

FLUCTUATION RATE ANALYSIS OF RUPIAH EXCHANGE IN THE INDONESIAN OPEN ECONOMY

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ABSTRACT: *This research aimed to analyze the long-term balance between KURS (Rate of Exchange), inflation (INF), Foreign Direct Investment (FDI), interest rate of Bank Indonesia (SBI), and the degree of openness of Economics (DKE) An open economy Indonesia using time series data period 1998: 1-2016: 4. Models Autoregressive Distributed Lag (ARDL) was used to observe the effect of these variables. The results show that there is a balance of long-term fluctuations in the exchange Rate against the US dollar which is influenced by the variable inflation and SBI are negatively correlated with the exchange rate. While the FDI variable and the degree of economic openness is positively correlated with the exchange rate. The degree of openness of the economy, inflation, FDI leads to fluctuations on the exchange rate. In the long term, SBI gives a significant effect on the exchange rate. Among the exchange rate with the degree of economic openness has a positive and significant impact. This means that increasing the degree of economic openness, it will result in the appreciated (US dollar depreciated). Economic openness leads to significant fluctuations in exchange rates in the short term and long term.*

KEYWORDS: Exchange rate rupiah/US \$, Degree of Openness, Interest Rate of Bank Indonesia, Inflation, Foreign Direct Investment, Autoregressive Distributed Lag (ARDL).

INTRODUCTION

Economic openness is increase with economic cooperation (bilateral and multilateral) (Center for Regional and Bilateral Policy, 2013). Indonesia's economic openness is marked by Indonesia's participation in international trade organizations, including Asia-Pacific Economic Cooperation (APEC) - 1989, World Trade Organization (WTO) - 1994, ASEAN Free Trade Area (AFTA) - 2002, ASEAN-China Free Trade Area (ACTFA) - 2004, ASEAN-Korea Trade Area (AKFTA) - 2007, Indonesia-Japan Economic Partnership - 2007, ASEAN-Australia Free Trade Area (AANFTA) - 2012.

The financial crisis has been a driver of economic openness in ASEAN countries. The degree of openness (trade/GDP ratio) increased remarkably in 1998 (excluding Singapore) and did not return to pre-crisis levels (Heiduk and Zhu, in Welfens et al. (Eds.), 2009). Economic openness results in improved revenue growth and equity all at once when the economy passes a certain threshold and when using goods between imports in the production process (Lim and McNelis, 2016). Inflation and exchange rate are negatively related to short-term and long-term economic openness (Abdullah and Khaled, 2015). Economic openness is efficient. The cost of economic openness is less than the increase in GDP (Manurung, 2012).

The impact of economic openness on heterogeneous economic growth by income, growth rate, and several other factors (Semancikova, 2016). Economic openness has a positive impact on

growth (Sun and Heshmati, 2010; Arif, 2012; Herawati, 2016). The degree of exchange rate flexibility is not related to growth (Rodriguez, 2017). The degree of high financial openness can reduce the negative impact of exchange rate flexibility on growth (Rodriguez, 2017). Financial openness promotes domestic financial markets, improves corporate and public governance, and provides incentives for greater macroeconomic policy discipline (Kose, Prasad, and Terrones, 2009 in (Rodriguez, 2017)).

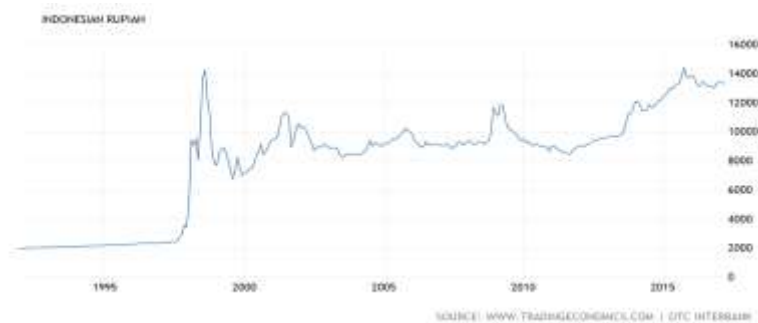
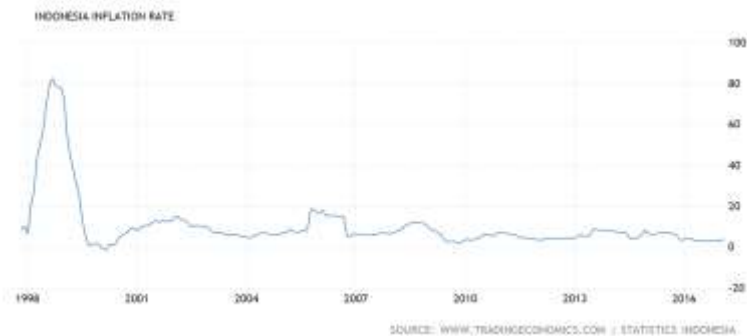
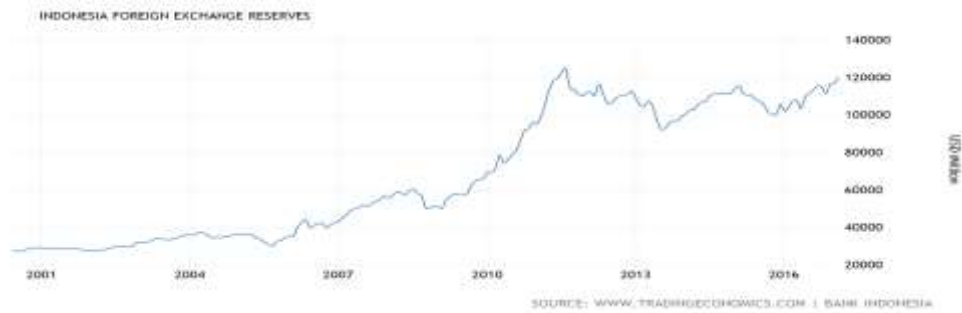
In the case of Indonesia, since the introduction of a floating exchange rate system since August 14, 1997, Indonesia has allowed the exchange rate to fluctuate according to economic conditions, but BI must maintain the stability of the rupiah and exchange rates and should always be ready to intervene in the market. A floating exchange rate system causes the movement of exchange rates on the market to be particularly vulnerable by the influence of economic and non-economic factors (Ramelan, 1999). Indonesia is a small and open economy. The steep inflation rate due to the weakening of the rupiah and the surge in money demanded a contractionary macroeconomic policy (BI 1998-99 Annual Report). Increased foreign exchange reserves and low inflation may not guarantee exchange rate stability.

The exchange rate of ASEAN countries in the early post-crisis years has appreciated, but it has depreciated steadily since 2011-2012. The Indonesian rupiah depreciates more. The following Figure 1 shows the exchange rates of several countries in Asia. Based on the picture, Indonesia experienced a considerable depreciation in comparison with other countries.



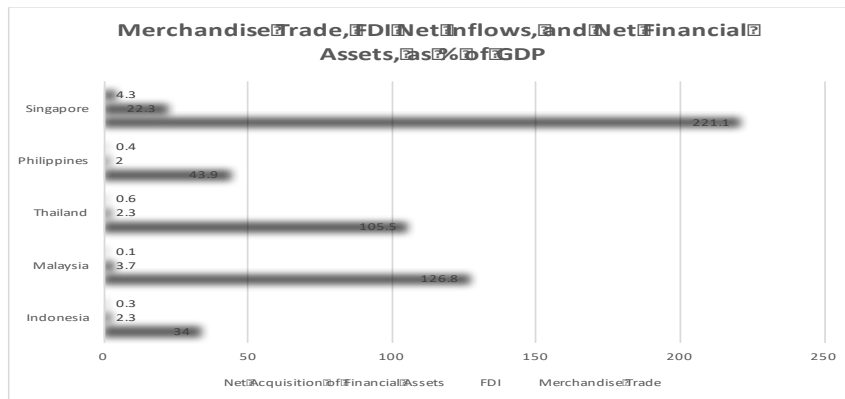
Source: Vladimir Klyuev and To-Nhu Dao, 2016.

Next, the following graphic images show the condition of Indonesia's foreign exchange reserves, inflation, and exchange rate from the 90s to 2016.



Based on the above graphic images shows significant fluctuations in foreign exchange reserves, inflation, and exchange rates. Although foreign exchange reserves are increasing, and inflation is manageable, it does not guarantee a stable exchange rate.

Furthermore, the condition of Indonesia's economic openness is still under 5 ASEAN countries. Indonesia's economic openness from the trade side is still under the state of Singapore, the Philippines, Thailand and Malaysia. The highest economic openness is owned by Singapore and the lowest is Indonesia. The situation is shown by the following graphic.



Source: data.worldbank.org

Trade openness Indonesia also experienced a downward trend after the 1998 crisis. In 1998 the economic openness was at 89.7 percent. The situation continues to decline until 2015 which is in the range of 34 percent. This is marked by the smaller export and import activities on GDP (Gross Domestic Product).



Source: data.worldbank.org

The purpose of this study is to determine whether there is a long-term balance of exchange rate fluctuations of the rupiah against the US dollar in Indonesia's open economy Period of 1998-2016?

EMPIRICAL LITERATURE

Economic openness is increasingly the loss of barriers in trading, whether in the form of export-import, tariff or non-tariff and the smoothness of capital mobility between countries through international trade, (Nopirin, 1999). The open economy is the occurrence of exports and imports of goods and services as well as capital movement in and out between one country with another to GDP, (Mankiw, 2006), (Romer, 1993). Open economy is the occurrence of exports and imports of goods and services as well as capital movement in and out between one country with another country (Makin, 2001). In this research, economic openness is defined as export plus import to GDP. Furthermore, in this study it is expected that readers will understand

the Exchange Rate, Interest Rate Parity Theory, Purchasing Power Parity Theory, International Fisher Effect Theory. The assumption used in this research is Indonesia as a small and open economic with perfect capital mobility. Furthermore, in adoption is also the theory of open economic system of Mundell-Fleming.

Previous Research and Hypothesis

Simorangkir (2006) stated that trade openness causes significant fluctuations in exchange rates and inflation in the short and long term. And financial openness leads to significant fluctuations in exchange rates and inflation in the short term. Depari (2009) stated that the index of degree of economic openness affects the exchange rate of Rupiah / US \$ in Indonesia. Abdillah (2006), stated that the factors that influence the fluctuation of exchange rate are the Money Supply, Inflation, and Interest Rate. Sanusi (2007) stated that the money supply, interest rate, forex in banking, foreign currency monetary authority, have a significant influence on exchange rate fluctuations, while inflation does not give a significant effect. The hypothesis in this study is "It is suspected that there is a long-term balance of fluctuations in the rupiah exchange rate against the US dollar in the Indonesian open economy Period of 1998-2016".

METHODOLOGY AND RESULTS

This research use ARDL method. This is because data is not integrated in the same order (Iskandar, 2009). If the dependent and free variable are not stationary at the same level and are not cointegrated, the model used is the ARDL model (Rosadi, 2011). The ARDL method is a method that can estimate linear regression models in analyzing long-term relationships involving cointegration tests among time series variables. The current ARDL model provides a very useful method for testing the existence of long-term relationships between economic time series. The ARDL model can be used to test Cointegration and estimate long-term and short-term dynamics at the same time. The ARDL model includes a combination of stationary and non-stationary time series. More specifically, the current ARDL model is used for non-stationary time series data. Bounds Tests are used to see if there is a long-term relationship. Furthermore, this research model is as follows:

$$KURS_t = \alpha_0 + \alpha_1 KURS_{t-1} + \dots + \alpha_p KURS_{t-p} + \beta_1 DKE_t + \beta_2 DKE_{t-1} + \dots + \beta_q DKE_{t-q} + \gamma_1 INF_t + \gamma_2 INF_{t-1} + \dots + \gamma_r INF_{t-r} + \rho_1 FDI_t + \rho_2 FDI_{t-1} + \dots + \rho_s FDI_{t-s} + \mu_1 SBI_t + \mu_2 SBI_{t-1} + \dots + \mu_2 SBI_{t-t} + \varepsilon_t.$$

The "autoregressive" model in this case is used because the KURS is partially explained by its lag value. The "distributed lag" component is the lags of the EFD (Economic Disclosure) variables, INF (Inflation), FDI (Foreign Direct Investments) and SBI (Interest Rate of Bank Indonesia). The dependence of KURS on the lag of KURS, DKE, INF, SBI, and FDI is assumed not to occur instantly, but after some lags. The short-term impacts are shown by α_i , β_i and γ while $\sum_{i=0}^p \alpha_i$, $\sum_{i=0}^q \beta_i$, $\sum_{i=0}^r \gamma_i$ is a long-term impact that is distributed in some lags. The aggregate variable KURS will respond to changes in the degree of economic openness. After a period of time in which the KURS adjusts to other variables. The data was obtained from quarterly time series data within the period of 1998 to 2016. Data (KURS) (SBI), INF, FDI, EFD were obtained from SEKI BI (Economic Statistics And Finance Indonesia Bank Indonesia) and BPS.

Test of Stationarity

No	Variabel	T. Statistik ADF	Mackinnon Critical Value (5%)	Keterangan
1	DKE	-8.264505	-2,900670	stasioner pada I(0)
2	INF	-4,814071	-2,900670	stasioner pada I(0)
3	KURS	-3,281640	-2,900670	stasioner pada I(0)
4	SBI	-4,871888	-2,906210	stasioner pada I(0)
5	FDI	-9,136223	-2,901217	stasioner pada I(1)

Based on the results of stationary test of DKE, INF, KURS, and SBI variables on the first test, obtained the value of ADF statistic < mackinnon critical value (5%) or Probability value < from $\alpha = 0,05$, then accept H_0 . This means that DKE, INF, KURS, and SBI variables are stationary at the level. As for the FDI variable, the ADF statistic value > mackinnon critical value (5%). This means that it is not stationary at the level so it is necessary to test the first difference. After the first difference test, the value of ADF statistic < mackinnon critical value (5%) for FDI, it means stationary FDI variable at first difference.

ARDL Bounds Test

Test Statistic	Value	k
F-statistic	2.442296	4
Critical Value Bounds		
Significance	10 Bound	11 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

The ARDL Bounds Test is performed by estimating the general ARDL equation. From the estimation results obtained the F-statistic value of the joint significance test, with the null hypothesis "there is no cointegration". Can be seen in Table, that the value of F statistics 2.442296 smaller Critical Value at the level of significance of 5% is 2.86 then it can be concluded there is no cointegration.

The model of short-term and long-term relationship

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(KURS(-1))	0.234114	0.163294	1.433697	0.1581
D(KURS(-2))	0.052896	0.143432	0.368788	0.7139
D(KURS(-3))	0.313387	0.140061	2.237502	0.0299
D(INF)	12.759344	81.988661	0.155623	0.8770
D(INF)	-2.770842	42.961081	-0.064497	0.9488
D(INF)	-59.058522	39.101832	-1.510377	0.1375
D(INF)	-91.323981	34.602876	-2.639202	0.0112
D(FDI)	0.107231	0.058620	1.829238	0.0736
D(FDI(-1))	-0.054437	0.074301	-0.732655	0.4673
D(FDI(-2))	0.355300	0.146808	2.420170	0.0193
D(FDI(-3))	-0.371921	0.145749	-2.551789	0.0140
D(SBI)	38.360741	72.900897	0.526204	0.6012
D(SBI(-1))	159.950496	72.213293	2.214973	0.0315
D(SBI(-2))	-27.962108	58.972747	-0.474153	0.6375
D(SBI(-3))	121.871409	48.902804	2.492115	0.0162
D(DKE)	-13.526857	15.157724	-0.892407	0.3766
D(DKE(-1))	27.131123	14.852215	1.826739	0.0740
D(DKE(-2))	-33.767774	15.107057	-2.235232	0.0301
CointEq(-1)	-0.475945	0.111752	-4.258944	0.0001
Cointeq = KURS - (364.4138*INF + 0.1981*FDI - 458.4828*SBI + 23.7750 *DKE + 8789.8934)				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	364.413773	214.104563	1.702036	0.0952
FDI	0.198088	0.256188	0.773213	0.4432
SBI	-458.482818	151.811312	-3.020083	0.0040
DKE	23.774981	50.000953	0.475491	0.6366
C	8789.893394	3361.753447	2.614675	0.0119

Based on the short term relationship in the table above, it can be concluded that the INF, FDI in the third period, EFD and EF during the second period significantly influence the stability of KURS in the short term.

Serial Correlation Diagnostic Test Results

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.622087	Prob. F(2,46)	0.5413
Obs*R-squared	1.896117	Prob. Chi-Square(2)	0.3875

In the serial correlation test obtained probability value Obs * R-square > 0,05, that is 1.896117 hence hypothesis stated that model was free from serial problem correlation.

Heteroskedasticity Diagnostic Test Results

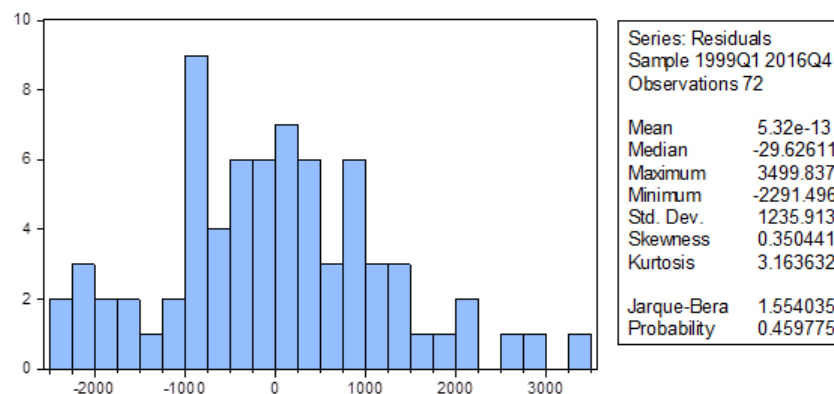
Heteroskedasticity Test: Breusch-Pagan-Godfrey

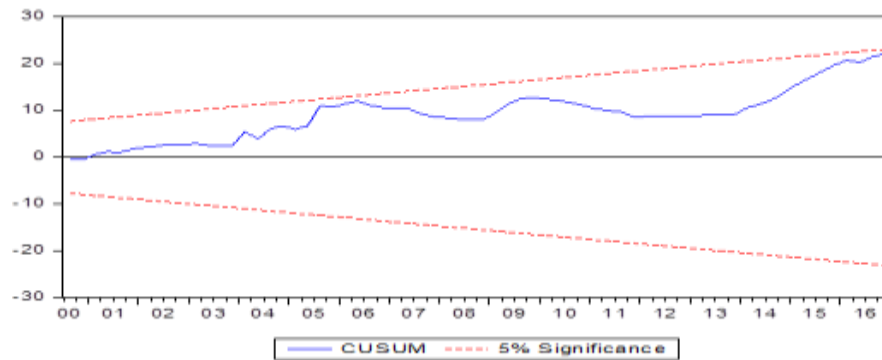
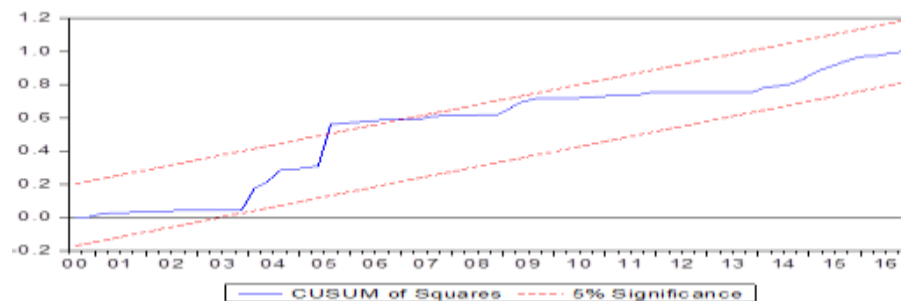
F-statistic	1.165394	Prob. F(23,48)	0.3193
Obs*R-squared	25.79930	Prob. Chi-Square(23)	0.3104
Scaled explained SS	12.40449	Prob. Chi-Square(23)	0.9637

The prerequisite that must be fulfilled in the regression model was the absence of symptoms of heteroscedasticity. Based on the table above, it obtained value Prob * R-square greater than 0.05 is 25.79930 it can be concluded that there is no heteroscedasticity.

Normality Test

Based on the table below, it can be seen that the value of ρ value = 0.459 > alpha = 5%, then with a confidence level of 5%, the data can be said to be normally distributed. This means that the data in use is good enough to test the hypothesis.



Results of cumulative sum (CUSUM) of Recursive Residuals**Results of cumulative sum of squares (CUSUMSQ) of Recursive Residuals**

Next is the stability test using CUSUM and CUSUMSQ as shown in the figures above. This test shows the CUSUM statistics and CUSUMSQ statistics are among the critical values of 5% significance. This indicates that the regression result coefficient is stable. However at CUSUMQ in the 5th period slightly out of the critical value of 5% significance, but it can be concluded that the regression coefficient is relatively stable.

Estimation Results of ARDL Mode

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
KURS(-1)	0.758169	0.124805	6.074822	0.0000
KURS(-2)	-0.181218	0.157008	-1.154192	0.2541
KURS(-3)	0.260491	0.146858	1.773764	0.0824
KURS(-4)	-0.313387	0.140061	-2.237502	0.0299
INF	12.75934	81.98866	0.156623	0.8770
INF(-1)	7.528378	40.52689	0.185763	0.8534
INF(-2)	2.770842	42.96108	0.064497	0.9488
INF(-3)	59.05852	39.10183	1.510377	0.1375
INF(-4)	91.32398	34.60288	2.639202	0.0112
FDI	0.107231	0.058620	1.829238	0.0736
FDI(-1)	-0.084009	0.075973	-1.105776	0.2743
FDI(-2)	0.054437	0.074301	0.732655	0.4673
FDI(-3)	-0.355300	0.146808	-2.420170	0.0193
FDI(-4)	0.371921	0.145749	2.551789	0.0140
SBI	38.36074	72.90090	0.526204	0.6012
SBI(-1)	-2.713741	69.66459	-0.038954	0.9691
SBI(-2)	-159.9505	72.21329	-2.214973	0.0315
SBI(-3)	27.96211	58.97275	0.474153	0.6375
SBI(-4)	-121.8714	48.90280	-2.492115	0.0162
DKE	-13.52686	15.15772	-0.892407	0.3766
DKE(-1)	18.20580	14.33517	1.270009	0.2102
DKE(-2)	-27.13112	14.85222	-1.826739	0.0740
DKE(-3)	33.76777	15.10706	2.235232	0.0301
C	4183.510	2025.493	2.065428	0.0443
R-squared	0.817623	Mean dependent var		9560.801
Adjusted R-squared	0.730235	S.D. of dependent var		2894.032
S.E. of regression	1503.130	Akaike info criterion		17.72969
Sum squared resid	1.08E+08	Schwarz criterion		18.48858
Log likelihood	-614.2688	Hannan-Quinn criter.		18.03180
F-statistic	9.356162	Durbin-Watson stat		2.108017
Prob(F-statistic)	0.000000			

The result of the estimation shows that the degree of economic openness of 2 months earlier gave a negative and significant effect on the Rupiah / US \$ exchange rate in Indonesia in the short term. From the test results to the value tstatistic is obtained the value -1.826739 smaller than t table $\alpha = 10\%$. It means that the variable degree of economic openness 2 earlier had a

significant effect on the Indonesian rupiah / US dollar exchange rate at 90 percent confidence level.

From the test result to the value of $t_{\text{statistic}}$ is obtained the value -2.214973 for period 2 and -2.492115 for period 4 which are bigger than t_{table} ($\alpha = 5\%$ equal to -2,750). It means that the variable of Bank Indonesia interest rate for the 2nd and 4th period gives significant influence to the rupiah / US \$ exchange rate in Indonesia at 95% confidence level. This result states that the interest rate of Bank Indonesia in the 2nd and 4th periods significant to the Rupiah / US \$ exchange rate at the level of $\alpha = 5\%$. The negative sign on the interest rate regression coefficient of Bank Indonesia is in line with expectations of interest rate parity theory because with the increase of Bank Indonesia interest rate, lowering net foreign investment (the decrease of net foreign investment is a decrease in the quantity of requested loan).

From the test result to the value of $t_{\text{statistic}}$ is obtained the value 0.0112 which is smaller than t_{table} ($\alpha = 5\%$ equal to 2,750). It means that the inflation variable gives significant effect to the exchange rate of Rupiah / US \$ in Indonesia at 95 percent confidence level. This result states that the 4th period of inflation has a significant effect on the exchange rate of Rupiah / US \$ at $\alpha = 5\%$. The value of the coefficient of foreign direct investment of 0.371921 means that any increase in foreign net investment of US \$ 1 million will lead to an increase in the exchange rate of Rp.0.371921 / US \$, ceteris paribus. From the test results to the value $t_{\text{statistic}}$ is obtained the value 2.551789 smaller than t_{table} ($\alpha = 5\%$ equals 2.750). It means that the net foreign investment variables significantly influence the exchange rate of Rupiah / US \$ in Indonesia at 95 percent confidence level.

Long-term balance mode

$\text{Cointeq} = \text{KURS} - (364.4138 * \text{INF} + 0.1981 * \text{FDI} - 458.4828 * \text{SBI} + 23.7750 * \text{DKE} + 8789.8934).$

Based on the above long-term equilibrium model, it can be concluded that if the inflation change increases 1 percent, it will cause a decrease of exchange rate of 364,418 rupiah per dollar As (Depreciated Rupiah). If the change in FDI increases 1 percent, it will cause an increase in the exchange rate of 0.1981 percent. If the SBI increases 1 percent, it will cause a decrease in the exchange rate of 458.4828 rupiah US dollars. If EFD increases 1 percent, it will cause the rupiah to strengthen 23.7750 per US dollar.

CONCLUSION AND RECOMENDATION

There is a long-term balance of fluctuations in the rupiah against the US dollar influenced by inflation and SBI variables that are negatively correlated with the exchange rate. While the FDI variable and degree of economic openness are positively correlated with the exchange rate. The degree of economic openness, inflation, FDI causes the fluctuation of the rupiah against the dollar significantly in the short term. In the long term, SBI gives a significant effect on the fluctuation of the rupiah against the dollar. The conclusion above is in line with the research: Simorangkir (2006), Watson (2015), Alesina (1998), Arif (2012), Barro and Gordon (1993), Samimi (2012), Depari (2009), Bramastyo (2012), Louail (2015), Hasna (2015), Herawati (2016), Zakaria (2011), Wu and Lin (2002), Hanif and Batool (2005), and Rodriguez (2017).

Not in line with the research: Romer (1993), Abdullah and Khaled (2015), Isnawati (2014), and Evans (2007).

Bank Indonesia is expected to consistently implement a flexible exchange rate policy so that exchange rate movements are in line with fundamental economic conditions. So it is expected to maintain the export competitiveness. Furthermore, sustained exchange rate volatility is expected to maintain business certainty and minimize its impact on inflation. In order to maintain the volatility of the rupiah, Bank Indonesia is also expected to intervene in interest rates and interventions in the foreign exchange market on a limited scale. Bank Indonesia is also expected to engage in exchange rate interventions through the monitoring of asset / capital traffic because if a withdrawal of capital / assets will result in high volatility and the rupiah will depreciate to disrupt the economy. The function of this research is as input for Bank Indonesia and the government in minimizing the risk of fluctuation of rupiah exchange rate stability against US dollar.

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