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Dynamic Behavior of the IDR/USD Exchange Rate with a Monetary Model Approach

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Abstract

This research aims to determine the behavior of the IDR/USD using the monetary approach. This study uses the Vector Error Correction Model (VECM) methods and using eviews 9 software. The data used in this research is data from the 2001q1-2022q3 period in the form of quarterly data. The results of this research show that IDR/USD exchange rate behavior based on a monetary model approach consisting of the Bilson, Dornbush, and Frankel model found that the average response was the difference in economic growth, the difference in money supply, and the difference in interest rates, as well as the difference in inflation when an exchange rate shock occurred. The IDR/USD shows a positive trend. Furthermore, the dynamic structure of the Bilson, Dornbush, and Frankel model shows that the economic growth difference variable has the highest contribution and the money supply growth difference variable has the lowest contribution value.

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Introduction

Exchange rates are becoming a growing topic for empirical research. This is because the exchange rate is an important factor in supporting international trade performance. Exchange rates in international trade transactions have a role as an agreed currency as a means of payment that can be accepted by both countries (export parties and import parties) because the two countries have different currencies. Therefore, countries whose currencies are not included in hard currencies must convert to one of the hard currencies (Taylor, 2003).

Currency conversion carried out to carry out international trade results in changes in exchange rate behavior. Changes in exchange rate behavior depend

on the exchange rate system adopted by a country. Recent developments show that the exchange rate system used by a country is a floating exchange rate system (flexible exchange rate) or a managed flexible exchange rate (Sarno &; Taylor, 2016).

The flexible exchange rate system applied results in uncertain exchange rate behavior, making it not easy to predict. Uncertain exchange rates can be known from changing exchange rates, sometimes the value strengthens but sometimes weakens. Humprey (1992) said that one approach in the international financial literature to analyze changes or behavior of exchange rates is the monetary model approach. The monetary model approach has been developed by Bilson, Dornbusch, and Frankel. There is a difference between the three, which lies in the sign of interest rates and inflation. Interest rates with a positive sign mean flexible prices while negative signs mean sticky prices (Afat et al, 2015). The flexible price model was built by Bilson, while the sticky price monetary model describes prices as rigid in the short run and flexible in the long run built by Dornbusch and Frankel.

The monetary approach developed by Bilson, Dornbusch, and Frankel has in common the sign of the coefficient on the difference in the money supply of domestic countries with foreign countries. The difference has a positive impact on the exchange rate. This means that the value is expected to depreciate if the domestic money supply grows faster than the foreign money supply (Sarantis & Stewart, 1995).

The difference in the variable difference between domestic and foreign interest rates occurs in the model built by Bilson with Dornbusch and Frankel. The variable difference between domestic interest rates and foreign countries has a positive sign, meaning that when domestic interest rates increase relative to foreign interest rates, there will be a weakening in the domestic currency through inflation (Mishkin, 2008).

The difference between domestic and foreign inflation is only in the model built by Frankel. The difference between domestic and foreign inflation has a positive impact on the exchange rate. This means that if the level of domestic inflation expectations is higher than the level of foreign inflation expectations, because domestic demand for real money increases, then the domestic exchange rate depreciates (Gandolfo, et al., 1990).

The advantage of the monetary model approach built by Bilson/Dornbush is that this model applies the concept of Purchasing Power Parity (PPP) which is assumed to exist in the long and short term. The shortcomings in the monetary model built by Bilson / Dornbush are that this model only uses 3 research variables, namely the difference in growth in the money supply, the difference in economic growth, and the difference in inflation. The approach of the monetary model built by Bilson has advantages and disadvantages where this model has improved from the model built by Bilson/Dornbush by adding the variable difference in inflation in the model. However, in Frankel's model, the application of the concept of Purchasing Power Parity (PPP) is only assumed to exist in the long run. So, the best model in the monetary model approach used is the model built by Frankel because it is a refinement of the model Bilson/Dornbush.

The description of the previous paragraph raises several issues raised in this study. First, a country with another country cannot conduct international trade, if soft currency is not converted to hard currency currency. Second, the implementation of a flexible exchange rate system results in unpredictable

exchange rate behavior, so policymakers continue to monitor exchange rate conditions in the forex market and carry out risk management that can minimize the impact of exchange rate instability. Third, the monetary model approach derived from the theory of money demand, PPP, and interest rate parity tries to be able to explain exchange rate behavior, so that the monetary approach model can be further analyzed related to controlling exchange rates.

Research conducted by Jallow et al., (2020) tested and analyzed inflation and interest rates in The Gambia. The methods used are Fully Modified Ordinary Least Square (FMOLS), Dynamic Ordinary Least Square (DOLS), and Canonical Cointegrating Regression (CCR). The estimation results show that in the long run, there is a positive relationship between inflation and the exchange rate, and interest rates are negatively related to the exchange rate.

Kilicarslan's research, (2018) examines and analyzes the determinants of exchange rate volatility in Turkey. The methods used are GARCH and FMOLS. The estimation results show that the root test of the ADF and PP units shows that the series is stationary at the first difference. Based on the results of the Johansen cointegration test, a long-term relationship was found between the variables involved in the analysis. The results of the FMOLS method to determine the direction and severity of long-term relationships between variables show that LGFCF, LMONEY, and LTRADE have a significant positive effect, while LFDI, LGDPC, LGGEXP have negative effective exchange rate volatility.

Research conducted by Suidarma et al., (2018) aims to identify the determinants of overshooting the rupiah exchange rate against the US dollar and test the Dornbusch model hypothesis. In his research, he used the Vector Error Correction Model (VECM). The results show that in the long run, the variable money supply has a negative influence on the exchange rate, while in the short run the exchange rate, inflation, economic growth, and interest rate policy have a significant influence on the exchange rate.

Researchers Kilicarslan, (2018), Jallow et al., (2020), and have gaps in samples, methods, and results. This means that every study has differences. Based on the differences in empirical research that have been outlined, this study develops several things to contribute to related research, so that previous research gaps can be supported by this study.

Based on the issues, phenomena, and problems as well as research gaps from previous studies, the author chose the title "Dynamic Behavior of the IDR/USD Exchange Rate with a Monetary Model Approach".

RESEARCH METHODS

Data Types and Sources

The source of data in this study is a secondary source. Secondary sources are data collection techniques whose sources are not obtained or provided directly, but the data is obtained through documents (Kosanke, 2019). This research was obtained from document sources on international data websites, namely the Bank of Louis (Federal Bank) and International Financial Statistics-IMF Data.

Table 1. Data Types and Sources

Variabel	Data Types	Source
Exchange Rate $US/IDR	Sekunder	www.stlouisfed.org
Difference in Money Supply Growth	Sekunder	https://data.imf.org and www.stlouisfed.org
Economic Growth Difference	Sekunder	www.stlouisfed.org
Interest Rate Difference	Sekunder	www.stlouisfed.org
Inflation Difference	Sekunder	www.stlouisfed.org

Models

The dependent variables in this study are bound values and for independent variables, namely the difference in money supply growth, the difference in economic growth, the difference in interest rates, and the difference in inflation Lin & Su, (2020). The equation model in this study can be estimated as follows:

$$E = \propto + \beta 1\ (m - m*) + \beta 2\ (y - y*) + \beta 3(i - i*) \quad (3.1)$$

$$E = \propto + \beta 1\ (m - m*) + \beta 2\ (y - y*) + \beta 3(i - i*) + \beta 4\ (\pi - \pi*) \quad (3.2)$$

Description:

Model Bilson $\beta 1 > 0; \beta 2 < 0; \beta 3 > 0; \beta 4 = 0$

Model Dornbusch $\beta 1 > 0; \beta 2 < 0; \beta 3 < 0; \beta 4 = 0$

Model Frankel $\beta 1 > 0; \beta 2 < 0; \beta 3 < 0; \beta 4 > 0$

m is the growth of the domestic money supply, $m*$ is the growth of the foreign money supply, y is the growth of the domestic economy, $y*$ is the growth of the foreign economy, i is the domestic rate, $i*$ is the foreign interest rate, π is inflation, $\pi*$ is foreign inflation.

Dependent Variables

The exchange rate variable is the dependent variable. The data used in this study is the Indonesian exchange rate in dollars-rupiah, data in the form of time series, namely quarterly data from 2001-2022. The exchange rate is transformed into a natural logarithm.

Independent Variable

There are four independent variables used:

The variable difference in economic growth in this study uses the difference in economic growth of the United States and Indonesia. The data used in this study is in the form of a time series from 2001-2022 in the form of percent. The information is eg_usa is the economic growth of the United States, and eg_ind is the economic growth of Indonesia.

$$eg\_diff = eg\_usa - eg\_ind \quad (3.3)$$

The variable difference in money supply in this study uses the difference in the growth of the money supply of the United States and Indonesia which is used as an independent variable. The data is in percent form during the period 2001-2022. The information is m_usa is the money supply of the United States, and m_ind is the money supply of Indonesia.

$m\_diff = m\_usa - m\_ind$..... (3.4)

The inflation variable in this study uses the difference in inflation between the United States and Indonesia. The data used in this study is in the form of a time series from 2001-2022 the data is in the form of a percent. Description, inf_usa is US inflation, and inf_ind is Indonesian inflation.

inf$_diff = inf_usa - inf_ind$..... (3.5)

The variable interest rate difference in this study uses the average difference in interest rates of the United States and Indonesia. The data used in this study is in the form of a time series from 2001-2022 in the form of percent. Description, ir_usa is the interest rate of the United States, and ir_ind is the interest rate of Indonesia.

$ir\_diff = ir\_usa - ir\_ind$..... (3.6)

Research Methods

Data analysis in this study used the Vector Error Correction Model (VECM). The process of the VECM method goes through several steps such as conducting stationary tests, optimal lag tests, Johansen cointegration tests, and analyzing long- term and short-term estimation results, then analyzing impulse response and variance decomposition.

Stationary Test Test stationarity using Augmented Dicky Fuller. The stationary test is used to see if the data is stationary or non-stationary. If the data is non-stationary, a differentiation process is carried out until the data is stationary.

$\Delta yt = y + \delta Trend + ayt{-}1 + \sum m\ \beta 1 \Delta yt{-}1 + et$ .....(3.7)

Δyt is the form $yt - yt{-}1$ or first derived form, γ is the ADF constant, y is the stationary checked variable, β is the lag parameter y, m is the lag length used in the model, Trend is the time trend, δ is the parameter of the trend, is interference with white noise. Stationary and non-stationary tests use the ADF test by looking at the ADF p-value (Woldridge, 2015).

Optimal Lag Test can be seen from several criteria, namely from SBIC (Schwartz Bayesian Information), HQIC (Hannah Quin Information), AIC (Akaike information), LR (Likelihood Ratio), and FPE (Final Prediction Error). Previou sly, the search for optimum lag will be carried out first, which is preceded by the VAR test (Enders, 2008).

Johansen Cointegration Test is a long-term relationship between variables. The existence of non-stationary variables makes it most likely that there is a long-term relationship between variables in the system. Cointegration tests are carried out to determine the existence of relationships between variables, especially in the long term. If there is a cointegration in the variables used in the model, it can be ascertained that there is a long-term relationship between the variables (Woldridge, 2015).

The method that can be used in testing the existence of this cointegration is the Johansen Cointegration method. In the model in this study, the variables are cointegrated in the long run, which is shown by trace statistics > critical value of 5%. Meanwhile, in the long run, the variables will affect each other, which is indicated by an asterisk in the Eviews results.

VECM Test After cointegration is known, the next test process is carried out using the error correction method. If there is a difference in the degree of integration between test variables, the test is carried out simultaneously (jointly) between the long-term equation and the error correction equation, after it is known that in the variable cointegration occurs. However, if no cointegration phenomenon is found, then the test is continued using the first difference variable (Gujarati, 2022). The assumption that must be met in the VECM analysis is that all independent variables must be stationary at the I(0) level and cointegrated. It is characterized by an average value of zero, constant variation, and among non-free variables there is no correlation. Here's the VECM estimation model in this study: $[\Delta LnExcht] = [\alpha] + [\delta 1 \quad \delta 2 \quad \delta 3 \quad \delta 4] \times [\Delta LnExcht{-}i \quad \Delta m\_difft{-}i \quad \Delta eg\_difft{-}i \quad \Delta ir\_difft{-}i] + \tau[ECTt{-}1] + [e1]$..... (3.12)

Description:

α	: costanta
$\delta 1 \ldots . \delta 4$	: coefficient of endogenous variable
τ	: error correction term coefficient
e1	: error term
i	: i-th lag
t	: subscript time series
m_diff	: the difference in the money supply between the United States and Indonesia
eg_diff	: the difference in economic growth between the United States and Indonesia
ir_diff	: United States-Indonesia interest rate difference
Ln	: logaritma natural
Δ	: First Difference

RESULT

Stasioner Test

The stationarity test of a data is the first stage in the VECM method. This test is done by testing all variables, from the dependent variable to the independent variable. The data stationarity test aims to see the results of non-sprious regression regression, namely the presence of non-stationary data. Researchers used the Augmented Dickey-Fuller root test (ADF) which has been widely used by econometricians in conducting stationary tests.

Converting data into logarithmic form is one of the efforts to get stationary data. In the testing process, researchers used Eviews 9 software. Data testing in stationary tests is carried out in three stages, namely; Stage one testing at the level level, if the data tested results are not stationary then stage two testing can be carried out. Stage two is testing at the first level difference and the third stage is second difference. Based on the results of the stationary test in Table 2, it can be seen that at the variable level of the exchange rate, the difference in growth in the money supply, the difference in economic growth, and the difference in inflation are

declared not to pass the stationary test. While the variable interest rate difference is declared to pass the level stationary test.However, at the First Different level of exchange rate variables, the difference in growth in the money supply, the difference in economic growth, the difference in interest rates and the difference in inflation are declared to pass the stationary test.

Table 2. Stationary Test Results Augmented Dickey Fuller (ADF)

Variabel	Model Bilson/Dornbush		Model Frankel	
	I(0)	I(I)	I(0)	I(I)
ln_exch	0.8783	0.0000	0.8783	0.0000
m_diff	0.2658	0.0000	0.2658	0.0000
eg_diff	0.1582	0.0000	0.1582	0.0000
ir_diff	0.0323	0.0000	0.0323	0.0000
inf_diff	-	-	0.3627	0.0000

Description : * Significant at the level 5%
Source : Output Eviews 9 (Processed)

The exchange rate variable at the level of the ADF probability value level is 0.8783. This is above the error rate of 5%. So it can be said that it is not stationary. While at the first different level, the exchange rate variable is declared stationary because it has an ADF probability of 0.0000.

The value is lower than the error rate of 5%, so it can be said to be stationary. The variable difference in money supply growth has an ADF probability value of 0. 0.2658 at the level level. The value is above the error rate of 5%, so it is stated that the data is not stationary at the level level. While at the first difference level the variable difference in the growth of the money supply has an ADF probability value of 0.0000. In conclusion, H0 is rejected and H1 is accepted and the value is declared significant because it is below the error rate of 5%. In other words, at the level of first difference variables, the difference in economic growth is already stationary.

Then for the variable interest rate difference is worth the probability of ADF worth 0.0323. The value is below the error rate of 5%, so it is stated that the data is stationary at the level level. While at the first difference level, the variable interest rate difference is worth the ADF probability of 0.0000. In conclusion, H0 is rejected and H1 is accepted and the value is declared significant because it is below the error rate of 5%. In other words, the variable data on the difference in interest rates at the first difference rate is already stationary.

Furthermore, for the inflation difference variable, the ADF probability value is 0.3627. The value is above the error rate of 5%, so it is stated that the data is not stationary at the level level. While at the first difference level of the variable, the difference in inflation is worth the ADF probability of 0.0000. In conclusion, H0 is rejected and H1 is accepted and the value is declared significant because it is below the error rate of 5%. In other words, the variable data on the difference in interest rates at the first difference rate is already stationary.

Test Optimal Lag

Determining the optimal lag length is important in VECM modeling. Determining optimal lag not only shows how long it takes one variable to respond to another, but also helps eliminate autocorrelation problems in the VECM system.

In addition, optimal lag can be indicated by the length of lag that affects or responds significantly.

Several criteria can be used to determine the optimal lag length, namely SBIC (Schwartz Bayesian Information), HQIC (Hannah Quin Information), AIC (Akaike information), LR (Likelihood Ratio), and FPE (Final Predicition Error). The results of the optimal lag length check are shown in the following table:

Tabel 3. Optimal Lag Test Results

Model Bilson/Dornbush		Model Frankel	
Lag	AIC	Lag	AIC
0	6.926333	0	10.85506
1	6.168790	1	10.08327
2	6.151942	2	10.17005
3	6.245951	3	10.10200
4	6.028117*	4	9.914105*

Description : Marked *
Source : Output Eviews 9 (processed)

Based on the results of the optimal lag length examination in table 3. The smallest AIC criterion value is indicated by an asterisk. It can be seen that the asterisk is at lag 4. It can be concluded that the optimum lag length is lag 4.

Johansen Cointegration Test

Furthermore, a cointegration test is carried out to see if there is a long-term relationship or balance between variables. A commonly used cointegration test in the VECM method is the Johansen Cointegeration Test. The testing criteria for the Johansen cointegration test are as follows:

Hypothesis:
H0: no cointegration
H1: there is cointegration

The results of the Johansen cointegration test between exchange rate variables, the difference in money supply growth, the difference in economic growth, the difference in inflation, and the difference in interest rates in the following table:

Tabel 4. Johansen Cointegration Test

Rank	Model Bilson/Dornbush		Model Frankel	
	Trace Statistic	5% Critical Value	Trace Statistic	5% Critical Value
0*	106.4645	47.85613	143.5946	69.81889
1*	57.13096	29.79707	91.23095	47.85613
2*	30.53209	15.49471	56.67758	29.79707
3*	13.47438	3.841466	29.62577	15.49471
4*	-	-	12.37150	3.841466

Description : Marked Cointegration*
Source : Output Eviews 9 (Prosseced)

Table 4 of the results of the Johansen cointegration test can be seen that in the Trace test all trace statistical values are greater than the critical value of 5%, then the test results obtained namely H0 are rejected (there is cointegration). So it can be concluded that there are 4 cointegrations or long-term relationships detected between exchange rate variables, the difference in the growth of the money supply, the difference in economic growth, the difference in interest rates, and the difference in inflation. In VAR modeling, cointegration tests are also used to determine later model decisions. Because this test detected that there is a cointegration or long- term relationship between variables, modeling cannot be continued with the VAR model but replaced with the VECM (Vector Error Correction Model) model.

VECM Model Estimation and Inspection

In the cointegration test, it was found that there is a cointegration or long-term relationship between variables, so the VAR model cannot be continued but replaced with the VECM model. To determine the variables that have a significant effect, the significance test is carried out by comparing the statistical value t calculate the estimated results with the value of t table (α, n − 1) where α = 5% and n = number of observations. Based on the results of the optimal lag test, the lag used in the VECM analysis is lag 4. So the VECM model was obtained.

The estimation of the VECM model is able to explain the long-term and short-term influence between the dependent variable and the independent variable. The estimation results between the dependent variable (exchange rate) and the independent variable (the difference in the growth of the money supply, the difference in economic growth, the difference in interest rates, and the difference in inflation) are presented in table 4.

Based on the results of long-term and short-term estimates presented in table 4. in the Bilson/Dornbush model the variable difference in growth in the money supply and the difference in economic growth has a significant effect both in the long run but the variable difference in growth in the money supply has no effect on the short term. While the variable difference in interest rates, both long-term and short- term, has no effect on the exchange rate. In the short-run Frankel model, the variable difference in economic growth and the difference in inflation has a significant effect, while the variable difference in growth in the money supply and the difference in interest rates has no effect. However, in the long run all variables have an influence on exchange rates The t-table results of this study are 1.98896 for the Bilson/Dornbush model and 1.989319 for the Frankel model The data is said to be significant or cannot be seen from the results of t-statistics and t-tables. If t-statistics > t-tables then the data is declared significant and if t-statistics < t-tables then the data is declared insignificant. Long-term and short-term estimates can be explained as following:

Short-term

The variable difference in money supply growth has no effect on exchange rates in the short run either in the Bilson/Dornbush model or in the Frankel model. This is shown from t-statistics on the difference in the growth of the money supply in both model I and model II values below the t-table.

The variable difference in economic growth significantly positively affects the exchange rate in the short run in both the Bilson/Dornbush model and the Frankel model. This is indicated by the t-statistical value of the difference in economic growth whose value is more than the t-table. The coefficient of economic growth difference in the Bilson/Dornbush model is 0.203049 and in the Frankel model is 0.754261. This means that an increase in the difference in economic growth of one percent in the previous period can appreciate the exchange rate by 0.203049 percent if using the Bilson/Dornbush model and by 0.754261 if using the Frankel model.

The variable interest rate difference has no effect on exchange rates in the short run either in the Bilson/Dornbush model or in the Frankel model. This is shown from the t-statistic on the difference in interest rates below the t-table. The coefficient of difference in inflation in Frankel's model is 1.162341. This means that an increase in the difference in inflation of one percent in the previous period can appreciate the exchange rate by 1.162341 percent.

Long-term

The variable difference in money supply growth significantly negatively affects the exchange rate in the long run by -0.284511 in the Bilson/Dornbush model and -0.106507 in the Frankel model. This means that an increase in the difference in money supply growth of one percent in the previous period can depreciate the exchange rate by 0.284511 percent if using the Bilson/Dornbush model and 0.106507 if using the Frankel model.

The variable difference in economic growth significantly positively affects the exchange rate in the long run both in the Bilson/Dornbush model of 1.206260 and the Frankel model of 0.410188. This means that an increase in economic growth difference of one percent in the previous period will appreciate the exchange rate by 1.206260 percent if using the Bilson/Dornbush model and by 0.410188 percent if using the Frankel model.

The variable interest rate difference significantly negatively affects the exchange rate in the long run by -0.112432 in the Frankel model. This means that an increase in the interest rate difference of one percent in the previous period can depreciate the exchange rate by 0.112432 percent. Whereas in the Bilson/Dornbush model, the difference in interest rates has no effect on the exchange rate in the long run. The variable interest rate difference significantly positively affects the exchange rate in the long run in the Frankel model the value is 0.136639. This means that an increase in the interest rate difference of one percent in the previous period can increase the exchange rate by 0.136639 percent.

The variable difference in inflation significantly positively affects the exchange rate in the long run in the Frankel model the value is 0.136639. This means that an increase in the difference in inflation of one percent in the previous period can appreciate the exchange rate by 0.136639 percent.

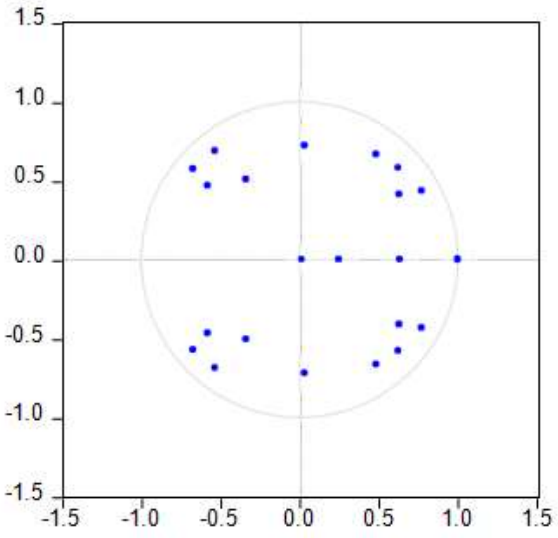
Tabel 5. VECM Estimation Test

Variabel	Model Bilson/Dornbush				Model Frankel			
	Short-Terim		Long-Term		Short-Term		Long-Term	
t-tabel 1.987608	Coefficient	t-statistik	Coefficient	t-statistik	Coefficient	t-statistik	Coefficient	t-statistik
ln_exch	-0.005867	-2.01904	1.000000	-12.77908	-0.27770	-2.64436	1.00000	-9.826539
m_diff	0.259511	0.96432	-0.284511	2.78820*	1.256755	1.18034	-0.106507	4.16718*
eg_diff	0.203049	3.25433*	1.206260	-3.70023*	0.754261	3.18204*	0.410188	-5.86714*
ir_diff	0.055438	0.97143	0.186413	-1.21072	-0.115899	-0.50818	-0.112432	2.80362*
inf_diff	-	-	-	-	1.162341	2.12050*	0.136639	-4.37611*

Description : Significant marked *
Sumber: Output Eviews 9 (prosseced)

From table 5 it can be known the robustness test of the model (robustness test) where the test is to determine the robustness of a variable. The robustness test in this study compares the strength of two existing models, including the Bilson/Dornbush model and the Frankel model. From the table it can be seen that the Frankel model has a t-statistical value that is significantly consistent with the results of the hypothesis test, so that this model has a considerable influence in suppressing the difference in the growth of the money supply, the difference in economic growth, the difference in interest rates, and the difference in inflation against the exchange rate. So, it can be concluded that in this study the model from Frankel is more study than the model of Bilson and Dronbush.

VECM Parameter Stability Test



Picture 1. VECM Parameter Stability Test

A VECM model is said to be stable if all its roots have a modulus smaller than 1 or are not outside the environment. Figure 4.1 shows that the VECM model is stable because nothing is out of the circle.

DISCUSSION

The estimation results from this study used the Bilson/Dornbush model, and Frankel to test the long and short term. The estimation results show that in the Bilson, Dornbush and Frankel models, the variable difference in money supply growth has no influence on the exchange rate of the United States dollar against the rupiah in the short term. While in the long run the variable difference in money supply growth has a significant negative effect on the exchange rate of the United States with a coefficient of -0.284511 Bilson and Donbush models while the Frankel model coefficient of growth of the money supply -0.106507. This means that an increase in the difference in money supply growth of one percent in the previous period can reduce the depreciated exchange rate by 0.2854511 percent with the Bilson/Bornbush model 0.106507 in the Frankel model. The results of this estimation are supported by research conducted by Suidarma, (2018). The results show that in the long run the variable money supply has a negative relationship with exchange rate movements where an increase in the money supply causes exchange rate depreciation. In the short term, it does not affect the exchange rate significantly, this is because the Dornbush hypothesis of overshooting exchange rates does not occur in Indonesia.

The estimation results from this study used Bilson, Dornbush, and Frankel models to test the long and short term. The estimation results show that in the Bilson/Dornbush and Frankel models, the variable difference in economic growth has a significant positive effect on the exchange rate of the United States dollar against the rupiah in the short term, both Bilson, Dornbush, and Frankel models with a coefficient of 0.203049 Bilson, Dornbush models of 0.754261 in the Frankel model. This means that an increase in the difference in money supply growth of one percent in the previous period can increase the appreciated exchange rate by 0.203049 percent with the Bilson and Bornbush models by 0.754621 on the Frankel model. While in the long run the variable difference in economic growth has a significant positive effect on the exchange rate of the United States with a coefficient of 1.206260 Bilson / Dornbush model while the Frankel model coefficient of economic growth difference is 0.410188. This means that an increase in the difference in circulating economic growth of one percent in the previous period can increase the appreciated exchange rate by 1.206260 percent with the Bilson/Bornbush model of 0.410188 in the Frankel model.

The results of this estimation are supported by research conducted by Afriyanti, (2018). The results show that in the long run the exchange rate is affected by inflation and economic growth. Meanwhile, in the short run, the exchange rate is not influenced by inflation and economic growth variables. Together, inflation and economic growth have a significant effect on exchange rate variables. This insignificant relationship is due to Indonesia's relatively stable economic growth rate and Indonesians tend to choose to use goods from abroad rather than domestic goods. This situation causes poor economic fundamentals and then also has an impact on macroeconomics in Indonesia so that Indonesian people prefer to buy goods rather than hold money. The government continues to strive to increase economic growth, especially through increasing the number of exports and foreign investment. Rising exports and foreign investment will drive a surplus. The increase in surplus is expected to increase economic growth and appreciate the exchange rate.

The estimation results from this study used the Bilson/Dornbush model,

and Frankel to test the long and short term. The estimation results show that in the Bilson/Dornbush and Frankel models, the variable interest rate difference has no influence on the exchange rate of the United States dollar against the rupiah in the short term. While in the long run the variable interest rate difference with the Bilson/Dornbush model does not have a significant effect on the exchange rate, but based on the Frankel model the interest rate difference has a significant negative effect on the United States exchange rate with a coefficient of -0.112432. This means that an increase in the interest rate difference of one percent in the previous period can reduce the depreciating exchange rate by 0.112432. The results of this estimation are supported by research conducted by Murtala et al., (2017), Joof & Jallow, (2020) and Demak et al., (2018). The results show that in long-term analysis interest rates have a significant and negative effect, implying that rising interest rates can cause exchange rates to depreciate.

The estimation results from this study used the Bilson/Dornbush model, and Frankel to test the long and short term. The estimation results show that in the Bilson/Dornbush model, the variable difference in inflation has no influence on the exchange rate of the United States dollar against the rupiah, either in the short or long run, this is because the Bilson/Dornbush model does not impose the variable difference in inflation. While in the Frankel model in the short and long term the variable difference in inflation has a significant positive effect on the exchange rate of the United States dollar with a coefficient of 1.162341 for the short term and a coefficient of 0.136639 for the long term. This means that an increase in the difference in inflation of one percent in the previous period can raise the exchange rate to appreciate by 1.162341 in the short term and 0.136639 in the long term.

The results of this estimate are supported by research conducted by Joof & Jallow, (2020) and Demak et al., (2018). The results show that in both long-term and short-term analyses inflation has a significant and positive effect, implying that rising inflation can cause the exchange rate to appreciate. The Government and Bank Indonesia continue to suppress imports through trade policy and inflation control. It is expected that with the decreasing import rate and controlled inflation, it will be able to appreciate the exchange rate to reach an equilibrium level.

CONCLUSION

Based on Bilson, Dornbush and Frankel's model, in the short run the variable difference in economic growth has a significant positive effect, the variable difference in growth in the money supply and the variable difference in interest rates do not have a significant effect on the exchange rate. Frankel's model of variable inflation difference has a significant positive effect. In the long run, the variable difference in growth in the money supply has a significant negative effect, the variable difference in economic growth and the difference in inflation has a significant positive effect. The variable interest rate difference had a significant negative effect on Frankel's model and had no significant effect on the Bilson and Dornbush models.

Based on the Bilson, Dornbush and Frankel model, the average response given when there is a shock between variables against the exchange rate of the United States dollar shows a positive trend.

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