3 Effect of Exchange Rate on Foreign Exchange Reserves

Based on the results of the t test, it is known that the exchange rate has a positive effect on Indonesia's foreign exchange reserves, which means it is in accordance with the research hypothesis. shows that if the Exchange Rate increases then the Foreign Exchange Reserves will increase. Theoretically, this meka¬nism occurs because if the exchange rate rises, the price in the country will be relatively cheaper than the foreign price. This condition will increase exports and reduce imports of goods, so that it will increase indonesia's foreign exchange reserves, which in the end will also increase foreign exchange reserves. This is because foreign exchange reserves held by Bank Indonesia are more widely used for international transactions such as payment of imports or foreign debt, while the use of Foreign exchange reserves to stabilize the rupiah exchange rate is only small, which causes depreciation of the rupiah exchange rate. In this case, the government is too focused on foreign activities, thus forgetting the activities that exist in the country, also because of the large amount of foreign debt that makes Indonesia continue to be dependent on other countries, the proceeds of foreign exchange reserves obtained by Indonesia are mostly spent on debt repayment.

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This is in line with the theory (Sonia, A. P., &Setiawan, n.d.) that the exchange rate is used as a determinant of the purchasing power of the goods being traded. Changes in exchange rates affect the price of goods traded. If there is an appreciation of a country's exchange rate, the price for the relevant country's export goods will decrease and vice versa the price of imported goods will increase. The higher the exchange rate of a country, the stronger the country, thus obtaining a large amount of foreign exchange reserves.

The results of this study are in line with the research conducted by (Reny, 2014) which states that the exchange rate has a positive and significant effect on foreign exchange reserves. But different results are obtained by (Mankiw, 2000) in his research entitled "Study of Keynesian and Monetary Approaches to the Dynamics of Foreign Exchange Reserves through International Balance of Payments Tracing: An Empirical Study in Indonesia for the Period 1983-2008" in his research Mankiw found that the variable exchange rate was proven to have a negative and significant effect on changes in foreign exchange reserves

CONCLUSION

Based on research that has been carried out using Partial Adjustment Model (PAM) regression analysis to examine the effect of interest rates, money supply, and exchange rates on Indonesia's foreign exchange reserves in 206-2021. With its independent variables, namely the level of conclusions obtained, including (1) interest rates do not have a positive and significant effect on the country's foreign exchange reserves with a coefficient of -0.00167, and a probability value of 0.947. (2) The money supply has a positive and significant effect on Indonesia's foreign exchange reserves with a coefficient of 0.82438, as well as a probability value of 0.016. (3) The exchange rate has a negative and significant effect on Indonesia's foreign exchange reserves, with a probability value of -1.16181, and a probability value of 0.019. In the regression results, an R-square value of 0.9779 was obtained, which means that 97.79% of the variation in foreign exchange reserves can be explained by variations in interest rates, money supply, and exchange rates and the remaining 2.3% is explained by variations in variables outside the study.

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