THE ANALYSIS OF RUPIAH EXCHANGE RATE FLUCTUATION TOWARD US DOLLAR (JANUARY 2010 – MARCH 2017)

ANALISIS FLUKTUASI KURS RUPIAH TERHADAP DOLLAR AMERIKA (JANUARI 2010 – MARET 2017)

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ABSTRACT

This research analyzed the influence of stock price, interest rate, and interest rate of Bank Indonesia (BI rate) toward Rupiah exchange rate. This analysis showed that all explanatory variables had a significant influence on exchange rates in the long term, while in the short term, export had no significant effect. Export and Jakarta Composite Index influenced foreign exchange rate negatively, the higher the two variables caused currency appreciation. This indicated that the increase in exports and the Jakarta Composite Index increased the US dollar supply through capital inflow. On the other hand, the amount of money and interest rates influenced the exchange rate positively, the higher the two variables caused currency depreciation. This is consistent with the theory that states large amounts of money supply will cause inflation (the quantity theory of money by Fisher's rhythm theory and Keynesian inflation theory) and high interest rates can also increase inflation (the International Fisher Effect theory).

Keywords: Exchange Rate, Error Correction Model, Export, Jakarta Composite Index, Money Supply, Bank Indonesia Interest Rate

INTISARI

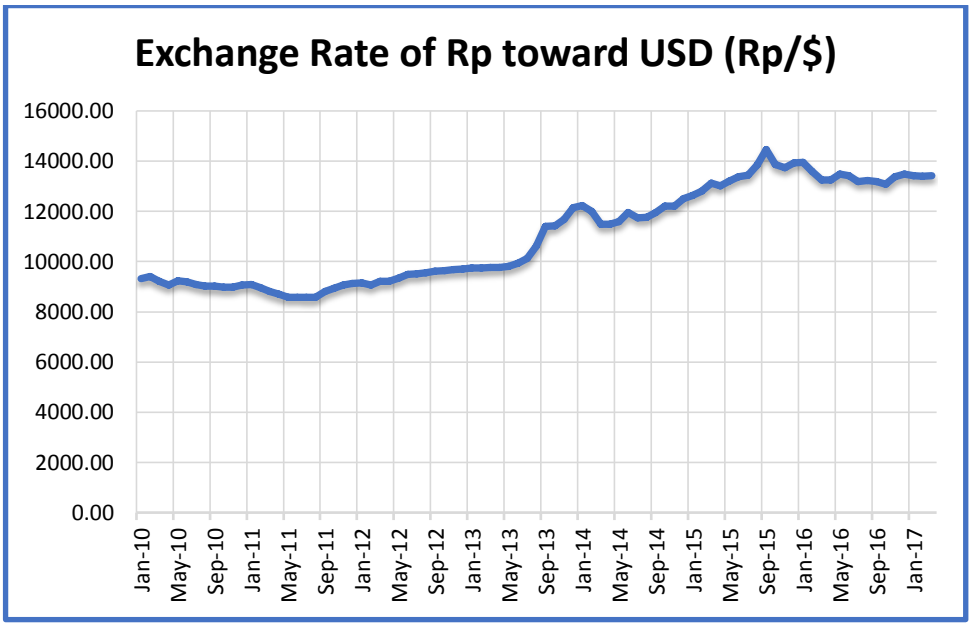
Penelitian ini menganalisis pengaruh ekspor, Indeks Harga Saham Gabungan, jumlah uang beredar, dan suku bunga Bank Indonesia (BI rate) terhadap nilai tukar Rupiah atas Dolar Amerika Serikat. Menggunakan analisis regresi berganda dengan Error Correction Model (ECM), analisis ini menunjukkan bahwa semua variabel penjelas memiliki pengaruh signifikan terhadap nilai kurs dalam jangka panjang, sementara dalam jangka pendek, eksport tidak memiliki pengaruh signifikan. Ekspor dan IHSG mempengaruhi kurs valuta asing secara negative, semakin tinggi kedua variabel tersebut

mengakibatkan apresiasi mata uang. Hal ini mengindikasikan bahwa kenaikan ekspor dan Indeks Harga Saham Gabungan menambah pasokan Dollar Amerika Serikat melalui capital inflow. Di sisi lain, jumlah uang beredar dan BI rate mempangaruhi kurs secara positif, semakin tinggi kedua variabel tersebut akan membuat mata uang terdepresiasi. Hal ini sesuai dengan teori yang menyatakan bahwa jumlah uang beredar yang besar akan menyebabkan inflasi (teori kuantitas uang oleh Irving Fisher dan teori inflasi Keynesian) dan tingkat bunga yang tinggi juga dapat meningkatkan inflasi (teori Internasional Fisher Effect).

Kata kunci: Kurs, Error Correction Model, Ekspor, IHSG, Jumlah Uang Beredar, Suku Bunga Bank Indonesia

INTRODUCTION

Since the free-floating exchange rate policy implemented in 1997, the movement of exchange rate in the market becomes very vulnerable by the influence of economic and non-economic factors as shown in the Figure below.

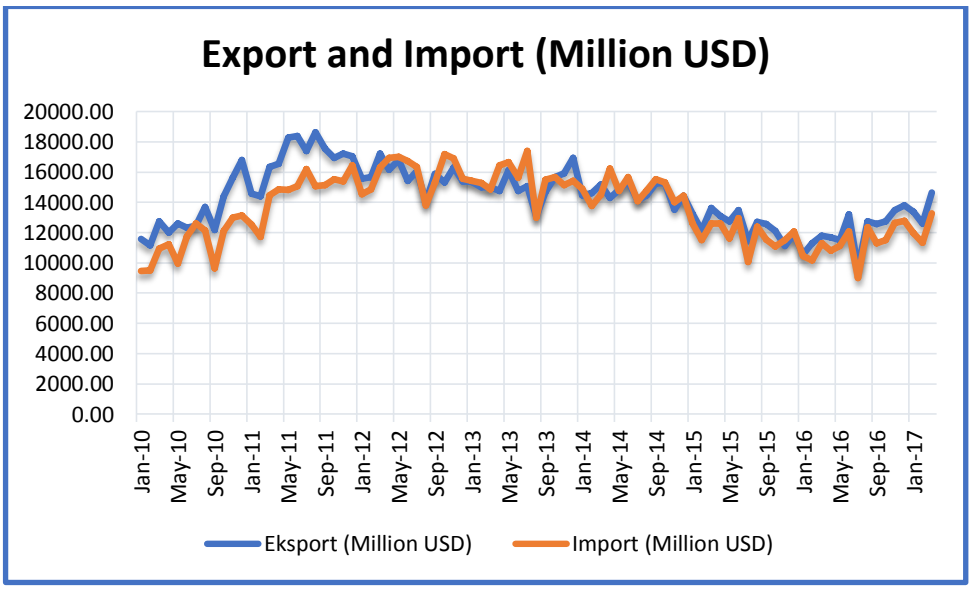


Resource: (Bank Indonesia)
http://www.bi.go.id/en/moneter/informasi-kurs/transaksi-bi/Default.aspx

Figure 1. IDR Exchange Rate toward USD (Jan 2010 – March 2017)

In 2015, Indonesia exchange rate had been fluctuating upward before it reached its highest point in September. Among many factors which caused this, 2015 was the year where the new president of Indonesia was elected. Such a big event had a great impact not only in domestic policy, but also the expectation of foreign investors and international market stakeholders.

While observing trade balance, at a glance, export and import show a long run relationship with exchange rate development. When IDR exchange rate began to devaluate in the end of 2011, in fact, both Indonesia export and import were also decreasing since the end of 2011. This indicates a relationship between export, import, and exchange rate that may be analyzed more.



Resource: Badan Pusat Statistik

Figure 2. Export and Import Development (January 2010- March 2017)

Higher exchange rate (depreciated currency) makes domestic product and tourism become cheaper for overseas importer and tourist. Such condition should attract more export and tourism entrants which will make US Dollar inflow, appreciating the Rupiah currency exchange rate. However, Indonesia still experienced decrease of export (import as well) during the depreciation period of Rupiah in recent years. As a country that imports many industrial raw materials, the rise of imported materials increases the production cost, causing the price of Indonesian owned goods to increase as well. Lower export makes fewer foreign exchange stocks which lower the capacity to import. Thus, during recent years, import and export were decreasing along with Rupiah depreciation.

This paper presents the analysis entitled "**Analysis of Rupiah Exchange Rate Fluctuation on Us Dollar".**

Research Framework

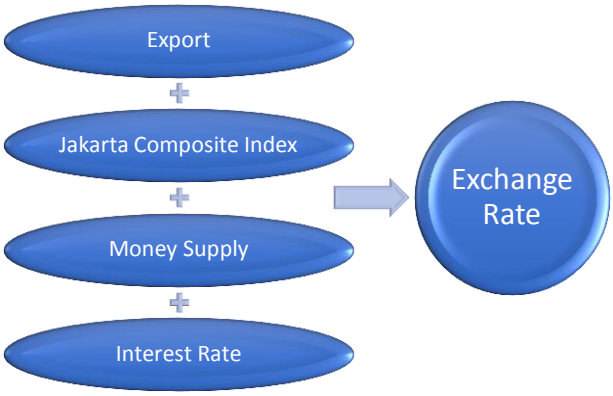


Figure 3. Research Framework Mapping

Hypothesis

Below is the hypothesis:

a. Export has negative influence toward exchange rate.
b. Jakarta Composite Index has negative influence toward exchange rate.
c. Money Supply (M2) has positive influence toward exchange rate.
d. Bank Indonesia rate has positive influence toward exchange rate.

DATA AND RESEARCH METHODOLOGY

A. Collecting Data Technique

Collecting data technique for this research is non-participant observation. Data are collected by downloading as the following description:

1. Exchange rate, downloaded from Bursa Efek Indonesia (Indonesia Stock Exchange), *http://www.bi.go.id/en/moneter/informasi-kurs/transaksi-bi/Default.aspx*

2. Export, downloaded from Badan Pusat Statistik (Central Bureau of Statistics), *Resource: https://www.bps.go.id/all_newtemplate.php*

3. Jakarta Composite Index, source: Bursa Efek Indonesia (Indonesia Stock Exchange), *https://www.investing.com/indices/idx-composite-historical-data*

4. Money supply, source: Bank Indonesia, SEKI data

5. Bank Indonesia rate, source: Bank Indonesia, SEKI data

B. Operational Definition of Variables

1. Exchange Rate

Exchange rate is the price of a currency against another currency. This research analysis the exchange rate of rupiah against US dollar measured in IDR/ USD, abbreviation of Indonesian Rupiah/ United State Dollar.

2. Export

Export reflects the value of goods or commodities sold abroad legally, generally in the trade process. This data is measured in million USD units.

3. Jakarta Composite Index

Jakarta Composite Index is stock market indices as a movement indicator of stock prices that includes price movements of all common and preferred stock listed on the Indonesia Stock Exchange measured in point.

4. Money Supply

Broad money supply (M2) is used to proxy money supply including foreign currency deposits. This is the broad stock of money in the country. This data is measured in billion IDR units.

5. Bank Indonesia Rate

Bank Indonesia rate is the policy rate reflecting the monetary policy stance adopted by Bank Indonesia and announced to public. The interest rate data is measured in percent units.

C. Research Model

The ECM (Error Correction Model) model is an econometric model used to look for long-term and short-term equilibrium regression equations. BI rate is the only variable in percentage unit, thus, all variables except BI rate are processed in form of Natural logarithm (Logarithm with base of 2.718281828459). denotation of variables:

LOG_EXC_RATE = Natural Logarithm of Exchange Rate
LOG_EXPORT = Natural Logarithm of Export
LOG_JCI = Natural Logarithm of Jakarta Composite Index
LOG_M2 = Natural Logarithm of Money Supply
VAR_BI_RATE = Variable of BI rate

Long-run Equation with Ordinary Least Square

This equation gives the long-term equilibrium. The residual lagged 1 period of this estimation will be used to generate Error Correction Term. Here is the formulation:

LOG_EXC_RATE = C(1)*LOG_EXPORT + C(2)*LOG_JCI + C(3)*LOG_M2 + C(4)*VAR_BI_RATE + C(5) + Ut

Where:
C(1) - C(4) = Coefficient of independent variables
C(5) = Constant
Ut = Error (Residual)

Error Correction Term

The error-correction term relates to the fact that last-periods deviation from a long-run equilibrium, the error, influences its short-run dynamics. Error Correction Term (ECT) is generated from residuals of Ordinary Least Square regression lagged one period. Here is the equation:

$$ECT = LOG\_EXC\_RATE_{(t-1)} - (C(1)*LOG\_EXPORT_{(t-1)} + C(2)*LOG\_JCI_{(t-1)} + C(3)*LOG\_M2_{(t-1)} + C(4)*VAR\_BI\_RATE_{(t-1)} + C(5))$$

Where:

ECT	= Error Correction Term
C(1) - C(4)	= Coefficient of independent variables
C(5)	= Constant

Short-run Equation with Error Correction Model

If Error Correction Term (ECT) is stationary on level, ECT can be included in short-run estimation of Error Correction Model. This model gives the short-term equilibrium and the ECT coefficient estimate the speed at which a dependent variable returns to equilibrium after a change in other variables.

Both dependent and independent variables (excluding ECT) are processed in their 1st difference form. Here is the equation:

$$D\_LOG\_EXC\_RATE = C(1)*D\_LOG\_EXPORT + C(2)*D\_LOG\_JCI + C(3)*D\_LOG\_M2 + C(4)*D\_VAR\_BI\_RATE + C(5)*ECT + C(6) + Ut$$

Where:

C(1) - C(4)	= Coefficient of 1st different of independent variables
C(5)	= Coefficient of Error Correction Term
C(6)	= Constant
Ut	= Error (Residual)

D. Methodology

Analysis method used in this research is Error Correction Model (ECM).

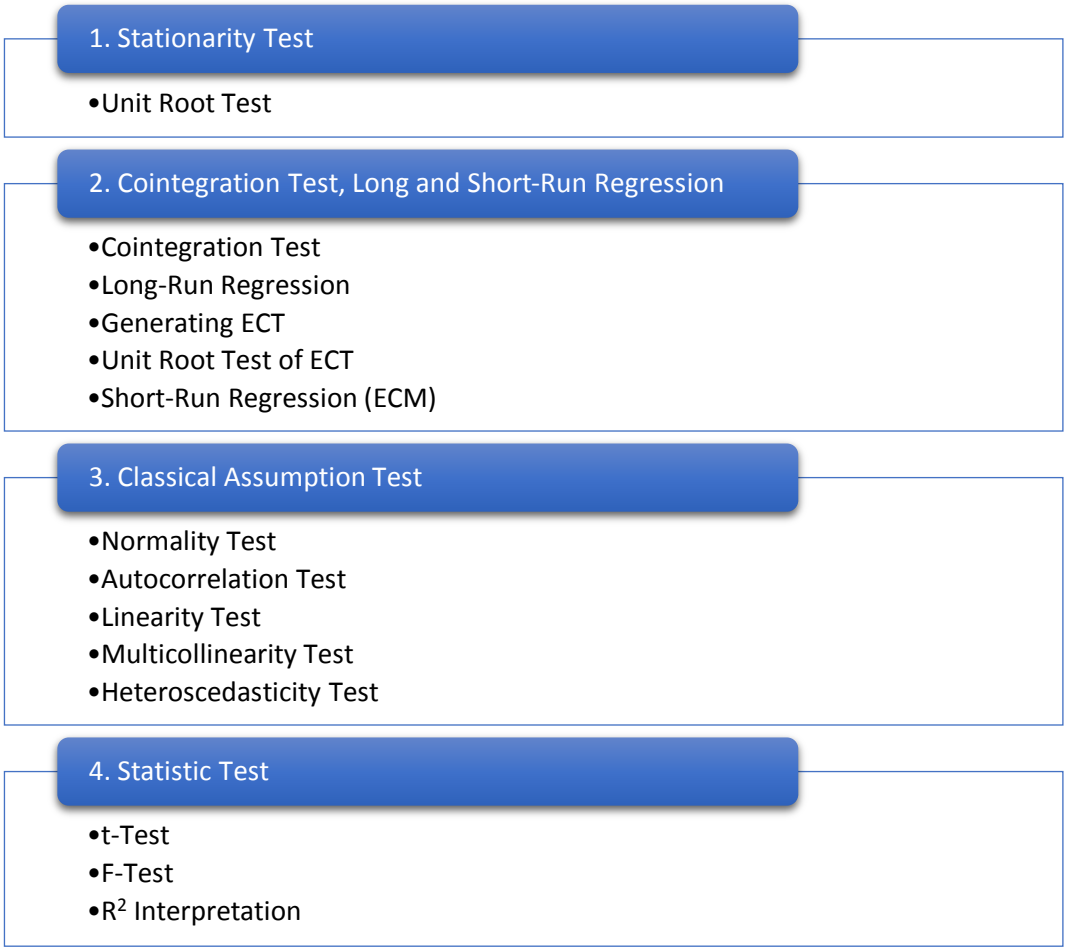


Figure 4 Analysis Methodology

RESEARCH RESULT AND DISCUSSION

A. Research Result

1. Unit Roots Test Result

This unit root test was conducted initially at level. If all variables are stationary at level, then variables can be analyzed using VAR methods. But if at least one variable is not stationary at level, then unit root test proceed at the differenced level until all variables are tested to be stationary at the same level. After all variables are stationary on certain level, research can run ECM (and VECM as well, if preferred).

Table 5.2. Unit Root Test (ADF-test) of Variables Result

	Test on Level			Test on First Difference		
Variable	**t-statistic**	**Prob**	**Stationary?**	**t-statistic**	**Prob**	**Stationary?**
LOG_ EXC_RATE	-2.470749	0.3416	**No**	-6.751445	0.0000	**Yes**
LOG_ EXPORT	-3.145516	0.1027	**No**	-15.72281	0.0001	**Yes**
LOG_ JCI	-2.969739	0.1468	**No**	-9.153810	0.0000	**Yes**
LOG_ M2	-0.947726	0.9449	**No**	-11.55550	0.0001	**Yes**
VAR_ BI_RATE	-1.623025	0.7757	**No**	-5.259911	0.0000	**Yes**

Resource: *Data Processing*

The results in table above shows that the exchange rate, export, Jakarta Composite Index, and money supply which are in natural logarithm form, plus the variable of Bank Indonesia rate, were non-stationary in level, but they were stationary in first difference level. therefore, it was an I(1) stochastic process.

2. Cointegration Test Result

After knowing that there is non-stationary data on level, the next step is identifying whether the data are cointegrated. The cointegration test gives an early indication that the model has a long-term relationship (cointegration relation).

The result of cointegration test was obtained by forming the residual obtained by regressing the independent variable to the dependent variable by OLS. The residual must be stationary at the level to be said to have cointegration. Below is the result of unit root test of the residual:

Table 5.3. Unit Root Test (ADF-test) of ECT Result

Null Hypothesis: ECT has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic - based on SIC, maxlag=11)			
		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-5.833728	0.0000
Test critical values:	1% level	-3.509281	
	5% level	-2.895924	
	10% level	-2.585172	
*MacKinnon (1996) one-sided p-values.			

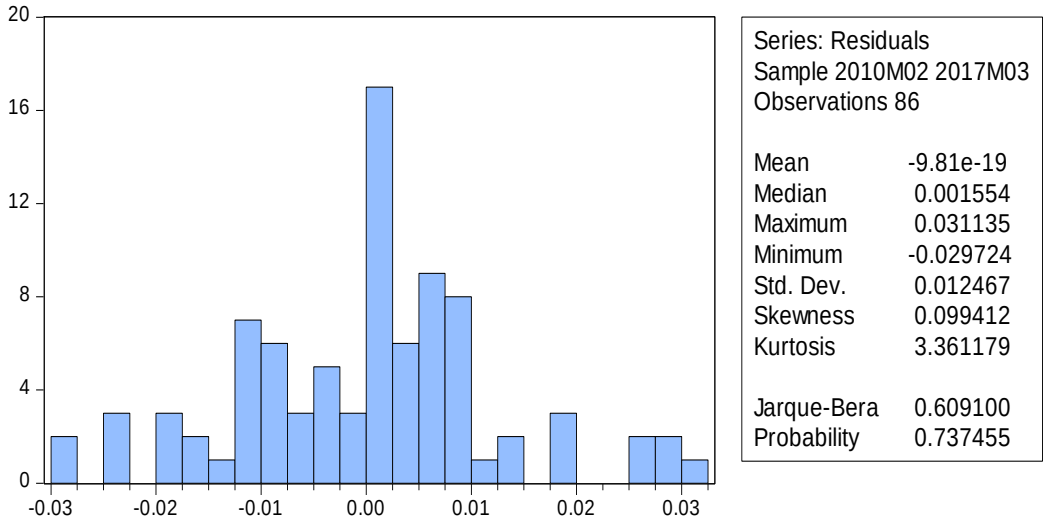
Resource: *Data Processing*

The p-value was 0.0000, less than even for 1% significance level. It showed that the residual (which is Error Correction Term) was stationary at level. Therefore, there was cointegration among variables, there was long run relationship between independent and dependent variables.

B. Classical Assumption Test Result

1. Normality Test Result

Normality Test Result



Resource: *Data Processing*

The Jarque Berra value was 0.6091 with p value 0.737455. Because p value was greater than α = 10%, we accepted H_0: residual was normally

distributed. Therefore, it was concluded that there is no normality problem (residual was normally distributed).

2. Autocorrelation Test Result

Autocorrelation Test Result

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	4.086961	Prob. F(2,78)	0.0205
Obs*R-squared	8.157424	Prob. Chi-Square(2)	0.0669

Resource: Data Processing

Because Prob. Chi-Square(2) of Obs*R-squared value was greater than α = 5%, it accepted H_0. residual was not autocorrelated. It was concluded that there is no autocorrelation problem.

3. Linearity Test Result

Linearity Test Result

Ramsey RESET Test
Equation: EQ_ECM

	Value	df	Probability
t-statistic	0.077551	79	0.9384
F-statistic	0.006014	(1, 79)	0.9384
Likelihood ratio	0.006547	1	0.9355

Resource: *Data Processing*

Based on result above, the p-value of F-statistics > α = 10%. It accepted H_0: model was linear. It was concluded that there is no linearity problem.

4. Multicollinearity Test Result

Multicollinearity Test Result

Correlation	LOG_EXPORT	LOG_JCI	LOG_M2	VAR_BI_RATE
LOG_EXPORT	1.000000			
LOG_JCI	-0.090134	1.000000		
LOG_M2	-0.376445	0.799070	1.000000	
VAR_BI_RATE	-0.295740	0.299291	0.411128	1.000000

Resource: *Data Processing*

Based on the test with partial correlation method between independent variables above, there was no multicollinearity problem in model because the values of all correlation matrix (correlation matrix) were less than 0.85.

5. Heteroscedasticity Test Result

Heteroscedasticity Test Result

Heteroskedasticity Test: White

F-statistic	1.556865	Prob. F(20,65)	0.0926
Obs*R-squared	27.85399	Prob. Chi-Square(20)	0.1129
Scaled explained SS	28.45572	Prob. Chi-Square(20)	0.0990

Resource: *Data Processing*

Based on test result above, the p-value of Obs*R-squared was 0.1129, greater than α = 5%. Because the p-values was greater than α = 5%, it accepted H_0: residual is in homoscedasticity condition. Therefore, there was no heteroscedasticity in the model.

C. Statistic Test Result

1. t-Test Result

T-Test Result

Long-Run Estimation				
Variable	**t-statistic**	**t-table (df:80 , α:0.05)**	**p-value**	**Effect is Significant?**
LOG_EXPORT	-8.277598	1.990	0.0000	Yes
LOG_JCI	-6.990737	1.990	0.0000	Yes
LOG_M2	22.80040	1.990	0.0000	Yes

VAR_BI_RATE	13.65759	1.990	0.0000	Yes
C	8.157334	1.990	0.0000	
Short-Run Estimation				
Variable	**t-statistic**	**t-table (df:80 , α:0.05)**	**p-value**	**Effect is Significant?**
D_LOG_EXPORT	-1.448564	1.990	0.1514	No
D_LOG_JCI	-4.821856	1.990	0.0000	Yes
D_LOG_M2	3.845786	1.990	0.0002	Yes
D_VAR_BI_RATE	2.502573	1.990	0.0144	Yes
ECT-1	-5.462244	1.990	0.0000	Yes
C	0.698927	1.990	0.4866	

Resource: *Data Processing*

In long-run estimation, all independent variables, individually, had significant effect on exchange rate (absolute value of t statistic > t-table value).

In short-run estimation, export was not significant affecting exchange rate (absolute value of t statistic < t-table value), while Jakarta Composite Index, money supply, and BI rate, individually, were significant affecting exchange rate (absolute value of t statistic > t-table value).

2. F-Test Result

F-Test Result

Estimation Period	F-Statistic	F-Table α , dfn , dfd	F-Table Value	p-value	Effect is Significant?
Long-Run	1194.793	0.01 , 4 , 80	3.56	0.0000	Yes
Short-Run	15.97234	0.01 , 5 , 80	3.26	0.0000	Yes

Resource: *Data Processing*

Both in long-run and short-run estimation, the F-Statistic values (1194.80 and 15.97) were greater than the F-Table Value (3.56 and 3.26). Thus, H0 is rejected and H1 is accepted, which means that all independent variables jointly had significant influence toward exchange rate, either in long-run or in short-run estimation. Besides, the p-values in both estimation were 0.0000, it means that the probability that results could have happened by chance was very small (0.0000).

3. R^2 (Determination Coefficient) Result

Determination Coefficient Result

Estimation Period	Adjusted R^2
Long-Run	0. 983132
Short-Run	0. 499567

Resource: *Data Processing*

In long-run estimation, the determination coefficient of 0.98 means that in this regression model, the independent variables could predict the variance of dependent variable by 98%. While the rest, 2% was affected by variables outside of this model.

In short-run estimation, the determination coefficient of 0.50 means that in this regression model, the independent variables could predict the variance of dependent variable by 50%. While the rest, 50% was affected by variables outside of this model.

D. Discussion

Coefficient Estimation Summary

Long-Run Estimation			
Variable	**Effect is Significant?**	**Coefficient**	**Relationship with exc. rate**
LOG_EXPORT	**Yes**	-0.200074	Negative
LOG_JCI	**Yes**	-0.269933	Negative
LOG_M2	**Yes**	0.674887	Positive
VAR_BI_RATE	**Yes**	0.058007	Positive
C	**Yes**	2.927566	-
Short-Run Estimation			
Variable	**Effect is Significant?**	**Coefficient**	**Relationship with exc. rate**
D_LOG_EXPORT	**No**	-0.025327	-
D_LOG_JCI	**Yes**	-0.163769	Negative
D_LOG_M2	**Yes**	0.425501	Positive
D_VAR_BI_RATE	**Yes**	0.027263	Positive
ECT-1	**Yes**	-0.370436	-
C	**No**	0.001262	-

Resource: *Data Processing*

1. Export

Coefficient Interpretation

Based on analysis result, export had significant negative influence toward exchange rate in long-run estimation. When export increased by 1%, exchange rate will appreciate by 20%, ceteris paribus. While in short-run estimation, export had no significant effect on exchange rate.

Explanation

When Indonesia receive the payment of export, Indonesia will receive US dollar or any foreign currency which can be exchanged with US dollars. The more export, the more US dollar supply. The increase US dollar supply makes dollar less valuable against Rupiah, thus, Rupiah currency will appreciate. Therefore, higher Indonesia export causes Rupiah to strengthen.

2. Jakarta Composite Index (JCI)

Coefficient Interpretation

Based on analysis result, Jakarta Composite Index has significant negative influence toward exchange rate in long-run estimation. When Jakarta Composite Index increased by 1%, exchange rate will appreciate by 26.99%, ceteris paribus.

While in short-run estimation, Jakarta Composite Index had significant negative influence toward exchange rate. When Jakarta Composite Index increased by 1%, exchange rate will appreciate by 16.38%, ceteris paribus.

Explanation

Jakarta Composite Index price fluctuates because of the force of demand and supply forces. When the index increases, it may be caused by the increasing of demand force of stock within Indonesia. The increase of demand force leads the price equilibrium of stocks to increase. This means that there is more capital used to purchase Indonesia stocks.

Because stocks registered in JCI are open for international trading, the purchase and sale may be made by foreign investors. Such transactions make foreign capital flow in and out Indonesia. When index of JCI increases, part or even all of the increasing demand force may be caused by foreigner investor demand. Such condition means that there is stock purchase from foreigner which makes capital inflow from abroad. In this case, Indonesia will receive foreign capital in USD currency or any other currency that can be exchanged with USD. With the increase of USD supply, USD will be less valuable relative to IDR. Thus, when JCI increases, IDR appreciate.

3. Money Supply

Coefficient Interpretation

Based on analysis result, money supply had significant positive influence toward exchange rate in long-run estimation. When money supply increases by 1%, exchange rate depreciated by 67.49%, ceteris paribus.

While in short run estimation, money supply had significant positive influence toward exchange rate. When money supply increased by 1%, exchange rate depreciated by 42.55%, ceteris paribus.

Explanation

"Other things remaining unchanged, as the quantity of money in circulation increases, the price level also increases in direct proportion and the value of money decreases and vice versa.". (Irving, 1991). Therefore, as the value of money (i.e. Rupiah) decreases, its value compared to other currency, which is the exchange rate against foreign currency, will be weakened (depreciated).

Based on the quantity theory of money by Irving Fisher, MV = PT, the money supply (MS) capable of causing something called inflation, which in turn could push the price level changes in currency values. This is also reinforced with purchasing power parity theory that states increasing supply of money will cause inflation in the country against inflation outside

country, this make domestic currency exchange rate depreciated against currency abroad.

4. BI Rate

Coefficient Interpretation

Based on analysis result, BI rate had significant positive influence toward exchange rate in long-run estimation. When BI rate increased by 1%, exchange rate depreciated by 5.8%, ceteris paribus.

While in short run estimation, BI rate had significant positive influence toward exchange rate. When BI rate increased by 1%, exchange rate depreciated by 2.73%, ceteris paribus.

Explanation

A higher interest rate offers higher return relative to other countries, this should attract foreign investor and make capital inflow. Capital inflow will increase demand of rupiah and/or increase supply of USD. This makes appreciation of Rupiah. Therefore, higher interest rate may appreciate Rupiah.

However, the analysis shows that the increasing BI rate, in the contrary, depreciated exchange rate. It means that the increase of BI rate didn't attract foreign investors. This may happen because, for some reasons, during that period Indonesia were not more preferable to invest compared to other countries.

This finding is in line with the International Fisher Effect (IFE) theory. It is an economic theory that states that an expected change in the current exchange rate between any two currencies is approximately equivalent to the difference between the two countries' nominal interest rates for that time.

The rationale for the IFE is that a country with a higher interest rate will also tend to have a higher inflation rate. This increased amount of inflation should cause the currency in the country with the high interest rate to depreciate against a country with lower interest rates.

5. Error Correction Term

ECT imbalance correction coefficients in the form of absolute values explain how fast time is required to obtain the equilibrium value. The value of ECT coefficient of -0. 370436 means that the difference between the exchange rate value with its equilibrium would be adjusted by 0. 370436 within 1 month.

CONCLUSION

A. Conclusion

1. Export negatively influenced exchange rate only in long-run, higher export made exchange rate appreciation.
2. Jakarta Composite Index (JCI) negatively influenced exchange rate both in long-run and short-run, higher JCI made exchange rate appreciation.
3. Money supply positively influenced exchange rate both in long-run and short-run, higher money supply made exchange rate depreciation.
4. BI rate positively influenced exchange rate both in long-run and short-run, higher BI rate made exchange rate depreciation.

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