Analysis of Factors Influencing the Rupiah Exchange Rate against the United States Dollar for the 2004-2021 Period

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| Keywords:	Abstract
Inflation, Interest Rates, Money Supply, Exports, Rupiah Exchange Rates	The purpose of this study was to determine the independent variables, namely inflation, interest rates, money supply, and exports in influencing the rupiah exchange rate against the US dollar using multiple linear regression analysis using the Ordinary Least Square (OLS) method. The results in this study indicate that jointly the independent variables have an effect on the rupiah exchange rate against the US Dollar for the period 2004 to 2021. Meanwhile, individually the inflation and interest rate variables have a positive and insignificant effect on the rupiah exchange rate against the US Dollar. Then, the variable money supply and exports have a significant impact, but only exports have a negative effect on the rupiah exchange rate against the US dollar. With a value of 92.2%, the dependent variable, namely the rupiah exchange rate against the US Dollar, can be explained by inflation, interest rates, money supply, and exports with a value of 92.9%. In addition, the remaining 7.1% can be influenced by variables or factors not included in the model.

1. INTRODUCTION

In terms of the world economy, in its economic development, many countries have entered the maturity stage, one of which is Indonesia. Indonesia as one of the countries that has adopted an open economic system, where this can have consequences or the impact of instability on the macroeconomic aspects of the country if the country cannot maintain the stability of economic fundamentals. This openness also causes a country to interact with other countries for transactions or what is commonly called international trade.

In conducting international trade, the US Dollar (US$) has been mutually agreed upon in conducting transactions in international trade. With the use of US Dollars, this can lead to danger in the movement of currency exchange rates caused by the uncertainty of the exchange rate (BR Silitonga et al., 2017) By looking at changes in a country's cost of goods and services, you can quickly see how changes in exchange rates have a direct impact on certain economic activities. Changes or volatility in exchange rates can result in the appreciation and appreciation of a currency. Depreciation is a decrease in the exchange rate of the domestic currency against foreign currency, while appreciation is an increase in the exchange rate of the country's own currency (R Wilya et al., 2015) .

Exchange rates or exchange rates can be used as a tool to assess the internal and external economic conditions of a country. The internal aspect can be seen in developments in the monetary sector, such as interest rates, exchange rates, inflation, and the money supply. Then based on the internal conditions can also be seen in changes in the real sector, such as output, consumption, and investment. Meanwhile, the situation on the external aspect is exports and other forms of international trade (Eris et al., 2017).

Rupiah Exchange Rate (Rp/US$) 2004-2021
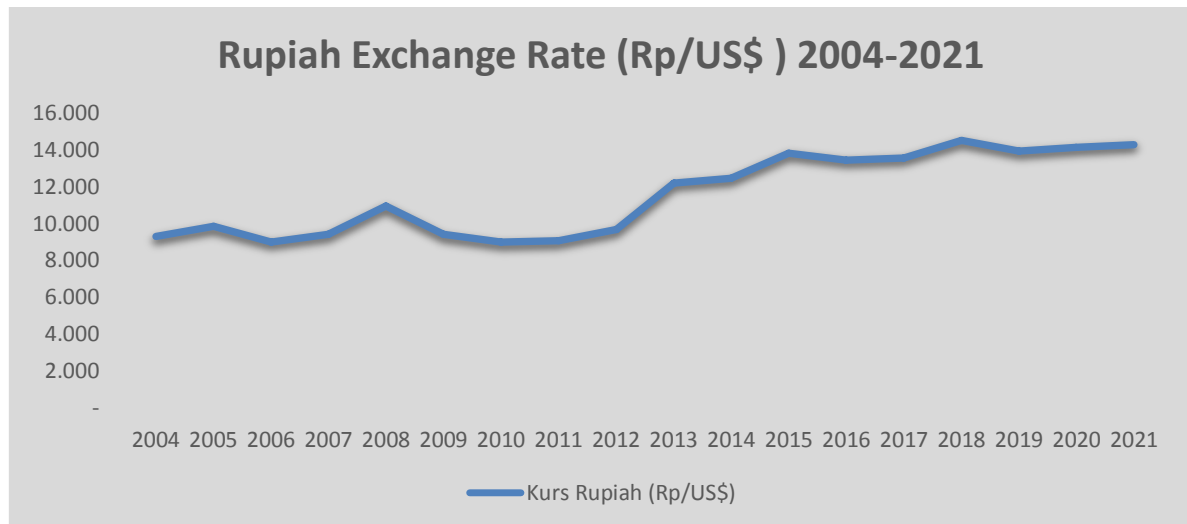
Source: Bank Indonesia and BPS
Graph 1. Rupiah Exchange Rate (Million/US$)

Based on Graph 1, it shows that the development of the rupiah exchange rate against the US Dollar (US$) over the past 18 years has continued to fluctuate or change in the rupiah exchange rate in 2010-2015 which has depreciated every year. In 2010 it was IDR 8,991 and in 2015 it reached IDR 13,795. And, the weakest rupiah exchange rate against the US Dollar was in 2018, namely at an exchange rate of IDR 14,481. The rise or strengthening of the US Dollar in that year occurred in almost all world currencies which caused a depreciation or weakening of the rupiah exchange rate.

Interest rates can affect the exchange rate of a country's own currency against other countries' currencies. Bank Indonesia has a strategy in controlling domestic interest rates, and if in the long term it continues to increase interest rates, the country's currency tends to rise against other countries' currencies. Unless there are other variables that influence or Bank Indonesia again takes a policy by cutting interest rates. Because interest rates have added value to a country's currency (Diana and Dewi, 2019) .

The money supply can affect the rupiah exchange rate. When the development of the money supply increases, it will trigger inflationary fluctuations in which the domestic currency often depreciates, which becomes very common because the pressure on the US Dollar against the domestic currency is always greater. Bank Indonesia as the manager of the monetary authority can set policies regarding the balance of the money supply in society so that the rupiah exchange rate does not depreciate against the US Dollar (Murtala, Raja Masbar and Nasir, 2017) .

The next factor that can affect the rupiah exchange rate is inflation. This occurs when the domestic inflation rate increases which can cause people to buy goods and services from other countries because domestic prices continue to increase due to inflation, so that the rupiah exchange rate will weaken or depreciate (Wijaya, 2020) .

In addition to the factors above, exports also have an impact on the exchange rate. If exports are greater than imports, then the exchange rate will appreciate, and conversely the exchange rate will depreciate if exports have less value than imports. That is, a decrease in the price of a domestic good will result in an increase in exports which can increase

demand for the domestic currency and strengthen the rupiah exchange rate. However, an increase in the price of a domestic good will result in a decrease in the value of exports thereby weakening the domestic currency due to increased demand for other countries' currencies (Fauziah and Khoerulloh, 2020) .

Darnawaty Sitorus (2018) researching using the OLS method states that exports have a negative and significant effect, but interest rates have a positive effect on the exchange rate, while inflation has a negative and insignificant effect. In line with research conducted by Carissa and Khoirudin (2020) using the Ordinary Least Square (OLS) method, where inflation has a negative and insignificant effect, and also explains that the money supply and interest rates have a positive and significant effect on the value of exchange rupiah.

Arifin and Mayasya (2018) explained in their research using the OLS and ARCH-M methods where inflation and interest rates have a positive and significant effect on the rupiah exchange rate. Furthermore, according to Siregar & Nugrahadi (2014) using the Engle-Granger Error Correcton Model (ECM-EG), in the short term it finds that domestic inflation and the money supply have a significant positive influence, while foreign inflation, foreign interest rates country, and domestic interest rates have a significant but negative effect on the exchange rate of the rupiah against the US dollar.

Based on the description above, this study aims to see the magnitude of the influence of inflation, interest rates, money supply, and exports on the rupiah exchange rate. It is felt that this needs to be done further because changes or fluctuations in the rupiah exchange rate have many influencing factors so that it can become a strategy or reference for the government in maintaining the stability of the rupiah exchange rate.

2. LITERATURE REVIEW
2.1 Inflation

Inflation is a general and sustained increase in the prices of goods and services in an economy over a certain period of time. This is usually measured using the consumer price index (CPI) or the producer price index (PPI). There is a lot of literature that discusses inflation, both in terms of its causes, impacts, and how to control it. Several literature reviews related to inflation include:

a. Causes of inflation:
   Many studies have been conducted to find out the causes of inflation. Factors such as increased aggregate demand, high production costs and loose monetary policy can all contribute to inflation. Several studies also show that factors such as rising oil prices and external factors such as exchange rate fluctuations can also affect inflation.

b. Impact of inflation: Inflation can have a significant impact on the economy, including reducing consumer purchasing power, increasing borrowing costs, and reducing currency exchange rates. In addition, inflation that is too high can also trigger economic instability, such as a recession or even a depression.

c. Ways to control inflation: There are several ways that can be used to control inflation. One way is to raise interest rates by the central bank, which can help reduce aggregate demand and control inflation. In addition, fiscal policies such as reducing government spending or increasing taxes can also help control inflation.

d. Inflation in developing countries: Inflation in developing countries is often higher than in developed countries. This could be due to a number of factors, such as a lack of infrastructure and investment, ineffective monetary policy, and political and economic instability.

e. Inflation in specific sectors: Apart from general inflation, there is also inflation that occurs in certain sectors, such as the health or education sectors. Inflation in this sector can be caused by a number of factors, such as rising labor costs or new medical technology.

2.2 Interest Rates

The interest rate is the rate of return given by the lender to the borrower for the loan provided. Interest rates are influenced by various factors such as inflation, economic growth, credit risk, and the monetary policy of the central bank. The following is a review of the literature on interest rates: "The Determinants of Interest Rates" by Campbell R. Harvey (1995) In this paper, Harvey examines the factors that affect interest rates, including credit risk, market liquidity, and inflation expectations. Harvey also studied the relationship between short-term and long-term interest rates. "The Term Structure of Interest Rates" by John C. Cox, Jonathan E.

Ingersoll, and Stephen A. Ross (1985) This paper examines the relationship between short-term and long-term interest rates. The authors state that long-term interest rates are the average of future short-term interest rates and additional risk factors. "The Theory of Interest Rate Determination" by Michael Woodford (2003) In this paper, Woodford discusses the theories that explain how interest rates are determined. Woodford points out that interest rates are influenced by inflation expectations, monetary policy, and other factors such as credit risk and market liquidity. "The Effects of Monetary Policy on Interest Rates" by Ben S. Bernanke (2005)

This paper discusses the effect of monetary policy on interest rates. Bernanke stated that central banks can influence interest rates by manipulating the money supply and changing the benchmark interest rate. "The Impact of Inflation on

Interest Rates" by Milton Friedman (1977) In this paper, Friedman discusses the relationship between inflation and interest rates. Friedman stated that inflation tends to increase interest rates because lenders need compensation for the loss of purchasing power of the money borrowed. This literature review can assist in understanding the factors that influence interest rates and how interest rates are determined by various economic factors and monetary policy.

2.3 Money Supply

Money supply refers to the amount of money circulating in an economy. The supply of money is usually measured by the central bank and is influenced by monetary policy and other economic factors. The following are some literature reviews related to money supply: "The Quantity Theory of Money" by Irving Fisher (1911) This paper discusses the quantity theory of money, which states that the amount of money circulating in the economy affects price levels and inflation.

Fisher also introduced the concept of the "velocity of money," which refers to how quickly money circulates in the economy. "Money Supply" by Milton Friedman (1960) In his famous book, "A Program for Monetary Stability," Friedman discusses the influence of the money supply on the economy and inflation. Friedman argues that the inflation rate can be controlled by controlling the growth rate of the money supply. "Money, Banking, and Economic Activity" by Frederic S. Mishkin (2017) This book discusses the role of money and banking in the economy.

Mishkin explained how the central bank influences the money supply through monetary policy and how changes in the money supply can affect economic activity. "Central Bank Independence and Money Supply" by Alberto Alesina and Lawrence H. Summers (1993) In this paper, Alesina and

Summers discuss the influence of central bank independence on money supply.

The authors point out that more independent central banks tend to result in lower inflation rates and greater monetary stability. "Monetary Policy and the Information Content of Money" by Michael T. Belongia and Peter N. Ireland (2016) In this paper, Belongia and Ireland discuss how money supply data can be used by central banks to make better monetary policy. The authors point out that the money supply can provide useful information about economic conditions and inflation.

3. RESEARCH METHOD

In this study used quantitative analysis and secondary data as the type of data. Secondary data is data that is systematically arranged and comes from other parties or authorized institutions such as Bank Indonesia and the Central Bureau of Statistics (BPS). The secondary data here is annual time series data starting from 2004 to 2021 and the State of Indonesia is the object of this study. The data to be examined include inflation, interest rates, the money supply, and exports as well as the research subject of the rupiah exchange rate.

Multiple linear regression using the Ordinary Least Square (OLS) method will be used as an analytical tool in this study. The model in this study was modified from research that had been conducted by Feisal et al. (2017) , Wijaya (2020) , and Demak et al. (2018) , then expressed by the econometric model as follows:

$$KURS_t = \beta_0 + \beta_1 INF_t + \beta_2 BIRATE_t + \beta_3 JUB_t + \beta_4 EKS_t + \varepsilon_t$$

Where:
EXCHANG : Rupiah Exchange Rate against US Dollars (Rupiah/US$)
INF : Inflation (%)
BIRATE : Interest Rate (%)
JUB : Amount of Money in Circulation (Billion Rupiah)
EXPORTS : Exports (Million US$)
ε : Error Term
β_0 : Constant
$\beta_1, \beta_2, \beta_3, \beta_4$: coefficient
t : t period (time series)

4. RESULTS AND DISCUSSION
4.1 Research Result

From the econometric model above and additional testing, we obtain estimation results that can be checked in Table 1.

Table 1. Econometric Estimation Results
Econometric Estimation Results

$\log(KURS)_t = 6{,}227 + 0{,}008\,INF_t + 0{,}020\,BIRATE_t + 0{,}516\,\log(JUB)_t$ $(0.363)(0.251)(0.000)* -0{,}403\,\log EKS_t(0.000)\,*$
$R^2 = 0.929$; DW-Stat. = 2.129 ; F-Stat. = 42.695 ; Prob. F-Stat. = 0.000
Diagnostic Test (1) Multicollinearity (VIF) INF_t= 4.957; $BIRATE_t$= 7.357; $\log(JUB)_t$= 4.898; $\log EKS_t$ = 3,376 (2) Residual Normality (Jarque fallow) JB (2) = 0.648 ; Prob. JB(2) = 0.723 (3) Autocorrelation (Breusch Godfrey) χ^2 (3) = 5.656 ; Prob. χ^2 (4) = 0.130 (4) Heteroscedasticity (White) χ^2 (14) = 16.576 ; Prob. χ^2 (14) = 0.279 (5) Linearity (Ramsey Reset) F(2.11) = 2.831 ; Prob. F (1.35) = 0.102 _

Source: Processed data (2022)

Based on the results of the diagnostic test in Table 1, it shows where the prob. for residual normality, autocorrelation, heteroscedasticity and linearity tests were 0.723 (> 0.10), 0.13 0 (> 0.10), 0.279 (> 0.10), and 0.107 (> 0.10). This shows that the estimated model has a normal distribution of residuals, free from autocorrelation and heteroscedasticity, and the estimated model is linear. And also the

model is free from multicollinearity problems because each has a VIF value below 10, namely 4.957 (<10), 7.357 (<10), 4.898 (<10), and 3.376 (<10).

The goodness of fit statistic shows that the model is estimated to exist, it can be shown from the empirical probability statistic F the value is 0.000 (<0.01), with R^2 or a coefficient of determination of 0.929. This means that 92.9% of the variation in the rupiah exchange rate against the US dollar can be explained by the inflation (INF), interest rate (BIRATE), money supply (JUB) and exports (EKS) variables.

The inflation variable has a regression coefficient of 0.008. Thus, inflation has a positive effect on the rupiah exchange rate against the US dollar. The rupiah exchange rate against the US Dollar and inflation has a logarithmic-linear relationship pattern; that is, when inflation rises by 1%, the rupiah exchange rate against the US Dollar will also increase by 8%. Conversely, when inflation drops by 1%, the rupiah exchange rate against the US Dollar will also fall by 8%.

The interest rate variable has a regression coefficient of 0.020. Thus, the interest rate has a positive effect on the rupiah exchange rate against the US dollar. The rupiah exchange rate and interest rates have a logarithmic-linear relationship pattern; that is, when the interest rate rises by 1%, the rupiah exchange rate against the US Dollar will also increase by 2%. Conversely, when interest rates fall by 1%, the rupiah exchange rate against the US dollar will also fall by 2%.

The money supply variable has a regression coefficient of 0.516. Thus, the money supply has a positive effect on the rupiah exchange rate against the US dollar. The rupiah exchange rate and the money supply have a logarithmic-logarithmic relationship pattern; that is, when the money supply increases by 1%, the rupiah exchange rate against the US Dollar will also increase by 0.516%. Conversely, when the money supply decreases by 1%, the rupiah exchange rate against the US Dollar will also decrease by 0.516%.

The export variable has a regression coefficient of -0.403. Thus, exports have a negative effect on the rupiah exchange rate against the US dollar. The rupiah exchange rate and exports have a logarithmic-logarithmic relationship pattern; that is, when exports increase by 1%, the rupiah exchange rate against the US Dollar will decrease by 0.403%. Conversely, when exports fall by 1%, the rupiah exchange rate against the US dollar will increase by 0.403%.

4.2 Discussion

Based on the test results, results were obtained with inflation having a positive and insignificant effect on the rupiah exchange rate against the US Dollar in 2004-2021. By increasing the price of goods will encourage inflation. When people are more inclined to buy from abroad as a result of the higher prices of domestic goods, so that foreign exchange transactions occur. Inflation will weaken the rupiah and strengthen the value of the US dollar. However, there is no significant effect of inflation on the rupiah exchange rate against the US dollar because it is necessary to maintain the stability of the rupiah exchange rate and prevent excessive depreciation due to rising inflation, Bank Indonesia distributes foreign exchange reserves to the foreign exchange market as the monetary authority holder. This supports the research findings. This supports research findings by Waldi & Amar (2020) that inflation has a positive and insignificant effect on the rupiah exchange rate.

The results of the regression tests that have been carried out show that interest rates have a significant and positive effect on the value of the rupiah against the

US dollar. If domestic interest rates increase, it will strengthen the rupiah exchange rate which encourages people to be more interested in saving it by assuming it will provide a large reward. However, interest rates have an insignificant impact on the rupiah exchange rate against the US dollar, meaning that during the 2004-2021 period, Bank Indonesia, which has a policy of lowering or increasing interest rates, will not necessarily affect the rupiah exchange rate against the US dollar. This is in accordance with the analysis by Yudiarti et al. (2018) where the interest rate has no significant effect in a positive direction on the rupiah exchange rate.

By looking at the test results, it is known that the money supply has a positive and significant effect on the rupiah exchange rate against the US dollar. That is, the increasing amount of domestic money will cause the supply of rupiah money to also increase. Where, if the money supply is high there will be an increase in transactions by the public in buying goods and result in an increase in domestic prices so that the rupiah exchange rate depreciates and the US dollar increases. In addition, if the money supply increases, the government will reduce interest rates so that investors withdraw their funds and invest abroad which can cause the rupiah exchange rate to weaken. The findings of this study corroborate previous work by Aryani and Murtala (2019) which explained that the money supply has a significant positive effect on exchange rates.

Based on the test results, it was found that exports had a negative and significant effect on the rupiah exchange rate against the US dollar. When exports increase, the exchange rate of the rupiah against the US dollar strengthens as a result of the increase in the amount of foreign currency (foreign currency) owned by the country. When exports are higher, there will be an increase in the demand for money from the exporting country and result in a decrease in the demand for money from other countries. This is in accordance with the research of Hazizah et al. (2017) where exports have a negative or opposite and significant effect on the rupiah exchange rate against the US dollar.

5. CONCLUSION

In this study, there are several independent variables, namely inflation, interest rates, money supply, and exports. The dependent variable, namely the rupiah exchange rate against the US dollar, is strongly and simultaneously influenced by the four independent variables. Meanwhile, partially the exchange rate of the rupiah against the US dollar is influenced positively and not significantly by inflation and interest rates. Then, the dependent variable which is influenced by the money supply and imports has a significant impact. However, based on the test findings, only exports had a negative impact on the rupiah exchange rate against the US dollar.

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