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THE EFFECTS OF MONEY SUPPLY ON EXCHANGE RATE: EVIDENCE OF DORNBUSCH OVERSHOOTING MODEL IN INDONESIA (2000-2021)

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ABSTRACT

This study aims to analyze the effects of money supply on exchange rate in Indonesia and to investigate whether there is an application of the Dornbusch Overshooting Model. The Autoregressive Distributed-Lag (ARDL) method is used to analyze short-term and long-term effects and uses time-series data from 2000:Q1 to 2021:Q4. The results of this study show that the long-term coefficient of the money supply has a smaller effect on the depreciating exchange rate than the short-term coefficient. Based on the estimation results, it can be concluded that there is an application of the Dornbusch Overshooting Model in Indonesia. A further implication of this research is that the factors that influence exchange rate fluctuations are of great concern in an effort to maintain exchange rate stability. For example, growth in the money supply because a 1 percent change in the money supply results in a change of more than 1 percent in the exchange rate. In addition to the money supply, other variables such as inflation and interest rates also have a large influence on changes in exchange rates and have different magnitudes of influence in the short and long-run.

Keywords: *Money Supply, Exchange Rate, Dornbusch Overshooting Model, ARDL*

ABSTRAK

Penelitian ini bertujuan untuk menganalisis pengaruh jumlah uang yang beredar terhadap nilai tukar di Indonesia dan menyelidiki apakah terdapat penerapan Dornbusch Overshooting Model. Metode Autoregressive Distributed-Lag (ARDL) digunakan untuk menganalisis pengaruh dalam jangka pendek dan jangka panjang serta menggunakan data time-series dari 2000:Q1 hingga 2021:Q4. Hasil penelitian menunjukkan bahwa pada koefisien jangka panjang dari jumlah uang yang beredar berpengaruh terhadap nilai tukar yang terdepresiasi lebih kecil daripada koefisien jangka pendek. Berdasarkan hasil estimasi tersebut, dapat disimpulkan bahwa terdapat penerapan Dornbusch Overshooting Model di Indonesia. Implikasi lebih jauh dari penelitian ini adalah faktor yang mempengaruhi fluktuasi nilai tukar sangat diperhatikan dalam upaya menjaga stabilitas nilai tukar. Misalnya, pertumbuhan jumlah uang beredar karena perubahan 1 persen pada jumlah uang yang beredar mengakibatkan perubahan lebih dari 1 persen pada nilai tukar. Selain jumlah uang yang beredar, variabel lain seperti inflasi dan suku bunga juga memiliki pengaruh yang besar terhadap perubahan nilai tukar dan memiliki besaran pengaruh yang berbeda pada jangka pendek dan jangka panjang.

Kata Kunci: *Jumlah Uang Yang Beredar, Nilai Tukar, Dornbusch Overshooting Model, Ardl*
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Introduction

Reform of Indonesia's economic system began to occur in 1978. This reform was marked by a change in the regime of peg exchange rate to the regime of managed floating exchange rate. These reforms aim to encourage Foreign Direct Investment (FDI), liberalize the financial sector, increase competition, and promote economic growth. Through the managed floating exchange rate regime, the rupiah is linked relatively with a currency basket consisting of Indonesia's main trading partners, and an upper and lower limit (intervention band) is established so that it can identify the extent to which the rupiah can appreciate or depreciate (Hardiyanto, 2007).

The effects of the managed floating exchange rate regime encountered issues in the middle of the 1980s, when natural gas and crude oil became the majority of Indonesia's export commerce. Therefore, the price of crude oil globally has a significant impact on the government's revenue. In 1986, the world price of crude oil fell, forcing the government to devalue the rupiah to encourage non-oil or gas exports. These problems can still be overcome because Indonesia still has large foreign exchange reserves. However, during the Asian Financial Crisis in 1997, the rupiah depreciated so sharply that it exceeded the upper intervention band set by Bank Indonesia. Due to dwindling foreign exchange reserves, Bank Indonesia decided to let the rupiah exchange rate float freely or switch to a floating exchange rate regime.

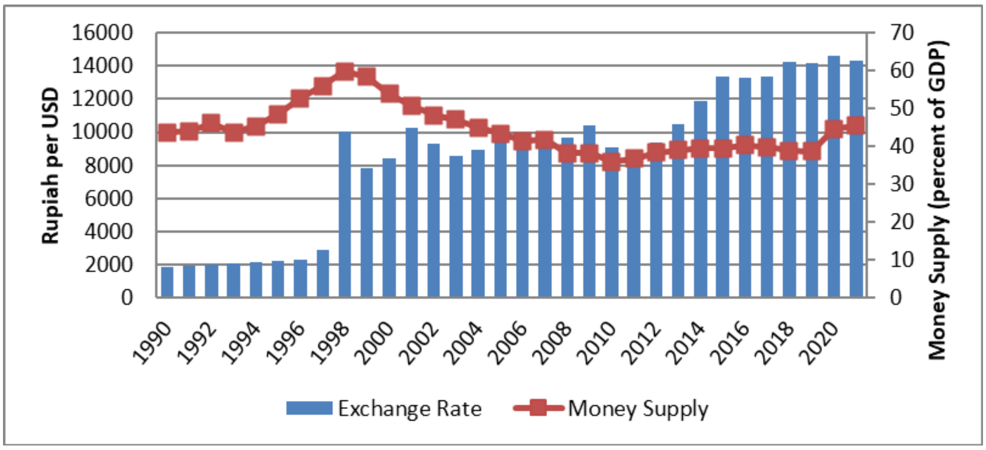

Figure 1: Fluctuations in Exchange Rate Rupiah per USD, 1990-2021

Source: World Bank, 2022

Based on Figure 1 above, the movement of the rupiah exchange rate jumped sharply or there was a depreciation of the rupiah, namely from IDR 2,909 in 1997 to IDR 10,013 in 1998. The depreciation of the rupiah was due to the lack of proper synchronization between fiscal and monetary policies and exchange rates and attacks of speculative forces that forced the government to abandon the managed floating exchange rate regime. The depreciation of the rupiah was also caused by the government's desire to make changes from the intervention band exchange rate so that other policy changes had to be followed. For example, capital mobility should not be as free as possible because it is feared that it could make the rupiah depreciate more sharply. This opinion was quite proven because the movement of capital outflows (capital outflow) at the end of 1997 which was getting high caused the rupiah money supply to increase and in the end caused the rupiah to depreciate further. Additionally to the depreciation caused on by the Asian Financial Crisis, the depreciation of the rupiah was felt again in 2009 as a negative response due to the World Financial Crisis and throughout 2012 to 2016 caused by a trade balance deficit (World Bank, 2022).

According to Thobarry (2009: 46), currency fluctuations can occur in countries that adopt a managed floating system or can occur in market mechanisms. In general, changes in exchange rates are caused by four indicators, namely money supply, inflation rate, national income, and international balance of payments. Based on the problem of the rupiah depreciation in 1998, it can be said that the money supply had a significant impact in determining exchange rate movements and ultimately depreciated the rupiah. The Dornbusch Overshooting Model can be used to explain how the money supply affects the exchange rate. A rise in the money supply will lower the real interest rate since short-term prices are sticky. This condition will result in a capital outflow so that the value of the domestic currency depreciates. In the short-run, the domestic currency will overshoot-depreciate beyond the level it should have occurred because there has been no price adjustment. However, in the long-run, prices of goods will increase/adjust to what should have happened, causing a decrease in the money supply and higher interest rates. This condition will result in capital inflow so that the value of the domestic currency appreciates towards a new balance point.

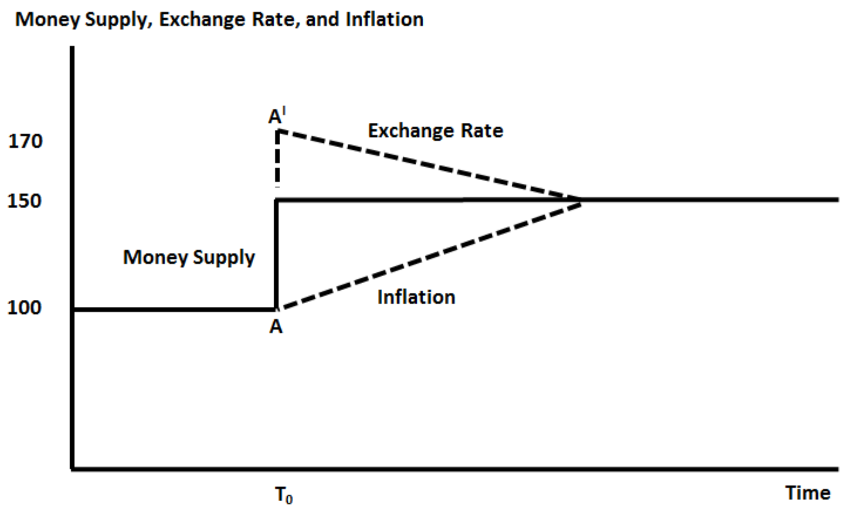

Figure 2: Dornbusch Overshooting Model

Source: *Dornbusch (2001)*

Several empirical studies that analyze the effect of money supply and exchange rates have obtained mixed results. Research conducted by Renani et al. (2014) showed that there was an exchange rate overshoot phenomenon in Iran, so it was proven that the Dornbusch Overshooting Model was applied. According to Falianty (2003), the exchange rate depreciates in the short run beyond its long-term balancing value when the money supply increases. Adjustment toward long-term balance occurs slowly. The depreciation of the rupiah exchange rate is strongly influenced by the increase of the money supply. In the short term, an increase in the money supply may cause the exchange rate to overshoot.

In contrast to the research conducted by Kim et al. (2017) analyzed the delayed overshooting puzzle in the era before and after Paul Volcker's leadership using the sign restrictions method. According to the study's findings, uncovered interest parity failed to persist during the Volcker era and tended to persist during the post-Volcker era and US monetary policy shocks have a large impact on exchange rate variations but erroneously appear to have little impact when a monetary policy regime is implemented. In other words, this study confirms Dornbusch's overshooting hypothesis. According to Flood & Taylor (1996), there is no overshooting phenomenon in the exchange rate.

Based on the problems, this research tries to examine the effect of the money supply on exchange rates in Indonesia and to investigate whether there is an application of the Dornbusch Overshooting Model. The Autoregressive Distributed-Lag (ARDL) method is used to analyze short-term and long-term effects and uses time-series data from 2000:Q1 to 2021:Q4. The estimation results indicate that the coefficient of influence of the money supply on the exchange rate in the short-run is 2.46 percent higher than the long-term coefficient of

2.38 percent. Therefore, it can be concluded that there is a Dornbusch Overshooting Model phenomenon in Indonesia.

There are five sections to this study: an introduction, a review of the literature, data and research methods, funding and discussion, and a conclusion.

Literature Review

Theoretical Framework

The sticky price model was introduced by Dornbusch (2001). This model contains the hypothesis of overshooting exchange rates. An increase in the money supply will lower the real interest rate since short-term prices are sticky. This situation will cause a capital outflow, which will cause the value of the domestic currency depreciates. In the short-run, the domestic currency will overshoot-depreciate beyond the level it should have occurred because there has been no price adjustment. However, in the long-run, prices of goods will increase/adjust to what should have happened, causing a decrease in the money supply and an increase interest rates. This occurrence will result in capital inflow so that the value of the domestic currency appreciates towards a new balance point.

The theory starts with two basic assumptions. First, interest rate parity associated with an efficient market where bonds from different countries are perfectly substituted:

$$d = r - r^{*} \qquad (1)$$

Equation 1 implies of Covered Interest Rate Parity (CIRP). The notation implies forward rate discount rate or the logarithmic form of the forward rate minus the logarithmic form of the current spot, denote domestic interest rate, denote foreign interest rates. In a perfectly free foreign exchange regime, there is no control over incoming and outgoing capital and there are no transaction costs. CIRP must apply perfectly because if there is a deviation from CIRP it will indicate that there is an opportunity profit that is not exploited. However, this research will be defined as the depreciation rate expected by market participants so equation 1 is a statement of Uncovered Interest Rate Parity (UIRP).

Second, the expected rate of depreciation is a function of the difference/gap between the current spot rate and the level of the equilibrium exchange rate and a function of the difference between domestic and foreign long-term inflation expectations:

$$d = -\theta\,(e - \overline{e}) + (\pi - \pi^{*}) \qquad (2)$$

by combining equations (1) and (2), obtained

$$e - \overline{e} = -\frac{1}{\theta}[(r - \pi) - (r^{*} - \pi)] \qquad (3)$$

where is the logarithmic form of *the spot rate*, π and π^{*} represents is long-term inflation rate at home and abroad, respectively. According to 2, in the short run, the expectation is that the exchange rate will return to its equilibrium value at a level that is proportional to the difference at that time. In the long run, where $e - \overline{e}$, the exchange rate is expected to change according to $(\pi - \pi^{*})$ the long run. The rational value of will be closely related to the speed of price adjustment which is *sticky* in the goods market.

The expression in brackets in equation 3 is interpreted as *a real interest rate differential.* On the long-run apply $e = \overline{e}$ so $\overline{r} - \overline{r}^{*} = \pi - \pi^{*}$. Notation from $\overline{r} - \overline{r}^{*}$ shows interest rates in the long run. Therefore, $[(r - \pi) - (r^{*} - \pi^{*})]$ equal to $[(r - r^{*}) - (r - r^{*})]$. Equation 3 can be explained that when a tight money policy is applied it causes the nominal interest rate differential to increase beyond its long-term level and ultimately results in capital inflow. These conditions will cause the currency to appreciate proportionally above its equilibrium value.

Furthermore, assume that *purchasing power parity* in the long run applies the following conditions:

$$e = p - \overline{p} \tag{4}$$

where and is defined as the logarithmic form of the equilibrium price level in the long run. When the money demand equation is assumed as follows:

$$m = p + \o y - \lambda r \tag{5}$$

and the long run money demand function as follows:

$$\overline{m} = \overline{p} + \o \overline{y} - \lambda \overline{r} \tag{6}$$

where m, p, and y respectively are the logarithmic form of money supply, price level, and output (bar notation denotes variables in the long run). By taking the differential between the two equations, then:

$$m - \overline{m} = p - \overline{p} + \o(y - \overline{y}) - \lambda(r - \overline{r}) \tag{7}$$

Recall that on the long-run , so:

$$e = p - \overline{p} = (m - \overline{m}) - \o(y - \overline{y}) + \lambda(r - \overline{r}) \tag{8}$$

This equation serves the monetary theory, which is based on exchange rates being determined by the relative supply and demand for money of two currencies. At the equilibrium level, if the money supply is increased, prices will increase and the exchange rate will depreciate proportionally. Then, if income increases or there is a decrease in the level of expected inflation, it will increase money demand so that the currency will appreciate.

Based on the assumption that the level of money supply equilibrium and current income is obtained from the actual level of each variable, a complete equation for determining the current exchange rate (spot exchange rate) is obtained:

$$e = (m - \overline{m}) - \o(y - \overline{y}) - \frac{1}{\theta}(r - \overline{r}) + \left(\frac{1}{\theta} + \lambda\right)(\pi - \overline{\pi}) \tag{9}$$

Empirical Framework

Several empirical studies that analyze the relationship between money supply and exchange rates have obtained mixed results. Bjornland (2009) used the Dornbusch Overshooting Model approach to analyzed monetary policy and exchange rates. The estimation results show that the Dornbusch Overshooting Model hypothesisis appropriate. Contractionary monetary policy has a strong effect on the exchange rate. Then, the exchange rate gradually depreciates. This study is following research conducted by Capistran et al. (2017), identified exchange rate overshooting in Mexico. According to Park (1997), Papel (1988), and Driskill (1981), supported the implementation of Dornbusch Overshooting Model.

Ruth (2020), analyzed the causal relationship between monetary policy shocks and the US Dollar exchange rate to prove the Dornbusch Overshooting Model hypothesis using VAR. The estimation results show that there is an overshooting phenomenon in exchange rates from the post-Bretton-Woods era to the Great Recession era. This study is following research conducted by Renani et al. (2014) who showed proof of the Dornbusch Overshooting Model hypothesis that there is an exchange rate overshoot phenomenon in Iran. This evidence is supported by Falianty (2003), an increase in the money supply causes the exchange rate to depreciate in the short-run, exceeding its long-term balance value. Adjustment toward long-term balance occurs slowly. Expansion of the money supply has a very strong influence on the depreciation of the rupiah exchange rate. Expansion of the domestic money supply can lead to overshooting of the exchange rate in the short-run.

Furthermore, Kim, et al. (2017), analyzed the delayed overshooting puzzle in the era before and after Paul Volcker's leadership by using the sign restrictions method. The results of these studies are: (1) During the Volcker era, uncovered interest parity failed to survive and tended to persist during the post-Volcker era; (2) US monetary policy shocks have a large effect on exchange rate variations, but erroneously appear to have a small impact when monetary policy regimes are combined. In short, the study confirmed the Dornbusch overshooting hypothesis. This research is following research conducted by Flood & Taylor (1996), Backus (1984), and Hacche & Townend (1981), which showed that there was no overshooting phenomenon in exchange rates.

Data and Research Methods

Data Analysis

Time series data were employed in this study, which included the quarterly intervals from 2000:Q1 to 2021:Q4. The money supply, inflation, interest rates, and GDP are the independent variables, whereas the exchange rate is the dependent variable. The analysis of the data and variables utilized in this study is described in more detail as follows:

Table 1: Variable, Notation, and Data Source

Variable	Notation	Explanation
Exchange rate	EX	Quarterly data from the Effective Real Exchange Rate (REER) in points (index).
Money supply	MS	Quarterly data from broad money growth (M2), which is the broadest measure of the money supply in units percent.
Inflation	INF	Quarterly data from the Consumer Price Index (CPI) as a proxy for inflation (data in percent).
Oil prices	INT	Quarterly data from real interest rates in percent terms.
Gross Domestic Product	GDP	Quarterly data on GDP growth as a proxy for economic growth in percent.

Source: BIS (2022), FRED (2022), OECD (2022)

Auto-Regressive Distributed Lag Method

Pesaran and Shin (1996) state the method used to analyze long-term relationships by involving the concept of cointegration between time series variables is Auto-Regressive Distributed Lag (ARDL) model. Testing with the ARDL methods has advantages because it can measure variables at different order levels, produce short-term and long-term estimates in one model, and estimate t-statistics with validity (Ari et al., 2019; Bahmani-Oskooee & Karamelikli, 2018). The following is the long-term ARDL model used in this study:

$$EX_t = \alpha_0 + \alpha_1(MS_t - \overline{MS}_t) + \alpha_2(INF_t - \overline{INF}_t) + \alpha_3(INT_t - \overline{INT}_t) + \alpha_4(GDP_t - \overline{GDP}_t) + e_t \quad (10)$$

Description:

EX_t	=	Exchange rate at time t,
α_0	=	Constant,
$\alpha_1, \alpha_2, \alpha_3, \alpha_4$	=	*Speed of adjustment* ,
$(MS_t - \overline{MS}_t)$	=	Adjustment between actual and long-term money supply at time t,
$(INF_t - \overline{INF}_t)$	=	Adjustment between the actual and long-run inflation rates at time t,
$(INT_t - \overline{INT}_t)$	=	Adjustment between actual and long-term interest rates at time t,
$(GDP_t - \overline{GDP}_t)$	=	Adjustment between actual and long-run GDP at time t,
e_t	=	*Error term* at time t.

The above model includes assumptions from the Dornbusch Overshooting Model which explains that there is an adjustment process in exchange rates and prices that do not move at the same speed. Based on the ARDL model above, an Error-Correction Model (ECM) can be made as follows:

$$\begin{aligned}\Delta EX_t = \beta_0 + \beta_1(MS_{t-1} - \overline{MS}_{t-1}) + \beta_3(INF_{t-1} - \overline{INF}_{t-1}) + \\ \beta_4(INT_{t-1} - \overline{INT}_{t-1}) + \beta_5(GDP_{t-1} - \overline{GDP}_{t-1}) + \\ \sum_{i=0}^{n2} \lambda_{0,i}\Delta(MS_{t-i} - \overline{MS}_{t-i}) + \sum_{i=0}^{n3} \lambda_{1,i}\Delta(INF_{t-i} - \overline{INF}_{t-i}) + \\ \sum_{i=0}^{n4} \lambda_{0,i}\Delta(INT_{t-i} - \overline{INT}_{t-i}) + \sum_{i=0}^{n5} \lambda_{0,i}\Delta(GDP_{t-i} - \overline{GDP}_{t-i}) + e_t\end{aligned} \quad (11)$$

Finding and Discussion

Stationary Test

This study used the Augmented Dickey-Fuller (ADF) stationarity test. In this test show that the dependent variable (exchange rate) are stationary at first different (I) and the independent variables (money supply, inflation, interest rates, and Gross Domestic Product) are stationary at level (0). These variables can be used in the ARDL method because they are considered valid (Guo, 2020; Ari et al., 2019; Panda & Reddy, 2016).

Optimal Lag Selection

The optimal lag selection in this study uses four maximum lags for each variable and applies the Akaike Information Criterion (AIC) to select optimal lag specifications (Ari et al., 2019; Bahmani-Oskooee & Karamelikli, 2018). Widarjono (2007) argues that the main advantage to employing the AIC technique is in choosing the most appropriate regression model for forecasting regression model, which can explain the fit of the model with current data (in sample forecasting) and values that will occur in the future (out of sample forecasting). The optimal lag selection results are (2,2,2,4,3). The results of selecting the optimal lag show the time needed for the dependent variable (exchange rate) to respond to changes in the independent variables (money supply, inflation, interest rate, and Gross Domestic Product).

ARDL Bound Test

Short-Run ARDL Bound Test

Table 2 shows the short-term ARDL estimation results. This estimation indicates that the money supply (MS) significantly affects the exchange rate negatively. In other words, the exchange rate decreases (depreciates) by 2.46 percent for every one percent rise in the money supply. The exchange rate is significantly positively impacted by the inflation variable. In other words, when inflation rises by 1 percent, the exchange rate rises (appreciates) by 1.17 percent as well. The exchange rate is then significantly negatively impacted by the interest rate variable. In other words, the exchange rate declines (depreciates) by 1.81 percent for every percent increase in interest rates. Finally, there is no evidence that the GDP variable has an impact on the exchange rate. That is, when GDP increases, there is no change in the exchange rate.

Table 2: Short Run Estimation

Variable	Coefficient	Standart Error	T-Statistic	Probabilitas
Constant	0.077530	0.288085	0.269120	0.7887
MS_t	-2.460188	0.686077	-3.585876	0.0006
MS_{t-1}	1.096641	0.741134	1.479680	0.1437
MS_{t-2}	-	-	-	-
MS_{t-3}	-	-	-	-

Variable	Coefficient	Standart Error	T-Statistic	Probabilitas
MS_{t-4}	-	-	-	-
INF_t	1.172250	0.518750	2.259757	0.0271
INF_{t-1}	0.731549	0.539362	1.356323	0.1796
INF_{t-2}	-	-	-	-
INF_{t-3}	-	-	-	-
INF_{t-4}	-	-	-	-
INT_t	-0.169553	0.613139	-0.276532	0.7830
INT_{t-1}	-1.809809	0.652909	-2.771918	0.0072
INT_{t-2}	0.917762	0.576862	1.590957	0.1164
INT_{t-3}	-1.381547	0.523416	-2.639481	0.0104
INT_{t-4}	-	-	-	-
GDP_t	0.193505	0.231620	0.835441	0.4065
GDP_{t-1}	-0.207761	0.260063	-0.798886	0.4272
GDP_{t-2}	-	-	-	-
GDP_{t-3}	-	-	-	-
GDP_{t-4}	-	-	-	-

Long-Run ARDL Bound Test

Table 3 shows the long-term ARDL estimation results. The estimation findings indicate a significant negative impact of the money supply (MS) on the exchange rate. In other words, the exchange rate declines (depreciates) by 3.38 percent for every percent increase in the money supply. There is no evidence that the inflation variable has any impact on the exchange rate. In other words, the exchange rate remains unchanged as inflation increase. The exchange rate then significantly positively from the interest rate variable. In other words, when interest rates rise by one percent, the exchange rate increases (appreciates) by 3.72 percent as well. Finally, the exchange rate is significantly positively impacted by the GDP component. In other words, when GDP grows by 1 percent, the exchange rate also grows (appreciates) by 1.97 percent.

Table 3: Long-Run Estimation

Variable	Coefficient	Standart Error	T-Statistic	Probabilitas
Constant	0.077530	0.288085	0.269120	0.7887
MS	-2.384235	1.077038	-2.213697	0.0303
INF	-2.981152	1.706328	-1.747115	0.0853
INT	3.723992	1.374896	2.708562	0.0086
GDP	1.971331	0.920279	2.142101	0.0359

Cointegration Test

The cointegration test, according to Pesasan et al. (1996), is used to examine whether the variables in the model have a long-term relationship. The bound test's rules state that the null hypothesis is rejected if the estimated F-statistic value is higher than the upper bound. The null hypothesis is accepted if the estimated F-statistic value is lower than the lower bound. However, the findings are inconclusive if the F-statistic value is in between the upper bound and lower bound. The cointegration test estimation results in Table 4.3 show that the cointegrated variable, in the long run, is at the 5% level. The findings of the estimation show that the independent variable and the dependent variable have a stable relationship in the long-term, because the F-statistic's value is higher than both the lower and upper bounds.

Table 4.3 Cointegration Test Result

Test Statistic	Value	Significant	Lower Bound	Upper Bound
			Asymptotic: n=1000	
F-statistic	6.266862	10%	2.45	3.52
K	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

Diagnostic Test

In this study, there were four diagnostic tests. First, the speed of adjustment toward long-run equilibrium is examined using the test. The coefficient value must be negative and significant because if it is positive then the model is considered unstable and divergent. The estimation results of the test show that the model has a significant negative value at the 5% level. The coefficient value of is -0.36, which means that the speed of adjustment between the long and short-run is 36%.

Second, the residuals are checked for autocorrelation using the Lagrange Multiplier (LM) test. In contrast to the alternative hypothesis, which says that there is no serial correlation, the null hypothesis says that there is a serial correlation. According to the estimation results, the F-statistic's value is not significant at the 5% level. It is obvious that there is no serial association as a result. Third, the model specifications are examined using the Ramsey RESET test. The alternative hypothesis suggests that the used model is incorrect, while the null hypothesis suggests that the model is valid. The estimation findings indicate that the F-statistic is significant at the 5% level. Thus, it can be said that the model employed is not completely accurate.

Fourth, the Adjusted-R^2 score is used to indicate the level of suitability (goodness of fit) of each model or how well the independent variables are responsible for the dependent variable. The estimation results show that the Adjusted-R2 value is 0.45. In other words, change in the independent variables (money supply, inflation, interest rate, and GDP) can explain 45% of change in the dependent variable (exchange rate), while the rest are influenced by other variables not included in the model.

Table 4: Diagnostic Test Result

Test	Value	Explanation
ECM_{t-1}	-0.357376	Speed of adjustment to long-run by 36%
LM	0.096839	There is no serial correlation
$Ramsey\ RESET$	4.232368**	The model used is inaccurate
$Adj.R^2$	0.449230	45% of the change in the dependent variable (inflation) may be explained to the variations of the independent variable, with the remaining 55% impacted by other variables not taken into account in the model.

Notes : ** significant at 5%

Robustness Test

This study uses a robustness test in the form of a stability test of the cumulative sum of recursive residuals test (CUSUM) to identify systematic changes in the regression coefficients and the speed of adjustment and the cumulative sum of squares of recursive residuals test (CUSUMSQ) to identify sudden changes in the coefficient and speed of adjustment regression. Figure 2 illustrates the stability of the model used in this study using the CUSUM and CUSUMQ tests.

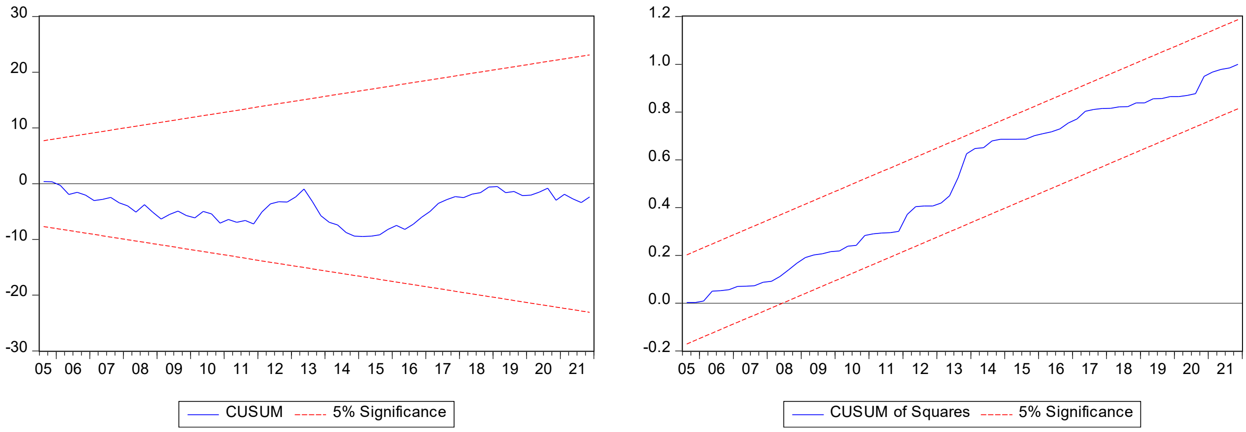

Figure 2: CUSUM & CUSUMQ Test

Discussion of Research

Dornbusch (2001), the phenomenon of the Dornbusch Overshooting Model occurs when the money supply rises, causing low real interest rates. This condition caused a capital outflow, which caused the value of the domestic currency depreciated. In the short-run, the domestic currency will overshoot-depreciate beyond its expected level. In the log run, however, prices of goods will rise or adjust to reflect what should have happened, which will lead to a decrease in the real money supply and an increase in interest rates.This condition resulted in a capital inflow so that the value of the domestic currency appreciated towards a new balance point.

According to the estimation results, the rupiah exchange rate is estimated to depreciate beyond its long-term depreciation value due to an increase in the money supply in the short run based on the theory of the Dornbusch Overshooting Model. According to the estimation results from this study, the money supply's short-term influence on the exchange rate is 2.46 percent greater than its long-term influence, which is 2.38 percent. Therefore, it can be concluded that there is a Dornbusch Overshooting Model phenomenon in Indonesia.

The results of the above research are consistent with research conducted by Falianty (2003) which found that a rise in the money supply leads the exchange rate to depreciate in the short run and exceed its long-term balance value. Adjustment toward long-term balance occurs slowly. Expansion of the money supply has a very strong influence on the depreciation of the rupiah exchange rate. Expansion of the domestic money supply can lead to overshooting of the exchange rate in the short-run. It is proven that from 1996 to 2021 there has been an increase or expansion in the growth of the money supply in society, which has caused an overshooting of the exchange rate in Indonesia (Bank Indonesia, 2021). Suryanto (2003), who argues that the phenomena of exchange rate overshooting has been showed to occur in Indonesia, supports the findings of this study. The short-term increase in domestic money supply will lead the rupiah to depreciate beyond its long-term rate of depreciation.

Additionally, the short-run impact of inflation on the exchange rate is positive (appreciation), whereas the long-term impact is no effect. The impact of interest rates is then inversely proportional with inflation, with interest rates having a significant short-run negative impact and a significant long-run positive impact on the exchange rate. The research by Arifin (1998), which confirms that tight monetary policy stimulates an increase in interest rates which can have an impact on the appreciation of the rupiah exchange rate, is supported by the findings of the present study. According to Warjiyo (1998), the exchange rate of the rupiah can be effectively depressed by using interest rates as an operational target for monetary policy. Noor (2014) did research on the relationship between inflation, interest rates, and money supply and found that there is a relationship between interest rates and money supply and exchange rates. Murtadho (2016), changes in interest rates in a country can have an impact on exchange rates. Therefore, the price of goods in the market has increased, thereby reducing the level of profits and reducing the level of production of the company.

The influence of GDP on the exchange rate is significantly positive in the log run and has no effect in the short run, in contrast to inflation and interest rates. In the long run, economic growth has a significantly impact on the rupiah exchange rate in the long run. This statement is following the theory put forward by Sukirno (2004), the effect of economic growth on the exchange rate depends on the prevailing pattern of economic growth. If economic growth is caused by increased exports, the demand for currency will increase.

Conclusion

The purpose in this study to analyze the influence of the money supply on the exchange rate in Indonesia (2000-2021) and to analyze whether there is an application of the Dornbusch Overshooting Model. According to the estimation results from this study, the money supply's short-term influence on the exchange rate is 2.46 percent greater than its long-term influence, which is 2.38 percent. Therefore, it can be say that there is a Dornbusch Overshooting Model phenomenon in Indonesia. Then, the relationship between inflation and exchange rate has a different effect between the short-run which has a positively effect (appreciation), and the long-run which has a negative effect (depreciation). The impact of interest rates and inflation is inverse, with interest rates having a short run negative influence and a long run positive impact on the exchange rate. The influence of GDP on the exchange rate is significantly positive in the long run and has no effect in the short run, in contrast to inflation and interest rates.

According to the research findings, there are two types of recommendations that can be made: theoretical recommendations and practical recommendations. To ensure exchange rate stability, monetary authorities are given helpful information. It is crucial to pay attention to the factors that influence exchange rate fluctuations such as money supply growth because a 1 percent change in the money supply results in a change of more than 1 percent in the exchange rate. Then, theoretical advice is given to academics in order for more extensive research involving many nations in both countries to result in more sophisticated recommendations regarding exchange rate stability.

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