CHAPTER III
RESEARCH METHODOLOGY

3.1 Research's Object

The research object is taking the macroeconomic perspective and focused on selected ASEAN-5 countries. This research is conducted to describe how the trade balance performance of selected ASEAN-5 countries and exchange rate fluctuations interrect each orther. The data spaning from 2000;M1 until 2015;M12 from selected ASEAN-5 countries i.e. Indonesia, Malaysia, Singpore, Thailand, and Philippine as secondary data collection.

3.1 Data Types

Quantitative research method are employed to capture the aim of this research. Quantitative researchs are best describe to analyze of macroeconomic fenomena, using the numbers and mathematical approaches as evidence to describe the current economic issues. All data are expressed in time series form and then analyze and utilized by unit root and co-integration tests. The data are monthly data collection of 3 variables (export, import, and exchange rate) from January 2000 to December 2015.

This research conducted using secondary data collection. Secondary data are usually obtained from indirect sources of documentation or official archives in form of numbers or mathemathical notes. The data collected from International

Financial Statistic and other sources that provide the time series variables of selected ASEAN-5 countries.

3.2 Techniqueof Data Collection

Since the data are secondary data, which means can be obtained from indirect sources of documentation in several sites, books, and public articles that provided. However, wrong data colletion which can be error in implementing the research would directly impact the result of research later on. So, this stage could be very crucial for the research.

3.3 Operational Definition of Researched Variables

The analysis is conducted using three variables to capture the effect of exchange rate fluctuation towards trade balance performance. Nominal exchange rate in national currency against US dollar (EXR), the amount of exports in million US dollar (EXP), and the amount of imports in million US dollar (IMP) are used to further investigate theirs relationship.In order to deep understanding of variables observed, the definition table will be shown below.

Table 3.1
Observed Variables

No	Variables	Explanation	Source	Unit
1	EXR	The number of units of the domestic currency that can purchase a unit of a given foreign currency.	International Financial Statistic	Countries currency/Million U.S. dollar
2	EXP	Export of the selected countries in U.S. dollar	International Financial Statistic	Million U.S. dollar
3	IMP	Import of the selected countries in U.S. dollar	International Financial Statistic	Million U.S. dollar

1. Exchange rate (EXR) is the price of a nation's currency in terms of another currency. An exchange rate thus has two components, the domestic currency and a foreign currency, and can be quoted either directly or indirectly. In a direct quotation, the price of a unit of foreign currency is expressed in terms of the domestic currency. In an indirect quotation, the price of a unit of domestic currency is expressed in terms of the foreign currency.
2. An export (EXP) is a function of international trade whereby goods produced in one country are shipped to another country for future sale or trade. The sale of such goods adds to the producing nation's gross output. If used for trade, exports are exchanged for other products or services. Exports are one of the oldest forms of economic transfer, and

occur on a large scale between nations that have fewer restrictions on trade, such as tariffs or subsidies.

3. Import (IMP) is a good or service brought into one country from another. Along with exports, imports form the backbone of international trade. The higher the value of imports entering a country, compared to the value of exports, the more negative that country's balance of trade becomes.

3.4 Model Analysis

To investigate more on wheter the selected ASEAN-5 countries are free from trade imbalances and investigate the effect of it as the exchange rate gets fluctuating; so VAR-based approaches are used.

The analysis used on this model is Vector Autoregression (VAR) model as an attempt to examine the dynamic relationships between two (or more) variables. A time series data are needed to investigate the phenomena using VAR approach. According to Enders (1995), an n-equation VAR is an n-variable linear system in which each variable is in turn explained by its own lagged values and past values of the remaining n-1 variables.

There are some reason for the researcher taking this model as the tools to investigate the variables. First, the previous studies imply that the trade balance’s variables are simoustantly co-integrated. We need to treat each variables symmetrically and see the relationship among them. Second, VAR analysis are very comprehence to a single equation approaches for capturing the long-run

dynamic of variables. VAR approach is enabled to do need to differentiate between exsogen and endogen variables, and its ability to capture dynamic movement as one or more variable are reached in respond a movement from other variable (Sim, 1980).

As the variables are treated as endogenous variables, hence we may write as the equation below.

$$EXR_t = c_{10} + \alpha_{11}EXR_{t-1} + \alpha_{12}EXP_{t-1} + \alpha_{13}IMP_{t-1} + \epsilon_1$$

$$EXP_t = c_{20} + \alpha_{21}EXR_{t-1} + \alpha_{22}EXP_{t-1} + \alpha_{23}IMP_{t-1} + \epsilon_2$$

$$IMP_t = c_{30} + \alpha_{31}EXR_{t-1} + \alpha_{32}EXP_{t-1} + \alpha_{33}IMP_{t-1} + \epsilon_3$$

The expanse definition of the equation can be writen in matrixes form as below.

$$\begin{bmatrix} EXR_t \\ EXP_t \\ IMP_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} \end{bmatrix} \begin{bmatrix} EXR_{t-1} \\ EXP_{t-1} \\ IMP_{t-1} \end{bmatrix} + \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \\ \epsilon_{3t} \end{bmatrix}$$

In addition, if the variable have unit roots, then we can exploit that there may exist co-movement in their behavior and possibilities that they will trend together toward a long run equilibrium state. Then, using the greater representation theorem, we may posit the following testing relationships that constitute a VEC model for exchange rate fluctuation.

We follow the standard procedure of time series analyses by following these procedures:

1. Unit Root Test – Augmented Dickey Fuller and Phillips-Perron Test
2. Correlation Matrix – Johansen-Juselius Cointegration Test
3. Vector Autoregression-based analysis (VAR/VECM)
4. Impulse Response Function
5. Variance Decomposition Test

The further analysis techniques will be explained in the following chapter.

3.5.1 Unit Root Test

Unit root test supposed to figure out the stationary of research data (Thomas, 1997). This undergraduate thesis using the commonly used tool which called Augmented Dickey Fuller (ADF) and Phillips Perron (PP) test.

The ADF test defines the existence of unit root in the research data. The estimation procedure will takes place in the form;

$$\Delta Y_t = a_0 + a_1 t + \delta_1 Y_{t-1} + a_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t$$

Phillips perron testassess the null hypothesis of a unit root in a univariate time series y. All tests use the model;

$$Y_t = c + \delta_t + aY_{t-1} + \varepsilon_t$$

Where ΔY_t denotes lag difference under variable consideration. M is the number of lags and $\varepsilon_t$is the error term. From the equation above comes with this following hypothesis;

$$H_0 = \delta = 0$$

$$H_1 = \delta < 0$$

The first equation show that the unit roots does exist and the data is not stasioner. The second equation means that there is no unit roots so than the data is stationer. If null hypothesis cannot be rejected and the data are not stationer in the level, therefore we need to go through higher order differentiating process to archieve stationer.

3.5.2 Co-integration Test

For the co-integration test we employ the VAR-based approach of Johansen (1988) and Johansen and Juselius (JJ, 1990). The latter develop two test statistic to determine the number of co-integrating vector i.e. trace statistic and maximum eighen value test. Start with a VAR representation of the variables, in this case what we think is the economic system we would like to investigate. We have dimensional process, integrated of order *d*, {x} t~I (d), with the VAR representation,

$$A_k(L)x_t = \mu_0 + \Psi D_t + \varepsilon_t$$

The empirical VAR is formulated with lags and dummy variables so that the residuals become a white noise process. Here we do test for all components in the residual process. The reason being that the critical values are determined conditionally on a normal distribution of the residual process. Typically, we will assume that the system is integrated of order one. If there are signs of I(2) variables, we will transform them to I(1) before setting up the VAR. The VAR in levels can be transformed to a vector error correction model (VECM). VECM is utilized to identify the long run behavior of the variables and their short run

relations and therefore can better reflect the relationship among the variables.In a traditional VAR analysis, Luthepohl and Reimers (1992) showed that impulse-responses and variance decomposition analysis can be used to obtain information concerning the interactions among variables.

3.5.3 Vector Auto Regression / Vector Error Correction Model

a. Vector Auto Regression (VAR) is an econometric model used to capture the evolution and the interdependencies between multiple time series. All the variables in VAR are treated symmetrically by involving each variable an equation explaining its evolution based on its own lags and the lags of all the other variables in the model. Econometric model that builds upon the relationship between the variable that refers to the model and used to see the causal relationships between variables

   General model, VAR with *lag*1;

$$Y_t = a_{1i} + \sum \beta_{1i} Y_{t-1} + \sum Y_{1i} X_{t-1} + \varepsilon_t$$

$$X_t = a_{2i} + \sum \beta_{2i} Y_{t-1} + \sum Y_{2i} X_{t-1} + \varepsilon_t$$

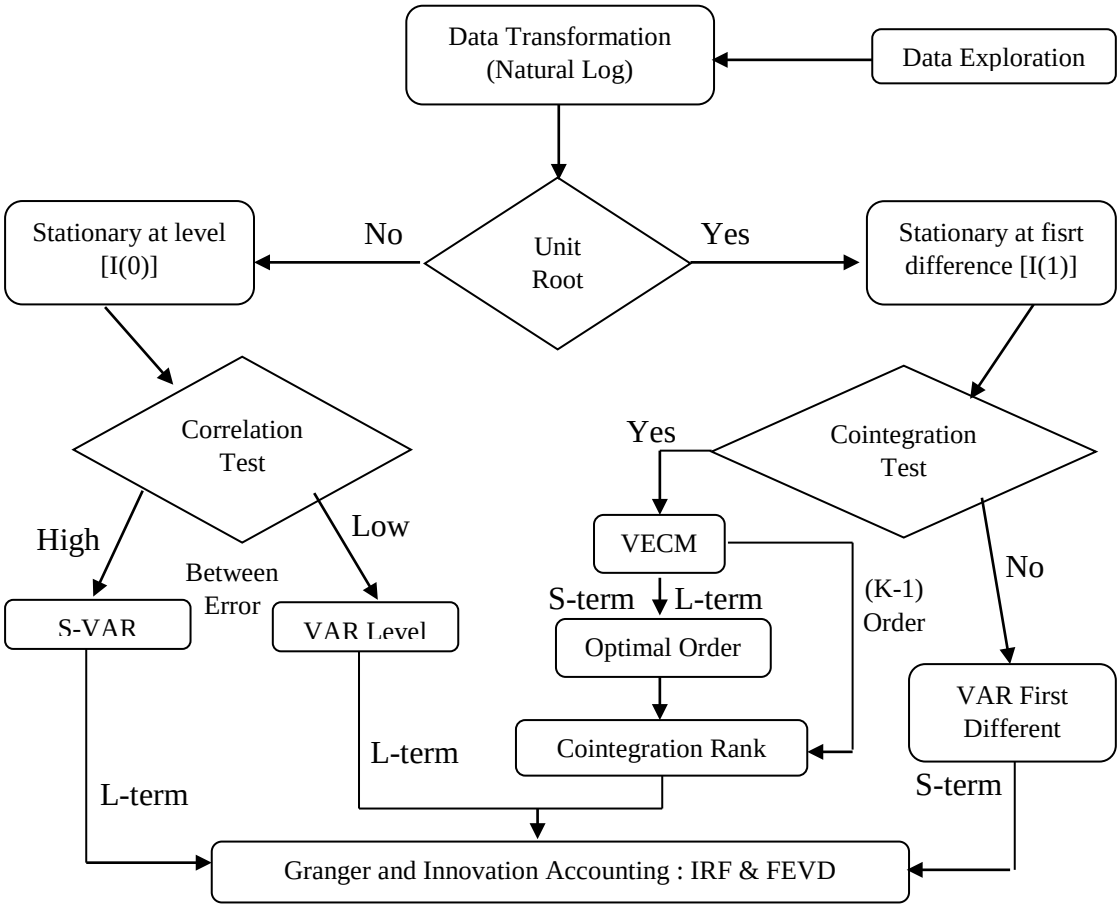
The advocates of VAR emphasize these virtues of the method; (1) the method is simple; one does not have to worry about determining which variables are endogenous and which one is exogenous. All variables in VAR are endogenous. (2) Estimation is simple; that is, the usual OLS method can be applied to each equation separately. (3) The forecasts obtained by this method are

in many cases better than those obtained from the more complex simultaneous-equation models. (Gujarati, Damodar N. 2004)

b. Vector Error Correction Model (VECM) is restricted VAR used for nonstationary data series that are known to be cointegrated. The VECM restricting the long-run relationship among endogenous variables and changing them into their cointegration relationship, while allowing their short-run adjustment dynamics. The short-run adjustments correcting the movement of long-run's deviation equilibrium gradually that is called cointegration term or known as error term. (Basuki and Yuliadi, 2015)

The process of VAR/VECM method will be shown below;

Figure 3.1
VAR/VECM analysis process



Source: Gujarati (2004)

3.5.4 Impulse Response Function

Impulse Response Function (IRF) estimation is needed to determine an endogenous variable response to shocks specific variables. IRF also used to see the shockscaused by the other variables and how long these effects occur (Nugroho, 2009). Through IRF, the response of an independent change of one standard deviation can be reviewed. IRF explore the impact of interference by one standard error as an innovation on an endogenous variable against other endogenous variable. An inovation on a variable, will directly impact the variable in question, and then proceed to all other endogenous variables through the dynamic structure of the VAR (Nugroho, 2009).

3.5.5 Variance Decomposition Test

Variance decomposition, the decomposition of the variance of the endogenous variables into the component surprises endogenous variables VAR else in the system. This explains the variance decomposition proportions due to the movement of a series of variables surprise itself compared with other variables surprise. (Nugroho, 2009). The variance decomposition will provide information on the proportion of the movement the shock effect to the shock on other variables in the current period and future periods (Ajija, 2011).