

## CHAPTER III

### DATA AND RESEARCH METHODOLOGY

#### A. Research Object

The object of this research some variables which are estimated to influence Indonesia currency (IDR) exchange rate against United State Dollar (USD). This research objects are exchange rate, export, Jakarta Composite Index, money supply, and Bank Indonesia rate.

#### B. Type of Data

This research used quantitative secondary data. The data are monthly time series data from January 2010 to March 2017.

#### C. 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

## **D. 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.

### **E. 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). Here is the 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:

$$\text{LOG\_EXC\_RATE} = \text{C(1)*LOG\_EXPORT} + \text{C(2)*LOG\_JCI} + \text{C(3)*LOG\_M2} + \text{C(4)*VAR\_BI\_RATE} + \text{C(5)} + \text{Ut}$$

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 1<sup>st</sup> difference form. Here is the equation:

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

Where:

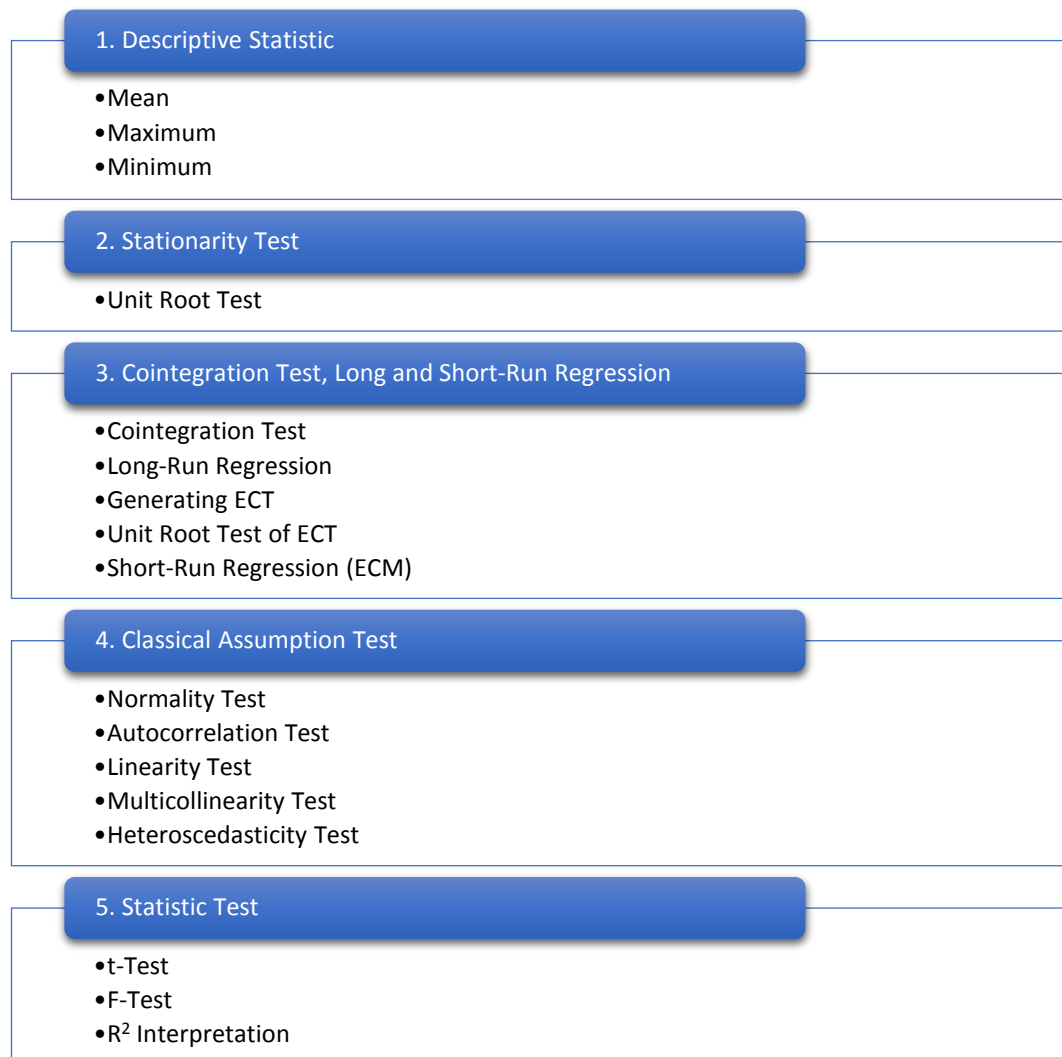
C(1) - C(4) = Coefficient of 1<sup>st</sup> different of independent variables  
 C(5) = Coefficient of Error Correction Term  
 C(6) = Constant  
 U<sub>t</sub> = Error (Residual)

## F. Methodology

Analysis method used in this research is Error Correction Model (ECM). Using this model, this study tries to examine the long run and short run relationship between exchange rate with the five independent variables.

Some tests have been set up to give the best estimation. Before estimating the regression, the data will be tested to make sure that the data is valid and reliable, by using such as the normality test, linearity test, and stationarity.

Below are the standard procedure of time series analyses this paper follow.



**Figure 3.1. Analysis Methodology**

### 1. Descriptive Statistic

Descriptive statistics describes the basic features of the data in a study.

They provide simple summaries about the sample and the measures.

- a. Examining the value of Mean (average)

- b. Examining the value of Maximum
- c. Examining the value of Minimum

## **2. Stationarity Test**

### **Unit Roots Test – Augmented Dickey Fuller Test**

This determines whether the variables are stationary or not. Data is said to be stationary when the data is close to the mean and Not affected time. If data are observed in unit root test is not stationary on level, then it should be continued with integration degree test (Integration Test) to obtain the stationary data.

Ganger and Newbold (1974) suggested that in the presence of nonstationary variables, there might be a spurious regression. A spurious regression has a high R<sup>2</sup> and t-statistics that appear to be significant, but the results are without any economic meaning.

## **3. Cointegration Test, Long-Run and Short-Run Regression**

### **Cointegration Test**

Cointegration test is a test whether there is a long-term relationship between independent variables and the dependent one, this test is continuation of Unit Root Test and Integration Test.

Engle and Granger suggested that cointegration refers to variables that are integrated of the same order. If two variables are integrated of different orders, they cannot be cointegrated.

Some following steps, which are (1) long-run estimation, (2) generating error correction term, and (3) unit root test of error correction

term, are the steps to test if variables are cointegrated (test if cointegration exists).

### **Long-Run Estimation**

This makes long-run estimation using Ordinary Least Square regression and the residual lagged 1 period will be used to generate Error Correction Term (ECT).

Later, if several tests ensure that regression is not spurious (variables are cointegrated), this Ordinary Least Square estimation will be valid. This equation will be used for long-run estimation about relationship between independent and dependent variables.

### **Generating Error Correction Term (ECT)**

ECT is generated from the residual of the long-run equation lagged 1 period.

### **Unit Root Test of Error Correction Term (ECT)**

Unit Root Test of ECT aims to test if ECT is stationary in level. If ECT is stationary on level, it is concluded the variables are cointegrated. This means that there is long-run relationship between dependent and independent variables. The long-run estimation using OLS regression becomes valid.

After finding that there is cointegration, ECT will be included in short-run Error Correction Model regression.

### **Error Correction Model Regression (Short-Run Estimation)**

This finds short-run equilibrium and will be used to estimate the short-run relationship between independent and dependent variables. This model also shows estimation of the speed at which a dependent variable returns to equilibrium after a change in other variables.

#### **4. Classic Assumption Test**

Multiple regression models can be referred to as good models if they meet several assumptions which are then called classical assumptions. The classical assumption testing process is performed together with the regression test process so that the steps taken in classical assumption testing use the same work step with the regression test. There are five assumption test that must be done to a regression model that is normality test, autocorrelation, linearity test, multicollinearity test, and heteroscedasticity test.

##### **Normality Test**

Normality test aims to determine whether the intruder or residual variable has a normal distribution. As a basis that the effect of the independent variables either individually (t-test) or simultaneously (F-test) assume that the residual values follow the normal distribution. If this assumption is violated then the regression model is considered invalid by the number of samples available.



There are two ways commonly used to test the normality of the regression model: graph analysis (normal P-P plot) and statistical analysis (Z analysis of skewness and kurtosis score).

### **Autocorrelation Test**

The autocorrelation test aims to test whether there is a linear regression model correlation between the confounding error in period  $t$  and the disturbance error in the previous period ( $t-1$ ). If there is a correlation it is called an autocorrelation problem.

There are several ways to detect autocorrelation symptoms: Durbin Watson (DW test), Langrange Multiplier (LM test), Q statistical test, and Run Test.

### **Linearity Test**

This test aims to see whether the model specification used is linear, quadratic or cubic empirical studies. There are three tests: the Durbin Watson test, Ramsey test, and Langrange Multiplier test.

### **Multicollinearity Test**

Multicollinearity test aims to test whether the regression model found a correlation between independent variables. A good regression model should not have a correlation between free variables, because if it occurs then the variables are not orthogonal or similar. The orthogonal variable is the independent variable whose correlation value among free variables is zero. This test is to avoid habit in decision making process about partial influence of each independent variable to dependent variable. To detect

whether there is a multicollinear problem can see the tolerance and versus variance inflation factor (VIF).

### **Heteroscedasticity Test**

Heteroscedasticity test aims to test whether in the regression model there is a uniformity of variance from the residual of one observation to the other. If the variance remains then it is called homoscedasticity and if it is different then there is a problem of heteroscedasticity. Good regression model is homoscedasticity or heteroscedasticity does not occur. There are several ways to detect whether or not heteroscedasticity is seen in scatter plots (dependent predicted values of ZPRED with residual SRESID), Gletjer test, Park test, and White test.

## **5. Statistic Test**

### **t-Test (Influence Validity Test)**

This test determines the validity of the individually influence of each independent variable on the dependent variable. This test shows the influence magnitude each independent variable on the two-tailed dependent variable.

### **F-Test**

F test aims to know whether the independent variables jointly affect the dependent variable.

**$R^2$  (Compound Determination Coefficient) Interpretation**

The coefficient of determination is the proportion or total procedure of the dependent variant described by the independent variable. The value of  $R^2$  lies between 0 and 1.