

DETERMINANTS OF FOREIGN EXCHANGE RATE  
(MALAYSIA: 1991 Q1 – 2015 Q3)

BY

LEE ANN JOE  
LEONG CHEE CONG  
LIM PEI SAN  
NONG JUAN A/P WAL  
YEE MIE CHIN

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- (1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.
- (2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.
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Name of Student:	Student ID:	Signature:
1. LEE ANN JOE	13ABB07626	_____
2. LEONG CHEE CONG	13ABB07120	_____
3. LIM PEI SAN	13ABB07682	_____
4. NONG JUAN A/P WAL	13ABB08174	_____
5. YEE MIE CHIN	13ABB07619	_____

Date: \_\_\_\_\_

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TABLE OF CONTENTS

	<b>Page</b>
Copyright Page .....	ii
Declaration .....	iii
Acknowledgement .....	iv
Table of Contents .....	v
List of Tables .....	ix
List of Figures .....	x
List of Appendices .....	xi
List of Abbreviations .....	xii
Preface .....	xiii
Abstract .....	xiv

**CHAPTER 1 - RESEARCH OVERVIEW**

1.0	Introduction .....	1
1.1	Research Background	
1.1.1	Exchange Rate History of Malaysia .....	1
1.1.2	Exchange Rate Regime in Malaysia .....	3
1.2	Problem Statement .....	6
1.3	Research Question .....	8
1.4	Research Objective	
1.4.1	General Objective .....	9
1.4.2	Specific Objective .....	9

1.5	Hypothesis of the Research	
1.5.1	First Hypothesis – Lending Interest Rate .....	10
1.5.2	Second Hypothesis – Foreign Exchange Reserve.	10
1.5.3	Third Hypothesis – Export Import Ratio .....	11
1.6	Significance of the Research Study	
1.6.1	Government and Policy Maker .....	12
1.6.2	Investor and International Traders .....	13
1.7	Chapter Layout .....	13
1.8	Conclusion .....	14

## **CHAPTER 2 – LITERATURE REVIEW**

2.0	Introduction .....	15
2.1	Review of Literatures	
2.1.1	Nominal Foreign Exchange Rate (EXR) .....	15
2.1.2	Lending Interest Rate (i) .....	18
2.1.3	Foreign Exchange Reserve (FER) .....	20
2.1.4	Export Import Ratio	
2.1.4.1	Export (EX) .....	21
2.1.4.2	Import (IM) .....	22
2.1.4.3	Ratio of Export to Import (EXIM) .....	23
2.2	Review of Relevant Theoretical Models	
2.2.1	Law of One Price .....	24
2.2.2	Purchasing Power Parity	
2.2.2.1	Absolute Purchasing Power Parity .....	25
2.2.2.2	Relative Purchasing Power Parity .....	26
2.2.3	International Fisher Effect (IFE) .....	28
2.2.4	Interest Rate Parity .....	29

2.2.4.1	Covered Interest Rate Parity .....	29
2.2.4.2	Uncovered Interest Rate Parity .....	30
2.2.5	Dornbush’s Overshooting Model .....	32
2.2.6	Buffer Stock Theory.....	35
2.2.7	Traditional Flow Approach.....	36
2.3	Proposed Framework .....	37
2.4	Conclusion .....	37

### **CHAPTER 3 – METHODOLOGY**

3.0	Introduction .....	39
3.1	Research Design .....	39
3.2	Data Collection Method	
3.2.1	Secondary Data .....	40
3.3	Sampling Design	
3.3.1	Target Population .....	42
3.3.2	Sampling Technique .....	42
3.4	Data Processing .....	43
3.5	Methodology	
3.5.1	F-Test .....	43
3.5.2	T-Test .....	45
3.5.3	Normality Test .....	46
3.5.4	Multicollinearity .....	47
3.5.5	Heteroscedasticity .....	48
3.5.6	Autocorrelation .....	50
3.5.7	Model Specification Error .....	51
3.6	Conclusion .....	52

## **CHAPTER 4 – DATA ANALYSIS**

4.0	Introduction .....	53
4.1	Ordinary Least Square (OLS) .....	58
4.1.1	F-Test .....	58
4.1.2	T-Test .....	58
4.1.3	Normality Test .....	60
4.1.4	Multicollinearity .....	60
4.1.5	Heteroscedasticity .....	61
4.1.6	Autocorrelation .....	62
4.1.7	Model Specification Error .....	63
4.2	Conclusion .....	63

## **CHAPTER 5 – DISCUSSION, CONCLUSION AND IMPLICATIONS**

5.0	Introduction .....	64
5.1	Statistical Analyses .....	64
5.2	Discussion of Major Findings	
5.2.1	Lending Interest Rate .....	65
5.2.2	Foreign Exchange Reserve .....	65
5.2.3	Export Import Ratio .....	66
5.3	Implication of Research Study	
5.3.1	Government and Policy Maker .....	67
5.3.2	Investors and International Traders .....	68
5.4	Limitation .....	69
5.5	Recommendations .....	70
5.6	Conclusion .....	71
	Reference .....	72
	Appendix .....	88



LIST OF TABLES

	<b>Page</b>
Table 3.1 : Explanation on Variables .....	41
Table 5.1 : The Expected and Statistical Result .....	64

LIST OF FIGURES

	<b>Page</b>
Figure 2.1 : The Dornbusch Overshooting Hypothesis Display .....	33
Figure 2.2 : Relationship between selected variables with foreign exchange rate .....	37
Figure 3.2 : The Flow Chart of Data Processing .....	43

LIST OF APPENDIX

	<b>Page</b>
Appendix 4.1 : Original OLS Model .....	88
Appendix 4.2 : Normality Diagnostic Testing .....	88
Appendix 4.3 : Multicollinearity .....	89
Appendix 4.4 : Heteroscedasticity Diagnostic Testing.....	90
Appendix 4.5 : White Heteroskedasticity-Consistent Standard Errors & Covariance Test.....	92
Appendix 4.6 : Autocorrelation Diagnostic Testing.....	93
Appendix 4.7 : Newey-West (HAC) Test .....	94
Appendix 4.8 : Model Specification Diagnostic Testing.....	94

LIST OF ABBREVIATIONS

BLUE	–	Best, Linear, Unbiased Estimator
BNM	–	Bank Negara Malaysia
CIA	–	Covered Interest Arbitrage
CIRP	–	Covered Interest Rate Parity
CLT	–	Central Limit Theorem
EX	–	Export
EXIM	–	Export Import Ratio
EXR	–	Foreign Exchange Rate
FE	–	Fisher Effect
FER	–	Foreign Exchange Reserve
GDP	–	Gross Domestic Product
HAC	–	Heteroskedasticity and Autocorrelation Consistent
i	–	Lending Interest Rate
IFE	–	International Fisher Effect
IM	–	Import
IMF	–	International Monetary Fund
IRP	–	Interest Rate Parity
JB	–	Jarque-Bera
LOP	–	Law of One Price
MSE	–	Mean Square Error
MSR	–	Mean Square Regression
MYR	–	Ringgit Malaysia
OLS	–	Ordinary Least Square
PPP	–	Purchasing Power Parity
UIRP	–	Uncovered Interest Rate Parity
USD	–	United State Dollar
VIF	–	Variance Inflation Factor

## PREFACE

We come across this research as we noticed that Ringgit Malaysia (MYR) is depreciated and bringing large effect in economy Malaysia during year 2015. A setback of foreign exchange rate will causes a lot of troubles in a nation. In order to manage foreign exchange rate efficiently, macroeconomic factors of foreign exchange rate should be deeply investigated. This research is concerning on the determinants of foreign exchange rate in Malaysia, in other words, what factors will bring impact towards the foreign exchange rate. First, are lending interest rate, foreign exchange reserve, export and import affecting the foreign exchange rate? Second, which variable is and which is not significantly affecting the foreign exchange rate? By understanding these two questions, it might help in investigation of macroeconomic determinants that affect foreign exchange rate in order to protect public interest and avoid economic problems.

## ABSTRACT

This research attempts to investigate the relationship between the foreign exchange rate and the independent variables, such as, lending interest rate, foreign exchange reserve, export and import in Malaysia. Secondary data was sourced within the period of 1991 Q1 to 2015 Q3, which was collected from International Monetary Fund Data-stream. On the other hand, the technique that implemented to estimate the model was Ordinary Least Square. The result showed that the determinants factors of foreign exchange rate through foreign exchange reserve, export and import is capable of influencing which has an direct relationship and statistically significant to the foreign exchange rate. However, result shown insignificant relationship between lending interest rate and foreign exchange rate. Further, one of the variables showed a distinctive result with the expected sign. As predicted by literature review, export import ratio should bring a positive impact to economic growth. Yet, this research investigates an inverse result with compare with the pasted researches. Although this study experienced some limitations, thence the recommendations have been suggested to the future researchers. Regardless of limitation occurred this study is still applicable for government, policy maker, investors and international traders.

## **CHAPTER 1 : RESEARCH OVERVIEW**

### **1.0 Introduction**

Chapter 1 will briefly explain the research topic from broad view. This chapter consists of background of foreign exchange market and exchange rate regime in Malaysia. Besides, problem statement, research questions, research objectives and hypotheses will be brought out in this chapter too. Moreover, significant of the research is showed in this chapter based on the information from the past researchers' studies. Lastly, chapter layout of this research report will be stated in the end of this chapter.

### **1.1 Research Background**

Foreign exchange rate is considered as price for a nation's currency in order to buy another nation's currency; it indicates a domestic currency's quotation in terms of foreign ones. For example, quotation of MYR/USD 0.24 means that MYR1.00 is able to buy 0.24 USD; or it can be quoted as 4.20MYR/USD which refers to people able to exchange for MYR4.20 per USD.

Foreign exchange rate is determined by the foreign exchange market, a market open for currency trading continuously 24 hours every weekday except weekends. Every countries manages value of its currency through different mechanism, this will determines the foreign exchange rate regime which apply to its currency. For example, countries can set their currency be floating, pegged, fixed or hybrid.

#### **1.1.1 Exchange Rate History of Malaysia**

Backed to 12 June 1967, the currency of Malaysia was known as

Malaysian Dollar (M\$) and issued by Bank Negara Malaysia (Aziz, n.d.). By that time, UK pounds sterling was the “official currency” in Malaysia foreign exchange market. However, on 23 June 1972, UK pounds sterling was floated, it cause Malaysian government decide to revalue the Malaysia Dollar and then Malaysia authority decided changed the “official currency” to US\$ instead of the UK£ (Talib, 2005). During August 1975, the Malaysia currency was legally renamed from “Malaysian dollar” to “ringgit” according to the Malaysian Currency (Ringgit) Act 1975 (BNM, 2015). However, even though the name of “ringgit” was officially accepted, the currency of Malaysia was still referred to as dollar. This scene was being continued until year 1993 when the currency of Ringgit Malaysia (RM or MYR) was introduced to replace Malaysian Dollar (Nathesan, 2015). Following will present some major events happened in Malaysia foreign exchange market.

In mid of 70s, dramatic fluctuation in value of M\$ was happened. M\$ is appreciated about 20% from 1976 to 1980 (Chua & Bauer, 1995). According to Ministry of Finance (1979), USD is weakened against Ringgit in late 1970s due to US had a high inflation. Besides, it is also because of Malaysia economy is growing rapidly as net exporter of oil.

In year 1980 to 1981, Ringgit depreciated against the US\$. It caused the exchange rate back to stable condition. The depreciation is continued until the first three quarters in 1982, as a result of high US interest rates and strong commercial demand for dollar, Ringgit depreciated against US\$. In the last quarter of 1982, the Ringgit gained slightly while US discount rate declined. Trade deficit in United States and the belief of major banks had funding problems with loans to Latin American countries caused the dollar depreciated in the first half of 1984 (Chua & Bauer, 1995).

The Ringgit was then continued depreciated about 15% relative to the USD from 1984 to 1989 due to high commercial demand for foreign currencies in Malaysia foreign exchange market, along with persistent



unfounded rumours of devaluation of Ringgit (Leeds, 1989). The depreciation is continued until 1990, economy recession in US caused the dollar depreciated against Ringgit for a while. In 1991, the Ringgit depreciated again due to the strengthening of the dollar arising in quick recovery of US economy. Not long after, Ringgit finally appreciated relative to dollar about 9% from late 1991 to early 1992 due to strong economy and tight monetary policy applied to combat inflation led to higher interest rates and large capital inflows (Chua & Bauer, 1995).

In order to avoid large capital outflow and volatile short term capital flows of the MYR during the 1997 Asian financial crisis, Bank Negara Malaysia (BNM) decided to control domestic interest rates. Few selective exchange controls were introduced on 1 September 1998 by BNM while the foreign exchange rate was fixed at MYR3.80/US1.0 (Seong, 2013).

In July 2005, the exchange rate peg to the USD was replaced by managed float system. This caused that exchange rate became relatively stable and a slight appreciation occurred. Ringgit reached MYR3.43/USD in 2009 (Malaysia Country Monitor, 2012). There was about 7% of appreciation in ringgit against dollar during the first quarter of 2010 due to rising external surpluses, low inflation, rapid economic growth, and higher domestic interest rates. In 2011, Asia crisis period caused Ringgit depreciated more than 6%. Bank Negara Malaysia (BNM) tried to make some recovery on it. However, there was a steady depreciation in MYR after it. The depreciation in MYR has shocked the investor confidences and it cause further depreciation in MYR to a 17 year low of MYR4.46/USD1.0 on 29 September 2015 (Reuters, 2015).

### **1.1.2 Exchange Rate Regime in Malaysia**

In this section discussion on exchange rate regime in Malaysia will be made. The exchange rate regime basically is the way of an authority

manages its currency in foreign exchange market. Government is needed to create an exchange rate regime which works with monetary policy of a country as they both are the main instrument for the government to achieve their countries' financial and economics objective (Bunjaku, 2015).

In the earliest time on 21 June 1973, floating rate exchange system has been introduced and being adopt in Malaysia (Bank Negara Malaysia, 2015). A floating rate exchange system can be explained as the exchange rate movement is totally affected by market force (Bunjaku, 2015). There are some advantages of floating exchange rate system which worth to be mention. As pointed by King (1977), the advantage of this system is all trades and financial transactions will be based on real factors rather than nominal factors, which mean the international inflation rate, will not affect the international trade. As the floating rate exchange system able to make adjustment by itself through demand and supply, a country is able to absorb the shock from the foreign exchange market.

At that time, currency of Malaysia was being called as Malaysian Dollar (M\$). The floating rate exchange system enables the M\$ to float. Bank was no longer bounded to buy USD at floor rate of M\$2.4805/USD, banks were independent to regulate its' own foreign exchange rates in terms to any foreign currency for any amount. At the same time, the commercial banks also being assisted by the central bank in order to safeguard the foreign exchange market conduct and operations (BNM, 2015).

In 1974, practicing of "deals" was changed from "value today" to "value spot" in order to keep the pace of international practice. "Value spot" is refers to settlement of a trade will only be settled on the second business day following the day of the trade or deal.

On 27 September 1975, foreign exchange rate market of Malaysia was based on basket of currencies; value of Malaysia currencies was being determined by currencies of those countries which have significant trading

with Malaysia. Malaysia government decided that it was no longer desirable for Bank Negara Malaysia to determine the exchange rate for the ringgit in terms of USD; it was not satisfying to depend only on exchange rate against to USD to maintain foreign exchange market in Malaysia (BNM, 2015). Bank Negara Malaysia are needed to start concern not only exchange rate against USD but also some other significant currencies like UK£ and AUD.

During the Asian financial crisis in 1997, a pegged exchange rate regime was imposed in Malaysia where foreign exchange rate against the USD was fixed (Goh & McNown, 2015). Further, there were some selective capital controls bring implied as to prevent speculative attacks on currency. The reason to run such regime is to protect the Malaysia's economy from external exposure and restore financial stability.

Under pegged exchange rate regime, convertible currency such as US dollar, Euro, or some other currencies are being pegged by the government. The main advantage of the pegged exchange rate regime is it can be acted as a monetary instrument which has the ability to achieve inflation stability (Aizenman & Glick, 2008). Besides, Aizenman and Glick (2008) also commented about the overall performance of pegged exchange rate system, saying that there will be an adverse outcome when exit from pegging system, there will be a huge welfare loss to the economy of that particular country.

After the Asian Financial Crisis ended in 2000s, BNM kept continue the fixed exchange rate regime but increased slightly on capital controls during May 2001. This regime was continued until 21 July 2005 as it changed back to managed float regime in order to deal in part with large current account surpluses and significant inflows of capital (Goh et al., 2006; Goh & McNown, 2015).

The reason of Malaysia substitute fixed exchange rate regime with managed float practices is because it is impossible to have monetary policy autonomy, fixed exchange rate regime and open capital market at the same time although it may be possible in short term. Governments have to allow foreign exchange rate float freely with an open capital account regime if the nations want to have its own monetary policy in long-run.

Managed floated regime is a specific practical type of foreign exchange rate regimes which the exchange rate is allowed to move freely according to market forces, but only in daily basis. It can be said that managed float system is a mixture of fixed and floating rate system (Bunjaku, 2015). It is being considered as kind of pragmatic because it utilise the benefits of floating-flexible exchange rate system where there is an automatic adjustment reacting to the international exchange rate fluctuations and at the same time, government able to take charges if necessary, in order to adjust the foreign exchange rate for certain period of time if the rate does not move in wanted direction.

During 2015, MYR has fallen against the USD to its lowest levels in 17 years, however Bank Negara did not peg the MYR and exercise institute capital controls for Malaysia. Managed float regime is still continuously functioning until now in Malaysia. This is because the exchange rate regime Malaysia currently can helps the country to adapt the changes of value of currency as if the exchange rate doesn't adjust; prices and demand has to be adjusted.

## **1.2 Problem Statement**

Nowadays, foreign exchange trading becomes a very popular profit earning method in Malaysia. Foreign exchange rate is a very important topic to study because it influences not only government but also all companies, traders, as well as all individuals in an economic. A reporter named Barbara (2015) reported that

there is 62 per cent from 8 million foreign exchange trading accounts were opened by people who under age 35. People nowadays like to work with jobs which have flexible working time, and many students trying to find a simple way to earn some pocket money, foreign exchange trading always is one of their choices of alternative income as it is easy to be exercised. As more and more people enter into foreign exchange market, the fluctuations in foreign exchange rate will have a bigger and bigger impact towards the society. Residents now should realise they are responsible for foreign exchange rate stability of their nations, and thus, it is important for them to study more about foreign exchange rate. In order to avoid personal losses and also social losses, knowing determinants of foreign exchange rate are crucial.

In relation to foreign exchange, Malaysia is now a hot topic due to the sharp depreciation and devaluation in domestic currency, Ringgit Malaysia (MYR). MYR started depreciate in late 2014, and on 29 September 2015, it breached at 4.46MYR/USD. These not only affect the consumer daily spending in that country, but also influence the economy in Malaysia as well. Besides, Malaysia is a developing country; foreign exchange rate is important to large amounts of the importer and exporter. In order to help maintain stability of MYR, it is necessarily to understand the determinants that affect it. Thus, Malaysia was chosen to be research target in this paper, to help in avoiding similar cases happen again.

Ringgit Malaysia (MYR) almost falls to ground-level in year 2015, Lau (2014) and Kok (2015) stated that it causes government difficult to achieve fiscal deficit target. Moreover, depreciation and devaluation in MYR affected household daily livings; they have to pay higher prices in order to get daily necessities like foods and groceries (Bernama, 2015). Besides, researchers state that depreciation in MYR will also increase Malaysia's external debt (Mohd Dauda et al., 2013). Moreover, foreign exchange rates also play a very important role in international trade. Firms and companies which involved in exportation and importation will be heavily impacted. Depreciation in MYR will make the imported goods in Malaysia becomes more expensive, due to it is now require more MYR in order to purchase foreign goods and services, vice versa (Pettinger, 2013).

From time to time, researchers used variety of variables on their researches to examine the determination of foreign exchange rate, such as debt, export, import money supply, tax and so on (Ahmed et al., 2012; Hassan & Gharleghi, 2015; Udousung et al., 2012). It cannot be denied that the macroeconomic variables tend to have notable effects on foreign exchange rate; however, it's arguable that which macroeconomic variables are significant to determine the rate.

Xavier (2015) reported that foreign reserves can back liabilities of central bank including local currency it issues, i.e. statutory deposits which banks required to store in central bank. Central bank intervene foreign exchange market by selling foreign currencies when demand for local currency is falling, it would cause additional demand to renovate the peg, vice versa.

As a short conclusion, a setback of foreign exchange rate will causes a lot of troubles in a nation. In order to manage foreign exchange rate efficiently, and avoid all problems caused by depreciation and devaluation of currency, determination of foreign exchange rate as a root of all problems is important to be examined. Thus in this research paper, factors of foreign exchange rate will be deeply discussed.

### **1.3 Research Question**

There are three research questions in this research:

1. Is there a relationship between lending interest rate and foreign exchange rate?
2. Is there a relationship between foreign exchange reserves and foreign exchange rate?
3. Is there a relationship between export import ratio and foreign exchange rate?

## **1.4 Research Objectives**

In current market economics, there are a lot of underlying factors which lead to changes in exchange rate and cause publics feel hesitate to buy or invest in foreign currency. The objectives of this research are as following:

### **1.4.1 General Objective**

The objective of this research is to investigate the macroeconomic determinants that affect foreign exchange rate in order to protect public interest and avoid some economic problems.

### **1.4.2 Specific Objectives**

- To evaluate the influences of lending interest rate on foreign exchange rate.
- To evaluate the influences of foreign exchange reserves on foreign exchange rate.
- To evaluate the influences of export import ratio on foreign exchange rate.

## **1.5 Hypothesis of the Research**

Based on research questions generated, following hypotheses are developed in our research:

### **1.5.1 First Hypothesis – Lending Interest Rate**

$H_0$  : There is no significant relationship between lending interest rate and foreign exchange rate.

$H_1$  : There is significant relationship between lending interest rate and foreign exchange rate.

From the research results of Mirchandani (2013), rises in lending interest rate will cause depreciation of home currency against other currency. According to Ramasamy and Abar (2015), this negative relationship might due to the strength of currency which arises from the confidence of public and investors but not from the influence of economic variables. However, Chowdhury and Hossain (2014) found that increase in lending interest rate will causes home currency to appreciate. Sinha and Kohli (2013) stated that higher interest rates may attract foreign capital as the investors would like to invest with higher interest rate to generate more profits thus domestic currency will appreciate. This result outcome is consistent with research results from Bashar and Kabir (2013). In either way, lending interest rate is expected to have significant relationship with foreign exchange rate.

### **1.5.2 Second Hypothesis – Foreign Exchange Reserves**

$H_0$  : There is no significant relationship between foreign exchange reserves and foreign exchange rate.

$H_1$  : There is significant relationship between foreign exchange reserves and foreign exchange rate.

According to Suthar (2008), rising of foreign exchange reserves will increase the supply of foreign currency; hence the value of domestic currency will also increase. The research shows that foreign exchange reserves have significant impacts on the exchange rates. Based on the study of Prabheesh et al. (2007), there is a higher demand for foreign



exchange reserves accumulation in developing countries compared to developed countries; this is because developing countries have to use reserves stock to reduce exchange rate fluctuation. Besides, Calvo and Reinhart (2002) found that an increase in foreign exchange reserves will leads to high demand of domestic currency in the international market, hence a currency appreciation, vice versa. In short, foreign exchange reserve is expected having positive relationship with foreign exchange rate, where increase in foreign exchange reserve will cause appreciation of home currency.

### **1.5.3 Third Hypothesis – Export Import Ratio (EXIM)**

$H_0$  : There is no significant relationship between export import ratio and foreign exchange rate.

$H_1$  : There is significant relationship between export import ratio and foreign exchange rate.

It is expected that rising export values will cause appreciation of home currency (Meng, 2015; Parveen et al., 2012; Wong & Tang, 2007) while increase in import values will have negative impact (Bashir & Luqman, 2014; Gelbard & Nagayasu, 2004; Nucu, 2011; Waheed, 2012). Thus, it is hypothesized that the relationship between ratio of export to import and foreign exchange rate is positive (Parveen, et al., 2012), where the ratio value is higher, the home currency will be appreciated more. It is expected that increase in export and/or decrease in import will cause the ratio increase; and when ratio becomes higher, the domestic currency value will be appreciated and thus foreign exchange rate will be increase. It might due to when export is larger than import, demand for local currency will be higher, and thus value of local currency will be appreciated, vice versa.

## **1.6 Significance of the Research Study**

### **1.6.1 Government and Policy Makers**

There is an increasing number in currency trading, appreciation or depreciation in foreign currency will always affect a country's economic. In order to have better forecast on foreign exchange rate movement, researchers always try to identify and investigate the macroeconomic factors associated with foreign exchange rate. Once the determinants have been proven having a relationship with foreign exchange rate, governments can try to control these determinants in order to achieve desired foreign exchange rate. There are many researches have been presented for policy makers in order to help government strengthen their economy (Amuedo-Dorantes & Pozo, 2004; Bashir et al., 2013; Chowdhury and Hossain, 2014; Nwude, 2012; Ogun, 2012; Parveen et al., 2012; Proti, 2013). This research would assists government in spending right money at the right place, without wasting resources.

According Chowdhury and Hossain (2014), researches enables policy makers have a clear view in formulating effective exchange policies and achieve economic growth. With appropriate understanding of factors influencing foreign exchange rate, it gives advantages to governments in controlling values of their currencies. In order to safeguard stability of a country's economy, foreign exchange rate is needed to be supervised. This research would give a clear view to policy makers in order to implement efficient exchange policies after realize the reason of falling or rising in currency values. As Parveen et al. (2012) stated: a suitable policy implementation always comes with findings from researches.

### **1.6.2 Investors and International Traders**

According to Bouraoui and Phisutthiwatcharavong (2015), foreign exchange rate will affect the real return of an investor's global investment portfolio. Investors prefer to invest in economy where foreign exchange rate is relatively stable (Chowdhury and Hossain, 2014), thus a country should become more attractive place for investment, where foreign exchange rate is playing the main role. In order to better forecast future foreign exchange rate, understand the determinants that force a move on foreign exchange rate is crucial. From time to time, researchers run researches to improve forecasting performance (Bashir et al., 2013; Chowdhury and Hossain, 2014; Meerza, 2012). This research would benefits individuals and firms in improving their forecasting performance on foreign exchange rate by further understand and investigate the macroeconomic determinants of foreign exchange rate. A better forecast performance will helps investors reduce investment risk and avoid losses when trading currencies.

Besides, knowledge on determinants of foreign exchange rate will assist exporters and importers in firm-value decisions and risk exposures (Necşulescu & Şerbănescu, 2013; Simpson & Evans, 2004;). They can avoid losses or earn revenues by accurately predicting the movements of foreign exchange rate (Dauvin, 2014) and thus gain competitiveness (Bouraoui & Phisutthiwatcharavong, 2015) by using appropriate actions and rational strategies, for example, forward contract on foreign exchange market. In other words, understand the relationship between the macroeconomic determinants and foreign exchange rate is essential; it enables people to predict the movements of foreign exchange rate and take appropriate actions beforehand to protect their self-interest.

## **1.7 Chapter Layout**

This research report can be divided into 5 chapters.

Chapter 1 is an overview of the research topic which includes introduction to determinations of foreign exchange rate, background of Malaysia's foreign exchange market, problem statement, research objectives, research questions, hypotheses and significance of this research.

In chapter 2, there will be review of literatures and theoretical models related to determinants of foreign exchange rate. Variables, proposed theoretical framework and hypotheses development will be also discussed in this chapter before start to analyse the data.

Further in Chapter 3 will focus on data and methodology which being used to carry out the research. It will describes the research design, the method of data collections, sampling design, research instrument, the measurement scales and also method of data being processed and analysed.

Chapter 4 will explain the result obtained from processed data. Detailed analyses will be discussed by aid of graphs, tables and charts for a clearer view of results.

Chapter 5 will be last chapter in this research. It will summarise the major findings of this research, discuss implication, limitations of the research and suggestion and recommendation for future researches on this research topic.

## **1.8 Conclusion**

This research is to investigate the macroeconomic determinants of foreign exchange rate in Malaysia. In this paper, lending interest rate ( $i$ ), foreign exchange reserve (FER), export import ratio (EXIM) are proposed to be independent variables that will have impacts on foreign exchange rate. In next chapter, some reviews on past researchers' works, literatures, and theoretical models will be discussed before variables being tested and analysed in Chapter 3.

## **CHAPTER 2 : LITERATURE REVIEW**

### **2.0 Introduction**

In chapter 2 further discussions will be made to provide a better understanding on foreign exchange rate in Malaysia. Literature review will be presented in this chapter which summarizes journals that related to foreign exchange rate (EXR), lending interest rate ( $i$ ), foreign exchange reserve (FER) and export import ratio (EXIM). This chapter will show the relationship of dependent variable and independent variables from previous researches in more details. The last part of this chapter will propose a framework to link all independent variables to dependent variable and conclude this chapter.

### **2.1 Review of Literatures**

#### **2.1.1 Nominal Foreign Exchange Rate (EXR)**

Nowadays is an era of globalization where all nations have their own currency to represent their home countries; money is important for daily transactions, and also as a measurement of a person's wealth. In order to make money paper and coins can be exchanged for goods and services in international market; foreign exchange rate has been introduced to the world. Foreign exchange rate shows the value of a nation's currency against another nation's currency, it can be quoted in either direct or indirect way. Direct quotation refers to a foreign currency is expressed in term of domestic currency; while indirect way meaning domestic currency is expressed in term of foreign currency. In modern era, countries are able to determine the foreign exchange rate solely based on the market forces with established standard. Most currencies fixed their values in term of

gold before World War I but after World War II, most of the currencies are fixed based on the USD (Bashir et al., 2013).

In international trade, foreign exchange rate plays an important role, as it gives value for currency in order for one country to make conversion to another country (Chowdhury and Hossain, 2014). It means that through foreign exchange rate, value of currency converted to another. In globalization era, exchange rate is important when it comes to considering any country to trade globally because trade will become cheaper if the exchange rate is low and become expensive when the exchange rate is high (Chowdhury and Hossain, 2014). Investor may prefer to invest in a country where its exchange rate is stable because in an economy where the exchange rate volatility is high, it gives higher risk to investors, a risk-averse investor will never invest in this type of economy. A country must manage its exchange rate in order to boost up its economy (Chowdhury and Hossain, 2014). Companies and banks need a stable foreign exchange rate in order to evaluate the performance of their investment, doing financing and hedging so as to help them reduce the risk they taken during operation (Abbasi & Safdar, 2014). High cost of importing capital and raw material may incur when there is depreciation in exchange rate which may result increase in unemployment rate and increase price of domestic goods (Waheed, 2012).

In this research, nominal foreign exchange rate is being used as dependent variable instead of using real foreign exchange rate. Nominal foreign exchange rate indicates quantities of one currency can be traded for a unit of another currency while real exchange rate describes how many of goods or services in one country can be traded for one of that good or service in another country. Real exchange rate is not directly observable. As main objective of this research is to investigate the macroeconomic determinants that affect foreign exchange rate but not the purchasing power nor cost of equivalent goods across countries, nominal foreign exchange rate would be suited to be dependent variable rather than real foreign exchange rate.

In reality, daily foreign exchange rate quotation established in foreign exchange market (FOREX market) is nominal rate. In researches study, it is often to see researchers use nominal exchange rate rather than real exchange rate (Abbasi & Safdar, 2014; Ahmed et al.,2012; Bashir et al., 2013; Meerza, 2012; Simpson & Evans, 2004; Waheed, 2012; Zakaria et al., 2007).

Changes in nominal exchange rate have important effects on real economy, useful information can be provided to policy makers and market participants if determinants are identified (Waheed, 2012). Nominal exchange rate represents a strong economic policy tool in its own term which influences growth of international trade, structural change and resource allocation. In economy market, it is extremely important relative price influencing practically all other prices; thus, it deserves high attention (Ogun, 2012) and it's determinants should be examined.

Back to Malaysia, here is some history of Malaysia Ringgit (MYR) since 1980. Ringgit depreciated against US\$ in year 1980 until the first three quarters in 1982, which caused by high US interest rates and strong commercial demand for dollar (Chua & Bauer, n.d.). In 1991, due to the strengthening of the dollar arising in the quick recovery of the United States economy causing the Ringgit depreciated again. Ringgit finally appreciated 9% from late 1991 to early 1992 against to dollar due to strong Malaysian economy and a tight monetary policy applied (Chua & Bauer, n.d.). Bank Negara Malaysia (BNM) then decided to control domestic interest rates in order to avoid large capital outflow and volatile short term capital flows of the MYR during the 1997 Asian financial crisis. Foreign exchange rate was fixed at MYR3.80/US1.0 (Seong, 2013). In July 2005, managed float system replaced the exchange rate peg to the USD causing exchange rate became relatively stable and a slight appreciation occurred. Ringgit reached MYR3.43/USD in 2009 (Malaysia Country Monitor, 2012). The depreciation in MYR has shocked the investor confidences and it cause further depreciation in MYR to a 17 year low of

MYR4.46/USD1.0 on 29 September 2015 (Focus Economics, 2015). Such volatility of MYR from time to time is the major reason of this research paper exists: to examine the macroeconomic determinations of foreign exchange rate.

Currently, foreign exchange market in Malaysia is still under managed float regime since year 2005 and all FOREX transactions in Malaysia are being ruled under Exchange Control Act 1953 and Foreign Exchange Administration (FEA) policies.

### **2.1.2 Lending Interest Rate ( $i$ )**

According to Ngumo (2012), lending interest rate is a price which borrower pays in order to consume resources. In other words, it is an amount charged by lender to borrower for uses of assets (Shafi et al., 2015; Vikram & Vikram, 2015). According to Keynes (1923), lending interest rates represent the cost of borrowing capital for a given period of time. Thus, in this research, lending interest rate is being examined as one of the macroeconomic determinants of foreign exchange rate.

Interest rate is determined by market forces and monetary policy of a country. In economy, price changes are part of process that determines interest rates. High saving interest rate attract investors to save moneys in bank while conversely, low interest rate will encourages investors involved in borrowings and bond markets (Okoth, 2014).

Interest rates are usually expressed in percentage and adjusted quarterly by central bank. If a country facing inflationary pressure, central bank will increase base lending interest rate in order to curtail the money supply. If the country does not apply interest rate adjustment, it might leads to inequilibrium in demand and supply for money market and cause



movements in foreign exchange rate and arbitrage profits exists via borrowing and investing between countries (Ramasamy & Abar, 2015).

There are many researchers analysed the relationship between lending interest rate and foreign exchange rate. From the research of Mirchandani (2013), lending interest rate and foreign exchange rate are highly correlated. The researcher indicated there is a negative correlation between lending interest rate and foreign exchange rate, where increase in lending interest rate will causes depreciation of home currency. According to Ramasamy and Abar (2015), lending interest rate should positively affect the home currency in foreign exchange rate as per theory but at the end it came out with opposite results. The researchers have analysed some of the reasons. Firstly, the value of currency is extremely stronger. The strength is probably come from the confidence of public and investors and not from the influence of economic variable prevailing in the countries.

On the other hand, Sinha and Kohli (2013) found that lending interest rate and foreign exchange rate has a positive relation. They further stated that higher interest rates may attract foreign capital as the investors would like to invest with higher interest rate to generate more profits. The demand for the domestic currency will then increase. Hence, the value of domestic currency will also increase. Moreover, highlighted from Chowdhury and Hossain (2014), increase in lending interest rate will cause appreciation of home currency against another currency. Bashar and Kabir (2013) also found a positive and significant relationship between lending interest rate and foreign exchange rate in the long run.

Besides, Abdoh et al (2016) stated that there is an insignificant relationship between foreign exchange rate and lending interest rates while other variables such as exports are significantly affect the foreign exchange rate. Their findings are identical with findings of Nwude (2012), who stated that lending interest rate has no statistically significant relationship towards exchange rates.

### **2.1.3 Foreign Exchange Reserves (FER)**

Foreign exchange reserves also known as FOREX reserves. It refers to foreign currency deposits and bonds held by central bank and monetary authorities of a nation. The term includes gold, SDRs and IMF reserve positions (Arunachalam, 2010). According to Olayungbo and Akinbobbola (2011), foreign exchange reserves are significantly affects the foreign exchange rates in the short run. The study showed that increase in reserve holdings would serve as a complementary tool to stabilize the exchange rates. Abdullateef and Waheed (2010) argue that holding of reserves has significantly positive impacts to foreign exchange rates, where increase in foreign exchange reserves will cause appreciation in foreign exchange rate. Highlighted from Bouraoui and Phisutthiwatcharavong (2015), there is also a positive relationship between foreign exchange reserves and appreciation of currency. The researchers stated that foreign exchange reserves reflect international investment position and the economy performance of a country. Therefore, higher foreign exchange reserves can raise the value of domestic currency against foreign currencies. Moreover, Emmanuel (2013) also found a similar result in Nigeria. For instance, increase in foreign exchange reserves will lead to domestic currency appreciation. According to Suthar (2008), rising of foreign exchange reserves will increase the supply of foreign currency; hence the value of domestic currency will also increase. Based on the study of Prabheesh et al. (2007), there is a higher demand for foreign exchange reserves accumulation in developing countries compared to developed countries; this is because developing countries have to use reserves stock to reduce exchange rate fluctuation. Besides, Calvo and Reinhart (2002) also promote that foreign exchange reserves are used to examine the determinants of exchange rate. They found that an increase in foreign exchange reserves will leads to high demand of domestic currency in the international market, hence a currency appreciation, vice versa.

However, there are some researchers that were not agreed with the statement above. They indicated that foreign exchange reserves were insignificantly affects the movement of foreign exchange rates. Zakaria et al. (2007) show the insignificant relationships between foreign exchange reserves and foreign exchange rates. The researchers further explained that this may due to some external factors dictated reserves position. Gokhale and Raju (2013) also conducted a study with examining causality between foreign exchange rate and foreign exchange reserves in the Indian. The result also indicates that there is no relationship existed between the foreign exchange rate and foreign exchange reserves in either long run or short run.

## **2.1.4 Export Import Ratio (EXIM)**

### **2.1.4.1 Export (EX)**

In world of economy, export is expected as lead of demand for currency while net investment leads to supply of the currency (Heim, 2010; Parveen et al., 2012). In between years 2008 and 2011, Swiss economy suffer the development problem while the country largely depend on exports, it cause an incredibly low exchange rate of one Swiss franc per euro on September 2011 (Lera et al., 2016). According to Ito et al. (1999), successful exports will cause surplus in current account and thus a nominal appreciation pressure on the currency, if and only if government does not intervene in the foreign exchange market. Moreover, according to Wong and Tang (2007), nation which relying heavily on export of technology market, the foreign exchange rate will increase due to rapid demand for electrical and electronic products.

Besides, Meng (2015) stated that increase in export rebate rate, will restore a country's export competitiveness and thus foreign

exchange rate devaluation. Continued fiscal expansions will also cause rising in home price level and foreign exchange rate. For example, as the Chinese exports become cheaper, other nations will in disadvantage position if they are competitors of China in export markets which can explain the competition in exportation market with the price affect.

#### **2.1.4.2 Import (IM)**

Today's, products which produced from every part of the world are seen everywhere. These overseas products or import products give consumers more purchasing choices and help them in managing household budgets. However, too much import might also distort a nation's balance of trade and devalue its currency. Bashir and Luqman (2014) stated that too much trade restrictions and import barriers imposed by country, the decreased import values will lead to appreciation of exchange rate. Parveen et al. (2012) also suggest that increases in import would lead to depreciation of foreign exchange rate. Further, Gelbard and Nagayasu (2004) said that import value is assumed to be negatively related to the exchange rate. These results are consistent with research results from Nucu (2011) who found increased imports would cause current balance account become poor, and thus currency depreciates. Moreover, Waheed (2012) argued that higher income level will cause residents purchase more imported goods or services, and thus result in high demand for foreign currencies which causes depreciation of domestic currency.

However, on the other hand, there is insignificant relationship found between imports and foreign exchange rate by Proti (2013) who argued that there is no clear evidence that imports affect exchange rates.

#### **2.1.4.3 Ratio of Export to Import (EXIM)**

Ratio of exports to imports shows whether a country has more exports than imports or vice versa. This ratio is being commonly used in various countries and organizations, for example: Bank of Japan, European Commission, Federal Reserve Bank of St. Louis, Statistic Canada, and Organisation for Economic Co-operation and Development (OECD). It also known as export coverage ratio by import, representing how many units of exports can be covered by one unit of import. The formula for this ratio is export divided by import. Ratio value which larger than 1 (more than 100%) indicates exports value is larger than imports value (positive trade balance); value which less than 1 (less than 100%) indicates imports value is larger (negative trade balance).

As mentioned earlier, commonly, export values have a positive relationship with exchange rate while import values have negative relationship with foreign exchange rate. Thus, as to have foreign exchange rate appreciation, researchers said it should have a high export value and low import value, where the value of ratio will be larger than 1 or 100%. It is hypothesized that the relationship between export import ratio and foreign exchange rate is positive (Parveen, et al., 2012). Increase in export and/or decrease in import will cause the ratio increase; and when ratio becomes higher, the domestic currency value will be appreciated and thus foreign exchange rate will be increased. It might due to when export is larger than import, demand for local currency will be higher, and thus value of local currency will be appreciated.

However, Necşulescu and Şerbănescu (2013) argue that increased value of export import ratio will cause depreciation of home currency against foreign currency. Besides, Abbas and Raza (2013) found that there is no significant relationship between the trade values and foreign exchange rate.

## 2.2 Review of Relevant Theoretical Models

### 2.2.1 The Law of One Price

The law of one price (LOP) is a theory state that if the international market is efficient and there is no barriers of trade, same product will be sold at the same common-currency price in different nations. To eliminate market arbitrage and create fair prices, price equalization is very important (Ardeni, 1989). Rogoff (1996) prices differently between countries are due to trade barriers and transportation costs.

According to Rogoff (1996), the LOP can be expressed as:

$$P_i = E P_i^*$$

Where,

$P_i$  = domestic price of good  $i$ ,

$E$  = nominal exchange rate (direct quotation)

$P_i^*$  = foreign price of good  $i$

According to Taylor and Taylor (2004), Law of One Price (LOP) holds, prices of a globally-traded good should be identical at anywhere in the world once those prices are expressed in a common currency. If the prices are different after convert into same currency, people will able to gain riskless arbitrage profits. Meanwhile, Rogoff (1996) stated that tariffs, transportation costs and other trade barriers will make the prices of a same goods different in different nations. Besides, Ardeni (1989) argued that LOP is unreal, because it assumed that commodity prices are perfectly arbitrated, while empirical evidence and research results provided to support is flawed and affected by econometric shortcomings (e.g.: non-stationary data, inappropriate use of first differences and etc.).

## **2.2.2 Purchasing Power Parity**

PPP concept is founded from Salamanca School, Spain in 16th-century, while its modern use as theory of foreign exchange rate determination begins with the work of Gustav Cassel in 1918 (Dogruel & Dogruel, 2013).

Law of One Price (LOP) and purchasing power parity (PPP) are related. According to LOP, price of a globally-traded good should be identical at anywhere around the world once the price is expressed in a common currency. PPP is a theory implied that nominal foreign exchange rate should be equal to the ratio of aggregate price levels between two nations, so that purchasing power of a unit of currency will be same in different nations. Absolute PPP would hold if LOP holds (Taylor & Taylor, 2004), it is an idea that arbitrage activities will enforces different nation's price levels to be identical after the currency being converted to be same.

### **2.2.2.1 Absolute Purchasing Power Parity**

Absolute PPP indicates that if a common currency is being used in pricing of a same good in different nations, the sum of prices over consumer price index should be identical across countries; and if LOP holds, absolute PPP should be held. According to Taylor and Taylor (2004), different consumer prices and national price levels in different countries tend to move together after being expressed in common currency, while correlation between two nations' producer prices will be greater than relative consumer prices (Hakkio, 1992).

In reality, most of the international-traded goods are differentiated products or commodities, but not substitute goods, and it would cause variations in consumption baskets across nations, thus

absolute PPP is hard to hold. This problem has been addressed and solved in relative version of PPP (Rogoff, 1996).

#### **2.2.2.2 Relative Purchasing Power Parity**

A more reliable version of purchasing power parity (PPP) is Relative PPP, which allows deviation in price levels across nations, while requiring nominal depreciation to equal inflation differential so that the real exchange rate does not change. However, relative PPP sometimes is not empirically supported and it needs further investigations (Goyal , 2014).

Relative Purchasing Power can be modeled as:

$$S_1 / S_0 = (1 + I_y) \div (1 + I_x)$$

$S_0$  = spot exchange rate at the beginning of time period  
(Currency Y per each unit of currency X)

$S_1$  = spot exchange rate at the end of the time period.

$I_y$  = expected annualized inflation rate for country Y

$I_x$  = expected annualized inflation rate for country X.

Relative PPP predicts that the real exchange rate will be constant in equilibrium, so that there is internal and external balance. Akram (2003) stated that favourable trade balance will cause depreciation in nominal exchange rate, while higher activity level will lead to higher domestic inflation.

Assuming PPP holds, ratio of price of good in nation A to identical good's price in nation B would same as nominal foreign exchange rate. For example, price of good A cost US\$ 2.25 in US while cost



¥279 in Japan; if PPP holds, the nominal exchange rate would be ¥124:\$1. However, due to inflation and certain reasons, this equilibrium is not always being achieved. In reality, good A in Japan might cost ¥300 while cost in US and nominal exchange rate remain unchanged. In this case,  $\frac{¥ P(\text{good A})}{US\$ P(\text{good B})}$  is larger than nominal exchange rate. People therefore can purchase good A in US then export it to Japan and generate arbitrage profits. However, this process of arbitrage would affect prices of good A and the nominal exchange rate between this two countries. The purchases of good A in US will push the domestic price upwards while selling in Japan will drive prices down. It causes selling of ¥ for US\$ on foreign exchange markets; and the market forces will weaken the Yen and strengthened the USD until the ratio of good A prices equals to the nominal exchange rate.

However, there are arguments that PPP effectiveness is being affected by factors other than inflation such as exchange intervention by central banks, cost of transportations, trade barriers and so on (Al-Zyoud, 2015; Frankel, 1981; Rogoff, 1996). Besides, correlation between inflation and currency depreciation seems become lower and lower from years to years, thus researchers start doubting effectiveness of relative PPP (Taylor & Taylor, 2004).

On the other hand, Hakkio (1992) stated that PPP can help in forecast the dollar value over long run but unsure its usefulness in a short-run guide. Koveos and Seifert (1985) argued that PPP is important in determining a company's foreign exchange risk. It is stated that if a company's sales and costs shift along general price level, economic exposure of the company will not severe in the case of PPP does holds compare to PPP does not hold. Further, Frankel (1978) and Gaillot (1970) also found that PPP is held and useful.

### 2.2.3 International Fisher Effect (IFE)

International Fisher Effect (IFE) is extension of Fisher Effect (FE) hypothesized by American economist Irving Fisher (Eun & Resnick, 2010). International Fisher Effect (IFE) theory suggested foreign exchange spot rate between two nations should change by an amount equal to but in opposite direction of the nominal interest rates differential. If the nominal rate in nation A is lower than nation B, the currency of nation A should appreciate against the nation B by the same amount.

The formula for IFE is as follows:

$$e = \frac{i_1 + i_2}{1 + i_2}$$

Where ,

e = rate of change in the foreign exchange rate

$i_1$  = interest rate of nation 1

$i_2$  = interest rate of nation 2

However, a lot of researchers argue that IFE theory does not constantly holds, it is argued that the relationship between nominal interest rate and foreign exchange rate is not stable and predictable (Alizadeh et al., 2014; Salas-Ortiz & Gomez-Monge, 2015; Shalishali, 2012; Sundqvist, 2002).

### 2.2.4 Interest Rate Parity

Interest Rate Parity (IRP) is one of the theories employed in forecasting foreign exchange rate (Zhang & Dou, 2010). It stated that there is no-arbitrage profit due to interest rates differentials will set of the differential in foreign exchange rate, assuming that international market is capital mobilize and perfect substitutable. However, interest rate parity (IRP) does not always hold, when IRP does not hold, arbitrage profit exists. There are generally two categories of interest rate parity theory: covered and uncovered. Covered interest rate parity (CIRP) are linked to forward

exchange rates, while uncovered interest rate parity (UIRP) make expectations on future spot rates (McBrady et al., 2010).

#### **2.2.4.1 Covered Interest Rate Parity (CIRP)**

Investor may hedge against foreign exchange risk by forward contracts on foreign exchange market (Eeddin, 1988). Covered interest rate parity (CIRP) is a theory establishing relationship between forward contract and interest differential in different nations (Frenkel & Levich, 1975). It states that covered interest rate differential between two risk-free securities with different currencies should be null (Taylor, 1987; Baba & Packer, 2009; Fong et al., 2010). Breaches of CIRP represent arbitrage profit opportunities (Balke & Wohar, 1998). The return on one country's deposit,  $1 + r_d$ , will be equal to return from another country's deposits,  $\frac{f}{s}(1 + r_f)$ . CIRP connects money market interest rates to spot and forward exchange rates.

Following equation represents covered interest rate parity:

$$\frac{F}{S} = \frac{1 + r_d}{1 + r_f}$$

$r_d$  and  $r_f$  = domestic and foreign interest rates on similar assets

S = spot exchange rate

F = forward rate of same maturity as the interest rates.

The spot and forward markets are not always at equilibrium level as described by IRP, when interest differential and forward discount/premium are not equal, riskless arbitrage profit will exist. Arbitrageur who recognizes the imbalance will thus invest in currency which offers higher return on covered basis by forward contract. This practice is known as covered interest arbitrage (CIA).

For empirical results, there is argument. Eeddin (1988) says CIRP does hold, while Baba and Packer (2009) states that CIRP and foreign exchange rate has significant relationships. Fong et al. (2010) also support the CIRP theory where they found that HKD/USD forex market is denominated largely by CIRP deviations. However, some researchers argues that arbitrage profit opportunities from CIRP is very small, and only for extremely short duration, maybe just for few hours (Kia, 1996; Balke & Wohar,1998; Skinner & Mason, 2011). On the other hand, with data set of US, UK and Canada, Frenkel and Levich (1975) state that CIRP does not seem to explain unexploited opportunities of profit; while Zubairu (2014) also argue against CIRP for case of Japan-UK.

#### **2.2.4.2 Uncovered Interest Rate Parity (UIRP)**

Uncovered interest rate parity (UIRP) is a status where no-arbitrage condition is reached without use of forward contract. UIRP states that difference between two nations' interest rates should be equal to expected foreign exchange rate, thus the regression of foreign exchange rate return on interest differential will have intercept of zero and unit slope coefficient, which eliminate potential arbitrage profits. From time to time, UIRP helps economists in explaining determinants of foreign exchange rate although this theory is often being rejected in research data (Chaboud & Wright, 2005). Besides, UIRP predicts while all other factors remain unchanged, an increase in real interest rate will appreciate the currency value, vice versa (Bekaert et al., 2007).

Following equation represents uncovered interest rate parity:

$$(1 + i_{RM}) = \frac{E_t(S_{t+K})}{S_t} (1 + i_{\$})$$

where

$E_t(S_{t+k})$  = expected future spot exchange rate at time  $t + k$

$k$  = number of periods into the future from time  $t$

$S_t$  = current spot exchange rate at time  $t$

$i_{RM}$  = interest rate in one country (e.g.: Malaysia)

$i_{\$}$  = interest rate in another country with different currency (e.g: U.S.)

If UIRP does not hold, arbitrageurs will borrow from currencies which having relatively lower interest rate, then invest in another currency which has relatively higher interest rate, and at the end earn arbitrage profits. This progress will be repeated and thus influence foreign exchange rate and interest rates until UIRP holds once again (Taylor, 1987). The transaction is “uncovered” due to investors does not involve in currency forward, which meaning they are remaining uncovered to any risk of the currency deviating.

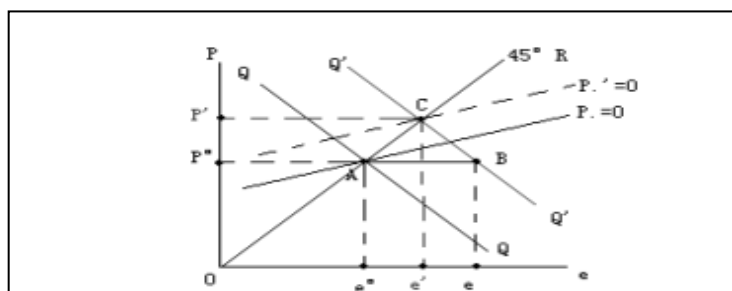
According to Harvey (2006), traditional UIRP cannot be employed in the real world due to UIRP deviation must always return to zero, he state that compared to 0%, a positive value should be employed because it reflects the risk premium. Chaboud and Wright (2005) also state that UIRP prediction on foreign exchange rate movement is never certain due to foreign exchange rates are very noisy. Moreover, there is argument saying that if foreign exchange rate is random walk, UIRP will become invalid because random walk model has more powerful estimation (Bekaert et al., 2007). Besides, researchers also found that UIRP prediction on foreign exchange rate is inconsistent among nations, and time horizon (Chaboud & Wright, 2005; Zhang & Dou, 2010; Lothian & Wu, 2011) In fact, short-horizon uncovered interest parity failure had being called as “forward premium puzzle,” a well-known circumstances in international finance (McBrady et al., 2010).

### 2.2.5 Dornbusch's Overshooting Model

In year 1976, the exchange rate overshooting hypothesis was introduced by economist Rudiger Dornbusch, which written in “Expectation and Exchange Rate Dynamics”. It theoretically explained foreign exchange rate fluctuations. It became a masterpiece in modern international macroeconomics, and contributed to theory of monetary approach in exchange rate determination.

In Dornbusch's overshooting exchange rate model, it assumes that all individual nation is small in world capital market, thus world prices and interest rate are given to them. Besides, commodities' prices are sticky in short-run while the currencies prices are flexible and adjust instantaneously. Money supply and money demand is stable and exogenous, with ability to affect income and interest rate. It is also being assumed that market participants use money for transactions purposes, and hold bonds to receive interest return (Husted & Melvin, 2010). Uncovered interest rate parity (UIRP) is assumed to be held continuously due to perfect capital mobility along with perfect assets substitution. Lastly, the market is on full employment level (Tu & Feng, 2009).

Figure 2.1: The Dornbusch Overshooting Hypothesis Display.



source: Tu & Feng, 2009; author's compilation

Above is an illustration of Dornbusch Overshooting Model by aid of graph. First at all, horizontal axis refers to spot foreign exchange rate and vertical axis refers to domestic price level. 45° degree upward slopping line R represents the assumption that PPP holds in long-run. Below the line 45° R

economy is competitive and net exports will increase, above the line will be in opposite circumstances. Next, the QQ line reflects money market equilibrium and UIRP, the foreign exchange rate will be depreciated if the money supply increases, vice versa. The positively sloped schedule  $P. = 0$  shows goods market and money market are in equilibrium. Below the line output is above market potential and there is an upward pressure on prices (Pilbeam, 2006). The economy initially achieves equilibrium at point A, along with price level  $P^0$  and foreign exchange rate  $e^0$ . At point A, UIRP holds and the domestic and foreign interest rates are equal (Dornbusch, 1976; Tu & Feng, 2009).

In long-run, money supply and price level might be changed in order to maintain money market equilibrium. According to quantity theory of money, 1% rise in money supply will cause also 1% rise in price level, while monetary model stated that this 1% rise in price level must be offset by 1% depreciation in foreign exchange rate in order to hold on PPP. In this case, rise in money supply will be represented by a schedule's move from QQ to Q'Q'. According to equation (ii), the demand for goods and money market balances will go down ( $P. = 0$  will move to  $P.' = 0$ ). The new long-run equilibrium is now at point C (Dornbusch, 1976; Tu & Feng, 2009).

However, in short-run cases, increase in money supply causes money market disequilibrium. The interest rate will fall in order to increase money demand and hence to reach equilibrium again. Unfortunately, lower interest rate makes foreign assets become more attractive. According to UIRP, people invest in domestic assets only if they expect an appreciation in foreign exchange rate, but the rate is now being expected will be depreciated in the long run as shown above. They will choose to invest in foreign currency; the foreign exchange rate will therefore depreciate heavily. It will cause an 'overshoot' on its long-run equilibrium level, and it is expected to be appreciated thereafter (i.e.: In short-run, the equilibrium will shift from point A to point B, then appreciation thereafter will cause equilibrium at point C in long run).

As a short conclusion, Dornbush suggested that slow price adjustment can explain the foreign exchange rates changes. An unexpected increase in domestic money supply will cause reduction in domestic interest rate in order to hold the real money balances. However, if foreign nominal interest rate is being constant, arbitrage in bond market requires domestic currency be expected to appreciate at a rate equal to difference between foreign and domestic interest rate differential. The attempt to obtain foreign exchange to purchase foreign bonds leads to immediate depreciation of domestic currency until the currency has depreciated so much that it is being expected to be appreciated again. At that point slow adjustment of goods prices keeps real returns being equated. The short-run impact of the foreign exchange rate is larger than the long-run impact on adjustment on interest rate or money supply (Copeland, 2008; Dornbusch, 1976; Tu & Feng, 2009).

There are many researchers support Dornbusch's overshooting model with empirical researches (Frankel, 1979; Driskill, 1981; Eichenbaum & Evans, 1995; Park, 1997; Nieh & Wang, 2005; Pratomo, 2005; Bjørnland, 2009; Sharifi-Renani et al., 2014). Hairault et al. (2004) declared that expansionary monetary policy will causes rises in interest rate and foreign exchange rate depreciates. A positive monetary shock has ability to trigger an overshooting of nominal foreign exchange rate. Besides, Bahmani-Oskooee and Kara (2000) argues that Dornbusch's overshooting model can be applied to long-run foreign exchange rate.

However, Backus (1984) rejected the theory of overshooting exchange rate, which is consistent with findings of Rogoff (2002) who state that monetary policy volatility is being amplified to has impacts on foreign exchange rate fluctuations, thus the theory is invalid, even in short-run. Moreover, Levin (1987) state that fiscal policy seems to be more important source to explain foreign exchange rate, compared to monetary model.



### **2.2.6 Buffer-Stock Money**

Buffer stock money was developed in earlier 1960s. In this theory, it stated that central bank used optimal level of money reserve to balance the costs of macroeconomic adjustment (Rangan et al., 2014). Hiroyuki (2011) stated that buffer stock in foreign exchange reserves is to manage pegged exchange rate regimes. Buffer stock money able to allow the intermediate levels managed exchanged rate flexibility buffered by large proportion of international reserves.

Different countries have different ways to manage the reserves depending on the objectives of the country. Normally the objectives have been formulated with respect to exchange rate management and monetary policy. In the cases, foreign reserves will acts as a buffer against excess of the trade balance in capital outflows (Irefin & Yaaba, 2012). The monetary authorities are able to intervene in the foreign exchange market at any time due to liquidity is always the target. The accumulation of foreign exchange reserve also serve as a “shock absorber” during the fluctuation in international transaction under the fixed or floating exchange rate regime (Irefin & Yaaba, 2012). When there is more foreign exchange reserves, the likelihood of depreciation of currency will be smaller, because government now able to sell foreign currency and cause an excess supply in foreign exchange market, thus depreciation of foreign currency against domestic currency, vice versa. Besides, rapid accumulation of external reserves is to insure against currency crisis especially in the Emerging Market Economies (EMEs) of Asia, by allowing relevant authorities to support their own currency in order to avoid the reoccurrence of the currency crisis of the late 1990s.

However, Aizenman et al. (2008) mentioned that foreign reserve has changed role where recent literature has focused on their role as a means of self-insurance against exposure to volatile “hot money” subject to frequent, sudden stops and reversals, while before literature focused on the

foreign reserves serves as a buffer stock in managing pegged exchange-rate regimes. In fact, recent accumulation of foreign reserves cannot explain by using the buffer stock model, because under this model, Emergency Market Economic (EME) currency regime shifts to floating regimes would helped to reduce reserve accumulation during past decades (Hiroyuki, 2011).

### **2.2.7 Traditional Flow Approach**

Traditional flow approach to foreign exchange rate determination stated that foreign exchange rate represents the relative price of different national export and import outputs. In mid-1970s, capital controls still in place, currencies exchange were trade-related and major exchange rates were fixed under the Bretton Woods System. During that era, current account imbalances were serious problems and will affect economic deeply. Afterward, for reasons, economists such as Milton Freedman began to advocate freeing the exchange rate, in order to use foreign exchange rate as a tool to achieve current account balances.

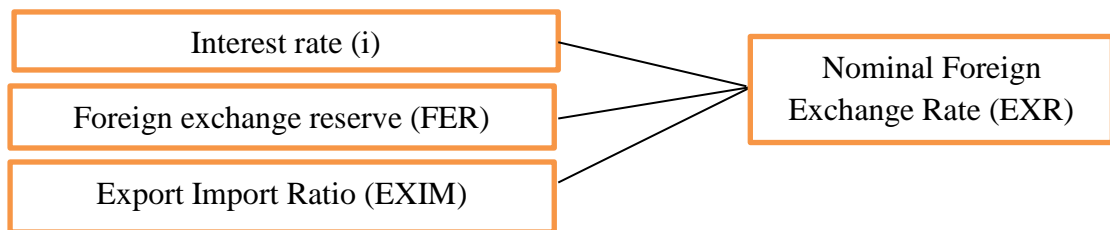
In flow approach, exports raise supply of foreign exchange; imports raise demand for foreign exchange. The exchange rate is in equilibrium when any current account imbalance is just matched with net capital flow in the opposite direction of same amount. Thus, if exchange rates were allowed to float, the problems caused by current account imbalances will be ceased. Exports and imports were flow variables. The model posits that foreign and domestic assets are imperfect substitutes in a portfolio. When balance of trade surpluses are associated with increases in domestic holdings of foreign money, thus holdings of foreign money increase relative to domestic money, value of foreign currency will depreciate; vice versa for situation when trade deficits are financed by depleting domestic stocks of foreign currency. The main criticism of this approach is its implications for the asset market where it predicts that an exchange rate could be in

equilibrium when a country is running a current-account deficit if the domestic interest rate is high enough to maintain an offsetting net capital inflow, however, there is no account given of how portfolios of foreigners are brought into equilibrium (Husted & Melvin, 2009; Pearce, 1983).

Lastly, it make sense that balance of trade flows in a model where foreign exchange rate is determined by desired and actual financial-asset flows, thus the role of exports and imports in foreign exchange rate determination may be consistent with the modern asset approach to the exchange rate. In short, exports and imports are crucial fundamental determinants of foreign exchange rate (Hooper & Morton, 1982; Rodriguez, 1980).

## 2.3 Proposed Framework

Figure 2.2: Relationship between selected variables with foreign exchange rate.



The proposed theoretical framework for this research is shown at above. There are four variables in total in this research: nominal foreign exchange rate (EXR) as dependent variable and interest rate (i), foreign exchange reserve (FER) and export import ratio (EXIM) as independent variables.

## 2.4 Conclusion

Through the literatures review of previous researches, the relationship of foreign exchange rate and macroeconomic factors had been further explained in this chapter. It is hypothesised that nominal foreign exchange rate and other three

variables (lending interest rate, foreign exchange reserves and export import ratio) are strongly correlated based on the previous studies. In next chapter, research methodology and technique used for data testing on relationship between variables will be further discussed.

## **CHAPTER 3: METHODOLOGY**

### **3.0 Introduction**

An overview of methodology performed in getting data was provided to deepen understanding of readers in chapter 3. In this chapter, presentation and description of types of methods that have been chose to carry out by researchers will be made, which consists of research design, variables data collection method, sampling design, data process and methodology.

### **3.1 Research Design**

In this research, quantitative data is utilized to run the research as it involves numerical data to answer specific research question. This research is being carried out by using exploratory research design as a fundamental of the study. It is useful for understanding on future studies and observations to be explained by existing theory (Kowalczyk, n.d.). In this research, it is to examine the relationship between independent variables lending interest rate (i), foreign exchange reserve (FER), export import ratio (EXIM) and the dependent variable nominal foreign exchange rate (EXR).

Dynamic relationship of dependent variables and nominal foreign exchange rate is measured by applying serial of empirical technique and sample data. Empirical tool such as EViews 9 software is used to compute the variables data collected from the data stream into empirical result for the purpose of the research.

## 3.2 Data Collection Methods

### 3.2.1 Secondary Data

In this research, nominal foreign exchange rate (EXR) is being chosen to be dependent variable and it is measured by MYR/USD (direct quote in Malaysia). It is hypothesized that units volume of USD could be bought with a unit of MYR will be influenced by following independent variables: interest rate ( $i$ ), Foreign Exchange Reserve (FER) and export import ratio (EXIM).

All data are extracted from International Monetary Fund database, which provides country data for most of the IMF members on a separate basis (International Monetary Fund [IMF], 2016). Data that used by this research is quarterly time series data from 1991 Q1 until 2015 Q3, which included 99 observations.

According to Watkins et al. (2014), Kouritzin and Heunis (1992), sampling distribution will be normally distributed as sample size ( $n$ ) is sufficiently large in numbers, which it is consistent with the theory of Central Limit Theorem (CLT), usually consider a sample size is large if it exceed 30 samples. Along with these, topic of this research is focus on Malaysia, which declared the independence from Britain in 31 August 1957; from September 1957 until December 2015; there are 233 quarters in total. Thus, with sample size of 99 quarters (approximately 42.5% from population), it could be said that the sample size is large enough to assume normal distribution.

**Table 3.1 : Explanation on variables.**

<b>Variables</b>	<b>Proxy</b>	<b>Description</b>	<b>Unit Measurement</b>	<b>Sources</b>
<b>Nominal Foreign Exchange Rate</b>	EXR	Units of domestic currency in order to buy one unit of foreign currency, without taking inflation into account.	MYR/USD (i.e. MYR/USD = 4.26 refers to USD1.00 can exchanged for MYR4.26 )	IMF database
<b>Lending Interest Rate</b>	i	Amount charged (expressed as a percentage of principal) by a lender to a borrower.	Percentage (%) per annum	IMF database
<b>Foreign Exchange Reserve</b>	FER	Various foreign currencies held by central bank or monetary authority to back up economic downturn.	MYR (‘millions)	IMF database
<b>Export Import Ratio</b>	EXIM	Ratio of export volumes to import volumes. ( $EXIM = \frac{X}{M}$ )	MYR (‘millions) (i.e : EXIM = 2 refers to 2 exports: 1 import, where export are enough to cover import for 2 times.)	IMF database

\*IMF = International Monetary Fund

### **3.3 Sampling Design**

#### **3.3.1 Target Population**

This research is targeted on Malaysia, a former British colony, achieved independence in 1957 (See & Ng, 2010). Malaysia is a multicultural country located in Southeast Asia and consisting 13 states and the government is a constitutional monarchy with elected parliament. Malaysia economy hasn't fully recovered yet from 1997–1998 financial crises, besides, globalization and competition from China resulted economic insecurity in Malaysia. Moreover, Malaysia is considered one of nations having best economic with GDP records in South and Northeast Asia, with average GDP annual rate of about 7% from year 1957 to 2015. However, due to the open economy, some problem such as oil crises 1970s, electronics industry downturn in mid 1980s, and Asian financial crisis of 1997 happened in Malaysia and the impact of these crises to Malaysia economic was huge (Karim & Yusop, 2009).

Nowadays, Malaysian facing many social changes and challenges, for example, increased urban migration, aging of population, family structure transformation, and illegal immigration. According to World Bank, Malaysia's current population are roughly 29.72 million of people, and the nation is very active in international trading. Regarding to international trades, foreign exchange market in Malaysia currently is under managed float regime.

#### **3.3.2 Sampling technique**

In this research, EViews 9 has been chose to be main analysis tool. EViews 9 helps in develop a statistical relation from the data and estimate

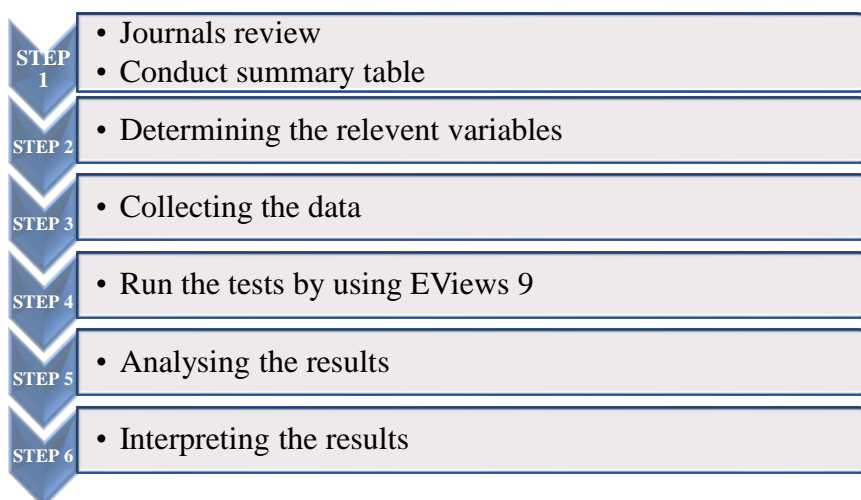


future values. It is an econometrics program which is useful in macroeconomic estimation, simulation, cost analysis, financial and scientific data analysis and evaluation, furthermore, sales estimation. EViews 9 can be used in teaching and is widely available in Internet. EViews 9 comes with forecasting tools, sophisticated data analysis plus with regression on Windows-based computers (Schwert, 2010).

In year 1981, MicroTSP was launched which is consider as the oldest edition of EViews. In order to replace MicroTSP, Version 1.0 of EViews was released in March 1994. EViews was created by economists who masters in application of economics functions. It is efficacy to economic time series data and also able to possess large cross-section projects (Schwert, 2010). This research will use EViews 9 for estimation, which is a powerful new spread-sheet editing tools that allow manipulation of multiple cells at once, and group comparison across multiple series. Besides, EViews 9 also enhanced data tables plus with full command line support which improves work files details view.

### 3.4 Data Processing

**Figure 3.2 : The flow chart of data processing**



There are six steps involve in the data processing. First, several journals was found and reviewed by the authors in order to obtain relevant variables which are fully supported and proved by previous researchers. Summary tables were then prepared by the authors based on the journals found. It brings conveniences to authors in understanding explanatory variables through a quickly and easier way. After few variables are confirmed to be used in this research, the authors try to collect the data from the sources of IMF. Authors have gathered all data with different periods which are monthly, quarterly and annually for each of relevant variables. Quarterly data and EViews 9 are applied in this research. Then data analysis will be run by using EViews 9 and obtain the econometric results. After all results have been achieved, analysis and interpretation will be carried out.

## 3.5 Methodology

### 3.5.1 F-test

F distribution in the null hypothesis which is consider as F-test. Gujarati and Porter (2009) said that the F distribution is named after the famous statistician, R.A. Fisher which it also known as the Fisher F Distribution or in others names the Snedecor-Fisher F distribution. The objective of f-test is to examine the gaps between the sample's variance (Gujarati & Porter, 2009). F statistic can be used to determine the statistical significance of overall relation between dependent variable and group of independent variables (Gujarati & Porter, 2009). Following is the formula of F-test:

$$F \text{ test} = \frac{MSR}{MSE}$$

Where,

MSR = Mean Square Regression

MSE = Mean Square Error

Hypothesis of F-test:

H<sub>0</sub>: Error terms are normality distributed.

H<sub>1</sub>: Error terms are not normality distributed.

Decision Rule: Reject H<sub>0</sub> if the F-statistic more than upper critical value, otherwise do not reject H<sub>0</sub>.

The null hypothesis bring the meaning of the overall model is not significant; on the others hand the alternative hypothesis mean by the overall model is significant. If the test statistic value lies in critical region, it means that the test is statistically significant. Therefore, null hypothesis will be rejected, vice versa. Meanwhile, P-value also can be used to find the significance of hypothesis testing. For example, null hypothesis will be rejected if P-value less than significant level. If null hypothesis has been rejected, this means that the overall model is significant.

### 3.5.2 T-statistic hypothesis test

T-test was developed by William Sealy Gosset in year 1908. It is one of the simplest analyses which widely used by many researchers (Gujarati & Porter, 2009). It is common used in parametric statistic, along with some assumptions that must be practiced. The first assumption applied is data represent a random sample of population studies. Besides, sample's mean should be normally distributed. Lastly, different groups' variances should be similar. In order to find statistical significance of each individual relationship between dependent variable and independent variables, following formula is used to calculate the t-statistic:

$$t_{\hat{\beta}} = \frac{\hat{\beta} - \beta_0}{s.e.(\hat{\beta})}$$

Where

$\hat{\beta}$  = Estimator of parameter  $\beta$

$\beta_0$  = Actual parameters  $\beta$

s.e. ( $\hat{\beta}$ ) = Standard error of estimator  $\hat{\beta}$

Hypothesis of the t-test :

$H_0: \beta_i = 0$

$H_1: \beta_i \neq 0$ , where  $i = 1, 2, 3, 4, 5$

Decision rule: Reject  $H_0$  if t-statistic larger than upper critical value or less than lower critical value, otherwise, do not reject  $H_0$ .

Null hypothesis indicates that there is insignificant relationship between dependent and independent variable, meanwhile the alternative hypothesis  $H_1$  refers to opposite explanation (Gujarati & Porter, 2009). By using P-value also can determine the significance of variables: reject null hypothesis when P-value less than the significant level, which meaning that the given independent variable is significant related to the dependent variable.

### 3.5.3 Normality Test

The JB test, originally suggested by Jarque and Bera (1987), is the most commonly used test of normality. Normality test are used to determine whether the set of data is well modelled by normality distribution. According to Brys, Hubert and Struyf (2004), normality test also testing on whether error term is normally distributed. A normality distributed data will show a bell shaped frequency distribution in graph presentation. The test is using skewness and kurtosis measures to compute the statistic by using the following formula:

$$JB = n \left[ \frac{S^2}{6} + \frac{(K - 3)^2}{24} \right]$$

Where,

n = sample size

S = skewness coefficient

K = kurtosis coefficient

Hypothesis of the normality test:

H<sub>0</sub> : The data are sampled from a normal distribution

H<sub>1</sub> : The data are not sampled from a normal distribution

Decision Rule: Reject H<sub>0</sub> if the calculated test statistic exceeds a critical value, otherwise do not reject H<sub>0</sub>.

In econometrics, normality test is usually performed by means of the skewness-kurtosis test. The main reason for generally use is due to its blunt performance and interpretation. The coefficient of skewness which combined with the kurtosis is useful for time series data. The skewness for a normal distribution should be near to or equals to zero. Kurtosis is a measure of whether data are heavy-tailed or light-tailed relative to a normal distribution, the standard coefficient of kurtosis is 3. Data with high kurtosis indicates high outliers.

Besides using formula, probability also can be used for testing normal distribution. If the P-value in Jarque-Bera test is higher than test-significance level, it refers to the data having normal distribution, vice versa.

### 3.5.4 Multicollinearity

According to Wiley Online Library (2010), it is said that multicollinearity

happen when the linear relationship among two or more variables. Multicollinearity makes the regression model hard to explain which explanatory variables are influencing the dependent variable. There is no exact method to detect multicollinearity problem. Nevertheless, to suspect any multicollinearity problem may happen in the model, it could be examined by using high  $R^2$  or high F statistic but few significant t-ratio. Second, compute Variance Inflation Factor (VIF) and the last one is high pair wise correlation among independent variables (Gujarati & Porter, 2009).

There are some consequences if multicollinearity problem happened in the model. It will cause OLS estimators and their standard errors to small changes in data. However, the OLS estimators are still BLUE (best, linear, unbiased coefficient) even when multicollinearity problem exist.

To overcome multicollinearity problem, one of the ways is to drop the independent variables which are high correlated to others independent variable. The model will become a significant coefficient after dropping related variable. However, this method might lead to model specification bias due to it losing important information and thus misleads the true values of the parameters. Following is the formula for multicollinearity testing:

$$VIF = \frac{1}{1 - r_{23}^2}$$

### 3.5.5 Heteroscedasticity

Ordinary least squares (OLS) regression model provides efficient and unbiased estimates of parameters when it met all assumptions of linear regression model. Homoscedasticity occurs when variances of the error terms are equal across the observations. Birau (2012) mentioned that

violation of homoscedasticity assumption will caused the heteroscedasticity arise. There are some common factors that cause heteroscedasticity problems such as a model misspecification, inadequate data transformation or a result of some certain outliers. Heteroscedasticity also brings various consequences to the OLS estimators. One of the most damaging consequences is that OLS will no longer BLUE, the OLS estimators will remain unbiased but become inefficient and thus hypothesis testing will become invalid.

There are several methods can be used to detect the presence of heteroscedasticity, for example, Breusch-Pagan LM test, White's test, Glesjer LM test, Harvey-Godfrey LM test, Park LM test and Goldfeld-Quand test. In this research, White's test will be conducted.

Hypothesis of heteroscedasticity test:

$H_0$  : The model is homoscedasticity.

$H_1$  : The model is heteroscedasticity.

Decision Making: Reject  $H_0$  if p-value is less than the significance level, otherwise do not reject  $H_0$ .

P-value is considered as a method to determine the significance of hypotheses testing. Rejecting null hypothesis when p-value is less than the significance level meaning the model is suffering from the heteroscedasticity problem, vice versa. When there is heteroscedasticity problem, researchers can solve the problem by using White Heteroskedasticity-Consistent Standard Errors & Covariance test which provided by eViews 9. With consistent estimates of coefficient covariance, heteroskedasticity will be avoided (White, 1980). Additionally, parameter estimations remain unchanged regardless existence of heteroskedasticity problem (IHS Global Inc, 2013).

### 3.5.6 Autocorrelation

According to Gujarati and Porter (2009), the term autocorrelation may be defined as correlation between disturbance terms in either time series or cross-sectional data. There are two types of autocorrelation which are pure autocorrelation and impure autocorrelation. Pure autocorrelation occurs when uncorrelated observation of the error term is violated in a correct-specified equation. Impure autocorrelation occur when there is serial correlation caused by specification error or incorrect function in the model.

There are some consequences will happen in the OLS estimator when there is autocorrelation problem. The OLS estimators are still remain unbiased and consistent, however, the OLS estimators will become inefficient, in the sense that the estimator no longer the best, due to the variance no longer minimum. It may cause all the hypothesis testing become invalid due to the OLS method underestimate or overestimate the variance (Gujarati & Porter, 2009).

The best known serial correlation test is the Durbin-Watson  $d$  statistic which developed by statisticians Durbin and Watson. It is defined as the ratio of the sum of squared differences in successive residuals to the residual sum of squares (RSS). However, there is a limitation of this serial correlation test which is the error terms are generated by the first-order autoregressive scheme. Therefore, it cannot be used to detect higher-order autoregressive schemes. To overcome some of the limitation of the Durbin–Watson  $d$  test of autocorrelation, Breush-Godfrey (BG) test has been developed by statisticians Breusch and Godfrey which is allows for random variable, higher-order autoregressive schemes and simple or higher-order moving averages of white noise error terms. The Breush-Godfrey (BG) test also called the Lagrange Multiplier (LM) test (Gujarati & Porter, 2009). In this research, Breusch-Godfrey Serial Correlation LM Test will be used in testing autocorrelation.



Hypothesis of autocorrelation test:

$H_0$ : The model is no autocorrelation.

$H_1$ : The model is autocorrelation.

Decision Rule: Reject  $H_0$ , if test statistic value is lies in the critical region, otherwise do not reject.

If test statistic value lies in the critical region, the test can be said that is statistically significant, where null hypothesis will be rejected, vice versa. Besides, P-value also acted as another method to determine the significance of hypothesis testing. Reject null hypothesis when P-value less than significant level indicates there that is an autocorrelation problem and vice versa.

If researcher found there is an autocorrelation problem, it is needed to find a way to solve the problem. In this case, researchers are suggested to use the Newey-west (HAC) test to overcome the problem. The test will change the standard errors of each variables become consistent, but their point estimates will not be affected (IHS Global Inc, 2013).

### **3.5.7 Model Specification Error**

When a model omitted relevant and important variable(s), included irrelevant variable(s), selected wrong sample, applied a wrong functional form or error of measurement, the possibility of model specification error will be high (Heckman, 1979; Gujarati & Porter, 2009). It is to be said that excluded an important variable will have larger impact than included an unimportant variable to the model. When an unimportant variable is being added into the mode, OLS estimators will still remain unbiased and consistent; however, if an important variable is omitted from the model, OLS estimators will become biased and inconsistent. Meanwhile, a model specification error indicates that the OLS estimators will no longer having

a minimum variance, which by all means, no longer the best estimators. The consequence of model misspecification is all hypotheses testing along with the model will become invalid (Gujarati & Porter, 2009).

In order to investigate the model's specification, Ramsey's RESET test could be used.

Hypothesis of model specification test:

$H_0$ : The model is correctly specified.

$H_1$ : The model is not correctly specified.

Decision rule: Reject  $H_0$  if test statistic value is higher than upper critical value (P-value is less than significant level), otherwise, do not reject  $H_0$ .

For this research, if the null hypothesis  $H_0$  is being rejected, the model specification is incorrect, vice versa. If there is misspecification, researchers can transform the form of model into other form such as log-lin model, lin-log model or log-log model, which might help to overcome the error. If the model is still having specification error, then variable(s) might need to be removed out or added into the model.

### 3.6 Conclusion

This chapter discussed clearly the research design, data sources and data collection. All data are collected from International Monetary Fund database. The research methodology applied in this research is also clearly stated in this chapter. Every result of the empirical test will be carried out by using empirical tool Eviews9. The empirical result will be discussed in the following chapter.

## **CHAPTER 4 : DATA ANALYSIS**

### **4.0 Introduction**

In this chapter data analysis of the research will be presented by using multiple linear regressions model and Ordinary Least Square (OLS). Relationships between the dependent variable and the independent variables will be showed in the test results. For information, EViews 9 had been applied to test and analyse the data in this research.

### **4.1 Ordinary Least Square (OLS)**

Ordinary Least Squares (OLS) regression is one of the most known from all regression techniques. It provides a global model of the variables analysis. Output of the analysis is a single regression equation relating the relationship between dependent and independent variables across the whole research area. OLS also applicable in forecast the unknown parameter (Łukawska-Matuszewska & Urbański, 2014).

The following represents the multiple linear regressions.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon_t$$

$$\text{LNEXR} = \beta_0 + \beta_1 I + \beta_2 \text{LNFER} + \beta_3 \text{LNEXIM} + \epsilon_t$$

Where,

Y = EXR = Nominal Foreign Exchange Rate in Malaysia (MYR/USD)

X<sub>1</sub> = I = Lending Interest Rate in Malaysia (Percentage per annum)

X<sub>2</sub> = FER = Foreign Exchange Reserve (Millions of MYR)

X<sub>3</sub> = EXIM = Export Import Ratio

### **The relationship between Lending Interest Rate (I) and Foreign Exchange Rate (EXR)**

Based on the past studies, it is expected that there is positive relationship between I and EXR (where in this research, it should be represented by a negative coefficient). According to Sinha & Kohli (2013), rising in lending interest rate in a country relative to overseas will give the investors higher return on that country's assets; the country's assets are now become relatively more attractive. Hence, the domestic currency will increase and the price of imports will decrease. Therefore, this research expects that increase in lending interest rate will cause an appreciation of home currency against foreign currency. As mentioned by researchers, I and EXR should have a positive relationship (Bashar & Kabir, 2013; Chowdhury & Hossain, 2014). Moreover, Interest Rate Parity theory also supported that increase in interest rate would cause appreciation of the currency.

### **The relationship between Foreign Exchange Reserve (FER) and Foreign Exchange Rate (EXR)**

Increase in foreign exchange reserve is expected to cause an appreciation on domestic currency against foreign currency, where in this research it should be have a negative coefficient. According to Bouraoui and Phisutthiwatcharavong (2015), foreign exchange reserve reflects international investment position and the economy performance of a country. Additionally, higher foreign exchange reserve can raise the value of domestic currency against foreign currencies. Hence, this research expects that the foreign exchange reserve will bring positive impact to foreign exchange rate. As supported by researchers, foreign exchange reserve would cause appreciation of home currency (Abdullateef & Waheed, 2010; Emmanuel, 2013; Olayungbo & Akinbobbola, 2011; Suthar, 2008). As the researcher investigated, increase in foreign exchange reserve will leads to high demand of domestic currency in the international market, hence a currency appreciation, vice versa (Calvo and Reinhart, 2002).

**The relationship between Export Import Ratio (EXIM) and Foreign Exchange Rate (EXR)**

It is expected that export import ratio and foreign exchange rate will have negative coefficient in this research, where indicates that increase in value of export import ratio would lead to appreciation of home currency against foreign currency. According to researchers, decreased in import values (higher EXIM) will lead to appreciation of currency due to lower supply of home currency, vice versa (Bashir & Luqman, 2014; Parveen et al.,2012; Waheed, 2012).

**Original Econometric Model** : (Please refer to Appendix 4.1)

$\widehat{LNEXR}$	=	2.235195	- 0.023894 I	- 0.100211 LNFER	+ 1.430886 LNEXIM
SE	=	0.297093	0.007972	0.023448	0.107878
t-stat	=	7.523552	-2.997324	-4.273800	13.26393
Prob.(t-test)	=	0.0000	0.0035	0.0000	0.0000
F stat	=	74.23325			
Prob. (F-test)	=	0.0000			
R	=	0.700976			
$\bar{R}^2$	=	0.691533			

Where,

Y = EXR = Nominal Foreign Exchange Rate in Malaysia (MYR/USD)

X<sub>1</sub> = I = Lending Interest Rate in Malaysia (Percentage per annum)

X<sub>2</sub> = FER = Foreign Exchange Reserve (Millions of MYR)

X<sub>3</sub> = EXIM = Export Import Ratio

Time period, t = 1991 Q1 – 2015 Q3

**Econometric Model with Best Linear Unbiased Estimator (BLUE) :**

*(Please refer to Appendix 4.7)*

$\widehat{LNEXR}$	=	2.235195	- 0.023894 I	- 0.100211 LNFER	+ 1.430886 LNEXIM
SE	=	0.452923	0.017053	0.032271	0.132972
t-stat	=	4.935044	-1.401118	-3.105306	10.76082
Prob.(t-test)	=	0.0000	0.1644	0.0025	0.0000
F stat	=	74.23325			
Prob. (F-test)	=	0.0000			
R	=	0.700976			
$\bar{R}^2$	=	0.691533			

Where,

Y = EXR = Nominal Foreign Exchange Rate in Malaysia (MYR/USD)

X<sub>1</sub> = I = Lending Interest Rate in Malaysia (Percentage per annum)

X<sub>2</sub> = FER = Foreign Exchange Reserve (Millions of MYR)

X<sub>3</sub> = EXIM = Export Import Ratio

Time period, t = 1991 Q1 – 2015 Q3

**Interpretation:**

$\hat{\beta}_0 = 2.235195$  indicates that if there is no lending interest rate, no foreign exchange reserve and export import ratio is zero, the estimated foreign exchange rate is MYR2.235195/USD.

$\hat{\beta}_1 = - 0.023894$ . Due to no statistically significant linear dependence of the mean of EXR on I was detected, thus interpretation is inappropriate for this coefficient.

$\hat{\beta}_2 = - 0.100211$  indicates that if the foreign exchange reserve in Malaysia increases by 1 percentage, the estimated foreign exchange rate will decrease by 0.100211 percentage, holding other variables constant.

$\hat{\beta}_3 = 1.430886$  indicates if the export import ratio in Malaysia increases by 1 percentage, the estimated foreign exchange rate will increase by 1.430886 percentage; holding other variables constant.

$R = 0.700976$  indicates that there are approximately 70.10% of the foreign exchange rate in Malaysia is explained by the lending interest rate, foreign exchange reserve and export import ratio in Malaysia.

$\bar{R}^2 = 0.691533$  indicates that approximately 69.15% of the foreign exchange rate in Malaysia is explained by the lending interest rate, foreign exchange reserve and export import ratio in Malaysia, after taking the degree of freedom into account.

**Correlation Analysis:**

		LNEXR	I	LNFER	LNEXIM
		LNEXR	I	LNFER	LNEXIM
LNEXR	LNEXR	1.000000	-0.383180	0.319789	0.801133
I	I	-0.383180	1.000000	-0.860522	-0.521795
LNFER	LNFER	0.319789	-0.860522	1.000000	0.578153
LNEXIM	LNEXIM	0.801133	-0.521795	0.578153	1.000000

Coefficient of correlation ( $rx_i + x_j$ ), where  $i = 1, 2, 3, \dots, 99$  &  $j = 1, 2, 3, \dots, 99$

**(I) Relationship between I and FER**

$(rx_1 + x_2) = -0.860522$ . It indicates that the correlation between I and FER is -0.860522. There is a negative correlation between I and FER. Therefore, I and FER have negative relationship.

**(II) Relationship between I and EXIM**

$(rx_1 + x_3) = -0.521795$ . It indicates that the correlation between I and EXIM is -0.521795. There is a negative correlation between I and EXIM. Therefore, I and EXIM have negative relationship.

**(III) Relationship between FER and EXIM**

$(rx_2 + x_3) = 0.578153$ . It indicates that the correlation between FER and EXIM is 0.578153. There is a positive correlation between FER and EXIM. Therefore, FER and EXIM have positive relationship.

#### 4.1.1 F-test *(Please refer to Appendix 4.7)*

$H_0$	:	$\beta_1 = \beta_2 = \beta_3 = 0$
$H_1$	:	At least one of the is different from zero, where $i = 1, 2, 3 = 0.05$
<b>Significance Level</b>	:	$\alpha = 0.05$
<b>Decision Rule</b>	:	Reject $H_0$ , if P-value less than significant level 0.05. Otherwise, do not reject $H_0$ .
<b>P-value</b>	:	0.0000
<b>Decision Making</b>	:	Reject $H_0$ , since P-value is 0.0000 which it is less than significant level 0.05.
<b>Conclusion</b>	:	There is sufficient evidence to conclude that the whole model is significant.

#### 4.1.2 T-test *(Please refer to Appendix 4.7)*

##### **Relationship between Foreign Exchange Rate (EXR) and Lending Interest Rate (I):**

$H_0$	:	$\beta_1 = 0$
$H_1$	:	$\beta_1 \neq 0$
<b>Significance Level</b>	:	$\alpha = 0.05$
<b>Decision Rule</b>	:	Reject $H_0$ if P-value less than significant level 0.05. Otherwise, do not reject $H_0$ .
<b>P-value</b>	:	0.1644
<b>Decision Making</b>	:	Do not reject $H_0$ , since P-value is 0.1621 which is larger than significant level 0.05.
<b>Conclusion</b>	:	There is insufficient evidence to conclude that the relationship between EXR and I is significant.



**Relationship between Foreign Exchange Rate (EXR) and Foreign Exchange Reserve (FER):**

<b><math>H_0</math></b>	: $\beta_2 = 0$
<b><math>H_1</math></b>	: $\beta_2 \neq 0$
<b>Significance Level</b>	: $\alpha = 0.05$
<b>Decision Rule</b>	: Reject $H_0$ if P-value less than significant level 0.05. Otherwise, do not reject $H_0$ .
<b>P-value</b>	: 0.0025
<b>Decision Making</b>	: Reject $H_0$ , since P-value is 0.0024 which it is less than significant level 0.05.
<b>Conclusion</b>	: There is sufficient evidence to conclude that relationship between EXR and FER is significant.

**Relationship between Foreign Exchange Rate (EXR) and Export Import Ratio (EXIM):**

<b><math>H_0</math></b>	: $\beta_3 = 0$
<b><math>H_1</math></b>	: $\beta_3 \neq 0$
<b>Significance Level</b>	: $\alpha = 0.05$
<b>Decision Rule</b>	: Reject $H_0$ if P-value less than significant level 0.05. Otherwise, do not reject $H_0$ .
<b>P-value</b>	: 0.0000
<b>Decision Making</b>	: Reject $H_0$ , since P-value is 0.0000 which it is less than significant level 0.05.
<b>Conclusion</b>	: There is sufficient evidence to conclude that relation between EXR and EXIM is significant.

### 4.1.3 Normality Test *(Please refer to Appendix 4.2)*

<b><math>H_0</math></b>	: Error terms are normality distributed.
<b><math>H_1</math></b>	: Error terms are not normally distributed.
<b>Significance Level</b>	: $\alpha = 0.05$
<b>Decision Rule</b>	: Reject $H_0$ if P-value less than significance level 0.05. Otherwise do not reject $H_0$ .
<b>P-Value</b>	: 0.152715
<b>Decision Making</b>	: Do not reject $H_0$ , since p-value (0.152715) is larger than significant level (0.05).
<b>Conclusion</b>	: There is insufficient evidence to conclude that the model is not normally distributed at 5% significance level. Thus, the model is significant.

### 4.1.4 Multicollinearity

From the result, it shows that the coefficient of determination ( $R^2$ ) is quiet high, which is 0.700976. It indicates that the overall regression model is fit into the data of the model where there are 70.10% of the changes in EXR is explained by the changes in I, FER and EXIM in Malaysia. For further investigation, we compute Variance-Inflating Factor (VIF) to measure how much variances of coefficients are inflated.

By using Variance-Inflating Factor (VIF):

*(Please refer to Appendix 4.3)*

$$VIF_I = \frac{1}{1-R^2_I} = \frac{1}{1-0.741383} = 3.866722$$

$$VIF_{FER} = \frac{1}{1-R^2_{FER}} = \frac{1}{1-0.763413} = 4.226775$$

$$VIF_{EXIM} = \frac{1}{1-R^2_{EXIM}} = \frac{1}{1-0.336533} = 1.507234$$

The VIF results shows there is multicollinearity problem exists in the model, however it is within acceptable range where VIF of each pair of independent variable is less than 10.

**4.1.5 Heteroscedasticity** *(Please refer to Appendix 4.4)*

Prob Chi Square	0.0005
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- $H_0$**  : The model is homoscedasticity.
- $H_1$**  : The model is heteroscedasticity.
- Significance Level** :  $\alpha = 0.05$
- Decision Rule** : Reject  $H_0$  if P-value less than significant level 0.05. Otherwise, do not reject  $H_0$ .
- P-value** : 0.0005
- Decision Making** : Reject  $H_0$  since the p-value is 0.0005 which is less than the significance level 0.05.
- Conclusion** : There is sufficient evidence to conclude that the model contains heteroscedasticity problem.

In order to solve the heteroscedasticity problem, White heteroskedasticity-consistent standard errors & covariance test was used in this research. The table below shows that standard errors are changed and coefficient estimates remain unchanged after using the test. The result now is more trustable due to consistent variances. Hence, we can say that the model is homoscedastic now.

*(Please refer to Appendix 4.5)*

Variables	Original OLS		White Test	
	Coefficient	Std. Error	Coefficient	Std. Error
I	-0.023894	0.007972	-0.023894	0.010806

LNFER	-0.100211	0.023448	-0.100211	0.021087
LNEXIM	1.430886	0.107878	1.430886	0.098304
C	2.235195	0.297093	2.235195	0.294136

**4.1.6 Autocorrelation** (Please refer to Appendix 4.6)

Prob Chi Square	0.0000
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- $H_0$**  : The model has no autocorrelation problem.
- $H_1$**  : The model has autocorrelation problem.
- Significance Level** :  $\alpha = 0.05$
- Decision Rule** : Reject  $H_0$  if P-value less than significant level at 0.05. Otherwise, do not reject  $H_0$ .
- P-value** : 0.0000
- Decision Making** : Reject  $H_0$  since the P-value is 0.0000 which is less than significant level of 0.05.
- Conclusion** : There is sufficient evidence to conclude that the model contains autocorrelation problem.

In order to solve the autocorrelation problem in the model, Newey-west (HAC) Test was used in this research. The table below shows that the standard errors are different while the coefficient estimates remain unchanged after using Newey-west Test. The results came out with consistent variances which mean that there is no autocorrelation. Therefore, the autocorrelation problem was solved in this model.

(Please refer to Appendix 4.7)

Variables	Original OLS		Newey-west (HAC) Test	
	Coefficient	Std Error	Coefficient	Std Error
I	-0.023894	0.007972	-0.023894	0.017053
LNFER	-0.100211	0.023448	-0.100211	0.032271

LNRATIO	1.430886	0.107878	1.430886	0.132972
C	2.235195	0.297093	2.235195	0.452923

#### 4.1.7 Model Specification Bias *(Please refer to Appendix 4.8)*

- $H_0$**  : There is no model misspecification error.
- $H_1$**  : There is model misspecification error.
- Significance Level** :  $\alpha = 0.05$
- Decision Rule** : Reject  $H_0$  if P-value less than significant level at 0.05. Otherwise, do not reject  $H_0$ .
- P-value** : 0.1710
- Decision Making** : Do not reject since the P-value 0.1710 is more than significant level of 0.05.
- Conclusion** : There is insufficient evidence to conclude that the model specification is incorrect at 5% significance level. Therefore, the model specification is correct.

## 4.2 Conclusion

From the start of this chapter presented the explanations of Ordinary Least Square (OLS). Furthermore, this chapter also provided the approaching relation between the EXR and the independent variables I, FER, and EXIM individually. Undoubtedly, those expected relationship was surely supported by the past empirical evidence. This research had used EViews 9 to compute and analysis a list of test. The results and opinions are similar with past researches. However, some variables showing result which not tally with expected relationship. Further explanation of results will be explained in next chapter.

## **CHAPTER 5 : DISCUSSION, CONCLUSION AND IMPLICATIONS**

### **5.0 Introduction**

This chapter will first present the summary of statistical analyses which discussed in the previous chapter and followed by the detail discussion on major findings to validate the research objectives and hypotheses. Furthermore, implication of research study and limitations will also be discussed in this chapter. Lastly, recommendations will be suggested for future researchers of the relevant topics.

### **5.1 Statistical Analyses**

Table 5.1: The expected and statistical result

<b>Test</b>	<b>Result</b>	<b>Expected Relation</b>	<b>Major Findings</b>
I and EXR	Insignificance	Positive	Abdoh et al. (2016); Nwude (2012)
FER and EXR	Positive Significance	Positive	Emmanuel (2013); Suthar (2008); Olayungbo & Akinbobbola (2011); Abdullateef & Waheed (2010); Prabheesh et al. (2007); Calvo & Reinhart (2002); Bouraoui & Phisuthtiwatcharavong (2015)
EXIM and EXR	Negative Significance	Positive	Necşulescu & Şerbănescu (2013)

Note: Due to EXR is representing MYR/USD, thus positive relationship is represented by negative coefficient in eViews 9 result output while negative relationship is represented by positive coefficient.

## **5.2 Discussion of major findings**

### **5.2.1 Lending Interest rate**

This research showed there is insignificant relationship between lending interest rate (I) and foreign exchange rate (EXR). The result is align with researches result by Chowdhury and Hossain (2014) and, who found that lending interest rate and foreign exchange rate has a positive relation but not highly significant compared to other variables. Not only that, the researchers such as Nwude (2012) and Abdoh et al. (2016) also discovered insignificant relationship between lending interest rate and foreign exchange rate. According to Waheed (2012), effect of interest rate on foreign exchange rate is highly influenced by confidence of public and their choice of investment.

However, having insignificant relationship does not mean that regulatory shall ignored the management of interest rates, instead, it should be managed well and regulated (Wilson, 2014). It is due to lending interest rate is an important factor that could affect other macroeconomic variables such as money supply and money demand which might on the other hand significantly affect foreign exchange rate.

### **5.2.2 Foreign Exchange Reserve**

Based on empirical results of this research, there is a significant positive relationship between the foreign exchange reserve (FER) and the foreign exchange rate at 5% of significance level, which mean that increases in foreign exchange reserve, will cause an appreciation on home currency against foreign currency. This result is consistent with the pass researchers'

result (Bouraoui & Phisuthiwatcharavong, 2015; Emmanuel, 2013). This result is consistent and can be explained with the buffer stock theory.

Foreign Exchange Reserve is very important to the international investment in a country. Currently, the U.S dollar is the main reserve currency used by other countries. Foreign exchange reserve are assets of the Central bank, it allow a central bank to purchase the domestic currency in order to stabilize the economy based on the equilibrium tend to control the currency lower or higher. The reserves usually used to have a trade between both countries, an increase in foreign exchange reserve will lead to increase the supply of foreign currency, this allow the value of domestic currency rise (Suthar, 2008). Managing reserve level enables Malaysia central bank to intervene against fluctuations in currency by affecting foreign exchange rate to a favourable position.

### **5.2.3 Export Import Ratio (EXIM)**

Based on the research result, there is a significant negative relationship between the export import ratio and foreign exchange rate at 5% of significance level. It indicates that increases in export will cause depreciation, vice versa. This result is consistent with the pass researchers' result (Necşulescu & Şerbănescu, 2013; Nucu, 2011; Kim, 2016), which rejected the traditional flow approach to foreign exchange rate determination.

This unordinary result might because of Malaysia currently is under managed float regime, where the effect of market forces from foreign exchange market is being reduced to avoid volatility. According to Martin (2001), effects of foreign exchange rate regime is larger compare to others macroeconomics variables, such as export, import and inflation. Reinhart (2000) also mentioned even if there are favourable circumstances (capital inflows, positive balance of trade and so on), many emerging nations are



reluctant to allow nominal exchange rate to appreciate due to “fear of floating” situation, where people scared of freely floating exchange rate will cause loss in trade competitiveness and a setback on export diversification. Regarding to this, Kim (2016) and Shelburn (1984) stated that maintain an undervalued exchange rate can improve the competitiveness of firms in international trading, vice versa. Moreover, in order to maintain an exchange rate level to avoid from over appreciation or depreciation which might damage Malaysia economy with economics growth deceleration, policymakers tend to intervene in foreign exchange markets (Siklos, 2009). These intervention might cause the foreign exchange rate does not align with the market situation, even result in an opposite output: initially a slump caused by market demand and supply will trigger government interventions, and it might cause currency appreciate even up to above the reference rate in short-run, vice versa (Ethier & Bloomfield, 1975).

### **5.3 Implication of Research Study**

Finding in this research showed that foreign exchange rate in Malaysia is significantly influenced by independent variables foreign exchange reserve, exports and imports of the country. The result of this research would contribute greatly to the various sectors as following:

#### **5.3.1 Government and Policy Maker**

A suitable policy implementation always comes with findings from researches. This research would assists government in spending right money at the right place, minimizing the probability of resources wastage. As appreciation or depreciation in foreign currency would affect a country’s economic, understanding the factors that influence foreign exchange rate movement would give government and policy makers a

clear view in formulating effective exchange policies to safeguard stability of a country's economy and achieve economic growth.

In order to enhance the economic growth, policy maker should base on the evidence to make some adjustment on the provision of law. From this research, it is showed that lending interest rate is not that significant in deciding the foreign exchange rate, and this result is aligned with some other researchers' research result (Abdoh et al, 2016; Nwude, 2012). Besides, it showed foreign exchange reserve and export-import ratio are more important criteria to affect foreign exchange rate. Thus, government and policies makers might have to put more attention on law and regulations regarding foreign exchange reserve and international trades compared to lending interest rate.

### **5.3.2 Investors and International Traders**

This research can be used as a reference for investors and international traders in hedging and avoid losses and at the same time, enhance profits. According to Bouraoui and Phisuthtiwatcharavong (2015), foreign exchange rate will affect the real return of an investor's global investment portfolio. A better forecast performance on foreign exchange rate will helps investors and traders reduce different types of risks, and thus gain competitiveness by using appropriate and rational strategies. Further, knowledge on determinants of foreign exchange rate will assist exporters and importers in firm-value decisions and risk exposures (Necşulescu & Şerbănescu, 2013; Simpson & Evans, 2004).

Besides, while a lot of researches focus on how foreign exchange rate might influence export and imports of a nation, little researches had been made on showing how exports and imports will influence foreign exchange rate. People should aware that export import and foreign exchange rate actually have bilateral relationship, especially nowadays

international trade is extremely common, foreign products and services are everywhere and substituting domestic products; people no longer treat foreign products as luxury items but more like necessities. Trade deficits will cause holdings of foreign money relative to domestic money decrease and thus depreciation of home currency, vice versa. When the demand for import products becomes more and more inelastic, the effect of foreign exchange rate on international trade will become smaller and smaller, in contrast, effects of imports and exports on foreign exchange rate would become larger and larger.

Through understanding of the relationships between export-import ratio and foreign exchange rate, investors might have better forecast on foreign exchange rate and thus gaining profits from investment. At the same time, traders and corporations would aware that their international trade decisions would influence the foreign exchange stability of the nation and thus become more responsible and careful when making trade decisions.

## **5.4 Limitation**

This research has contributed useful information for policy makers and also investors. However, there are some limitations throughout this research needed to be optimized to in future research in order to become an ideal research. As well, it is rare to perform a perfect research in reality.

Firstly, there is limited journal can be found to support the result. For instance, some of the journal in the past were proves that the export import ratio and foreign exchange rate is significantly positively correlated. However, the result in this research showed a negative relationship where higher export import ratio will lead to depreciation of home currency against foreign currency. It is just supported by limited empirical researches that investigated the same evidence. Besides, while most of the researchers found that there is significant relationship between lending interest rate and foreign exchange rate, this research result found it insignificant.

Although the result is align with some researchers but the amount was limited. There are inadequate journals to support the same results, and these different results between researches might due to some other factors that researchers failed to observe.

Next, the original model has multicollinearity problem causing researchers weren't able to run the model as a whole and interpret its result. Instead, researchers decided to omit some of the determinant such as inflation in order to solve this problem to preserve the reliability of the research.

In addition, this research used MYR/USD as sample to represent whole foreign exchange market in Malaysia. It might have different test results if use exchange rate of MYR against other currencies such as British Pound, EURO and Japanese Yen as the dependent variable.

## **5.5 Recommendations**

The limitations mentioned in this research has brought upon recommendations which could further improve the interpretation of the determinants of exchange rate in future research.

The journals provided in UTAR online Library E-Resources, Ebscohost and Google Scholar might not enough to support the research. In order to seek more empirical evidence, researchers might need to search as much research reports and journals as possible. For instance, there are some websites provide priced journals which limit accesses; researcher should try to gain access to them in order to produce better research result. By retrieving more journals it might able to improve the research's evidence as well as the accuracy level.

On the other hand, to solve the multicollinearity problem, an alternative way is to increase the sample size. Researchers who are interested in further studying this paper are highly recommended to increase the sample size as many as possible. Researchers may use monthly data or even daily data instead of using quarterly

data. This is because the bigger the sample size, the lower the probability of having multicollinearity problems. Besides, there are some other analysis tools which able to solve multicollinearity problem such as Partial Least Squares Regression (PLS) or Principal Components Analysis which cut the number of predictors to a smaller set of uncorrelated components, however, these analysis tools is recommended if and only if there is huge sample size, and for researchers who mastered these analysis tools.

Last but not least, this research used sample data of foreign exchange rate of MYR against USD solely to represent the whole foreign exchange market in Malaysia. Information thus might not be able to fully explain the determinants of exchange rate in the entire market of Malaysia. Foreign exchange rate of MYR against other countries such as China, Japan, England and Indonesia might provide different results. It is recommended future researchers should include foreign exchange rate of MYR against as much foreign currencies as possible in a same test in order to produce a more comprehensive and reliable research results.

## **5.6 Conclusion**

This research studied the determinants of the foreign exchange rate. The purpose of this research is to investigate the macroeconomic determinants that influence the nominal foreign exchange rate. The determinants included are lending interest rate, foreign exchange reserves and export import ratio. Based on the major findings, this research found that foreign exchange reserve and foreign exchange rate having positive relationship, while export-import ratio and foreign exchange rate having negative relationship in Malaysia. Besides, this research found no significant relationship between lending interest rate and foreign exchange rate.

As a conclusion, this research could provide useful information to government, policy makers, investors and international traders in performing their responsibilities, duties and trading activities. The limitations that faced during the progress of the research were presented and recommendations were provided for future researchers in this chapter.

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**APPENDIX**

**Appendix 4.1 : Original OLS Model**

Dependent Variable: LNEXR  
 Method: Least Squares  
 Date: 04/06/16 Time: 23:39  
 Sample: 1 99  
 Included observations: 99

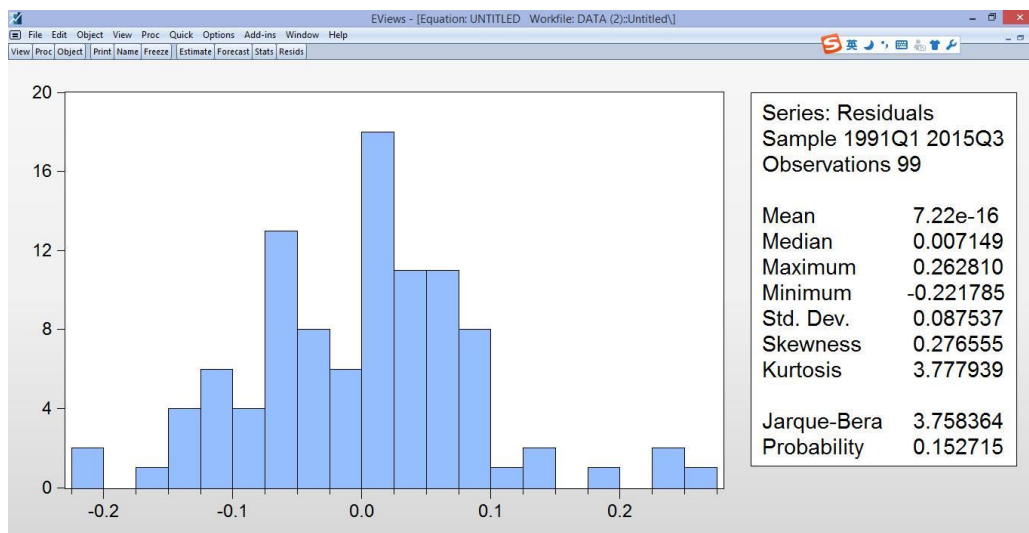
Variable	Coefficient	Std. Error	t-Statistic	Prob.
I	-0.023894	0.007972	-2.997324	0.0035
LNFER	-0.100211	0.023448	-4.273800	0.0000
LNEXIM	1.430886	0.107878	13.26393	0.0000
C	2.235195	0.297093	7.523552	0.0000

R-squared	0.700976	Mean dependent var	1.178679
Adjusted R-squared	0.691533	S.D. dependent var	0.160080
S.E. of regression	0.088908	Akaike info criterion	-1.962858
Sum squared resid	0.750945	Schwarz criterion	-1.858004
Log likelihood	101.1614	Hannan-Quinn criter.	-1.920434
F-statistic	74.23325	Durbin-Watson stat	0.551470
Prob(F-statistic)	0.000000		

	I	LNFER	LNEXIM
I	1.000000	-0.860522	-0.521795
LNFER	-0.860522	1.000000	0.578153
LNEXIM	-0.521795	0.578153	1.000000

**Appendix 4.2 : Normality Diagnostic Testing**



**Appendix 4.3 : Multicollinearity**

Dependent Variable: I  
 Method: Least Squares  
 Date: 04/06/16 Time: 23:40  
 Sample: 1 99  
 Included observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNFER	-2.361593	0.178961	-13.19611	0.0000
LNEXIM	-0.790593	1.378812	-0.573387	0.5677
C	32.70466	1.823892	17.93125	0.0000
R-squared	0.741383	Mean dependent var	7.246014	
Adjusted R-squared	0.735995	S.D. dependent var	2.215394	
S.E. of regression	1.138300	Akaike info criterion	3.126784	
Sum squared resid	124.3898	Schwarz criterion	3.205424	
Log likelihood	-151.7758	Hannan-Quinn criter.	3.158602	
F-statistic	137.6028	Durbin-Watson stat	0.133643	
Prob(F-statistic)	0.000000			

Dependent Variable: LNFER  
 Method: Least Squares  
 Date: 04/06/16 Time: 23:40  
 Sample: 1 99  
 Included observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNEXIM	1.367176	0.448354	3.049326	0.0030
I	-0.272962	0.020685	-13.19611	0.0000
C	12.52931	0.192466	65.09877	0.0000
R-squared	0.763413	Mean dependent var	10.73527	
Adjusted R-squared	0.758484	S.D. dependent var	0.787467	
S.E. of regression	0.386995	Akaike info criterion	0.969025	
Sum squared resid	14.37746	Schwarz criterion	1.047665	
Log likelihood	-44.99674	Hannan-Quinn criter.	1.000843	
F-statistic	154.8851	Durbin-Watson stat	0.135734	
Prob(F-statistic)	0.000000			

Dependent Variable: LNEXIM  
 Method: Least Squares  
 Date: 04/06/16 Time: 23:41  
 Sample: 1 99  
 Included observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
I	-0.004317	0.007529	-0.573387	0.5677
LNFER	0.064589	0.021182	3.049326	0.0030
C	-0.527634	0.275869	-1.912624	0.0588
R-squared	0.336533	Mean dependent var	0.134469	
Adjusted R-squared	0.322710	S.D. dependent var	0.102208	
S.E. of regression	0.084115	Akaike info criterion	-2.083427	
Sum squared resid	0.679233	Schwarz criterion	-2.004787	
Log likelihood	106.1297	Hannan-Quinn criter.	-2.051609	
F-statistic	24.34719	Durbin-Watson stat	0.244792	
Prob(F-statistic)	0.000000			

#### **Appendix 4.4 : Heteroscedasticity Diagnostic Testing**

Heteroskedasticity Test: ARCH

F-statistic	28.73335	Prob. F(1,96)	0.0000
Obs*R-squared	22.57510	Prob. Chi-Square(1)	0.0000

Test Equation:

Dependent Variable: RESID^2  
 Method: Least Squares  
 Date: 04/06/16 Time: 23:41  
 Sample (adjusted): 2 99  
 Included observations: 98 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003835	0.001341	2.858995	0.0052
RESID^2(-1)	0.550031	0.102611	5.360350	0.0000
R-squared	0.230358	Mean dependent var	0.007662	
Adjusted R-squared	0.222341	S.D. dependent var	0.012749	
S.E. of regression	0.011243	Akaike info criterion	-6.118001	
Sum squared resid	0.012134	Schwarz criterion	-6.065247	
Log likelihood	301.7821	Hannan-Quinn criter.	-6.096663	
F-statistic	28.73335	Durbin-Watson stat	1.763772	
Prob(F-statistic)	0.000001			



Heteroskedasticity Test: White

F-statistic	4.193815	Prob. F(9,89)	0.0002
Obs*R-squared	29.48210	Prob. Chi-Square(9)	0.0005
Scaled explained SS	37.70752	Prob. Chi-Square(9)	0.0000

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 04/06/16 Time: 23:43

Sample: 1 99

Included observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.505872	1.292474	-1.938819	0.0557
I^2	0.000380	0.000733	0.518571	0.6053
I*LNFER	-0.008015	0.004795	-1.671655	0.0981
I*LNEXIM	0.003908	0.015407	0.253651	0.8004
I	0.077752	0.060176	1.292070	0.1997
LNFER^2	-0.018490	0.008737	-2.116191	0.0371
LNFER*LNEXIM	0.095677	0.054758	1.747284	0.0840
LNFER	0.435342	0.211664	2.056762	0.0426
LNEXIM^2	-0.365915	0.183292	-1.996350	0.0490
LNEXIM	-0.943874	0.660146	-1.429797	0.1563
R-squared	0.297799	Mean dependent var	0.007585	
Adjusted R-squared	0.226790	S.D. dependent var	0.012707	
S.E. of regression	0.011173	Akaike info criterion	-6.055014	
Sum squared resid	0.011111	Schwarz criterion	-5.792881	
Log likelihood	309.7232	Hannan-Quinn criter.	-5.948955	
F-statistic	4.193815	Durbin-Watson stat	1.369556	
Prob(F-statistic)	0.000153			

Since there is a heteroscedasticity problem in our model, therefore we will need to solve it by using White heteroskedasticity-consistent standard errors & covariance test thus the overall model is adjusted without heteroscedasticity problem.

**Appendix 4.5 : White Heteroskedasticity-Consistent Standard Errors & Covariance Test**

Dependent Variable: LNEXR

Method: Least Squares

Date: 04/06/16 Time: 23:43

Sample: 1 99

Included observations: 99

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
I	-0.023894	0.010806	-2.211175	0.0294
LNFER	-0.100211	0.021087	-4.752288	0.0000
LNEXIM	1.430886	0.098304	14.55572	0.0000
C	2.235195	0.294136	7.599188	0.0000
R-squared	0.700976	Mean dependent var	1.178679	
Adjusted R-squared	0.691533	S.D. dependent var	0.160080	
S.E. of regression	0.088908	Akaike info criterion	-1.962858	
Sum squared resid	0.750945	Schwarz criterion	-1.858004	
Log likelihood	101.1614	Hannan-Quinn criter.	-1.920434	
F-statistic	74.23325	Durbin-Watson stat	0.551470	
Prob(F-statistic)	0.000000	Wald F-statistic	104.5032	
Prob(Wald F-statistic)	0.000000			

**Appendix 4.6 : Autocorrelation Diagnostic Testing**

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	59.37872	Prob. F(2,93)	0.0000
Obs*R-squared	55.52101	Prob. Chi-Square(2)	0.0000

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 04/06/16 Time: 23:44

Sample: 1 99

Included observations: 99

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
I	-0.001132	0.005342	-0.211849	0.8327
LNFER	0.019774	0.015917	1.242326	0.2172
LNEXIM	-0.245315	0.077465	-3.166779	0.0021
C	-0.168391	0.200410	-0.840233	0.4029
RESID(-1)	0.678375	0.100140	6.774239	0.0000
RESID(-2)	0.198851	0.106621	1.865029	0.0653
R-squared	0.560818	Mean dependent var	7.22E-16	
Adjusted R-squared	0.537206	S.D. dependent var	0.087537	
S.E. of regression	0.059550	Akaike info criterion	-2.745295	
Sum squared resid	0.329801	Schwarz criterion	-2.588015	
Log likelihood	141.8921	Hannan-Quinn criter.	-2.681660	
F-statistic	23.75149	Durbin-Watson stat	1.788566	
Prob(F-statistic)	0.000000			

Since there is an autocorrelation problem in our model, therefore we will need to solve it by using Newey-West (HAC) fixed bandwidth test thus the overall model is adjusted without autocorrelation problem by giving us the best model.

### **Appendix 4.7 : Newey-West (HAC) Test**

Dependent Variable: LNEXR

Method: Least Squares

Date: 04/06/16 Time: 23:45

Sample: 1 99

Included observations: 99

HAC standard errors & covariance (Bartlett kernel, Newey-West fixed

bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
I	-0.023894	0.017053	-1.401118	0.1644
LNFER	-0.100211	0.032271	-3.105306	0.0025
LNEXIM	1.430886	0.132972	10.76082	0.0000
C	2.235195	0.452923	4.935044	0.0000
R-squared	0.700976	Mean dependent var		1.178679
Adjusted R-squared	0.691533	S.D. dependent var		0.160080
S.E. of regression	0.088908	Akaike info criterion		-1.962858
Sum squared resid	0.750945	Schwarz criterion		-1.858004
Log likelihood	101.1614	Hannan-Quinn criter.		-1.920434
F-statistic	74.23325	Durbin-Watson stat		0.551470
Prob(F-statistic)	0.000000	Wald F-statistic		58.37077
Prob(Wald F-statistic)	0.000000			

### **Appendix 4.8 : Model specification diagnostic testing**

Ramsey RESET Test

Equation: UNTITLED

Specification: LNEXR I LNFER LNEXIM C

Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.379460	94	0.1710
F-statistic	1.902911	(1, 94)	0.1710
Likelihood ratio	1.984114	1	0.1590

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.014900	1	0.014900
Restricted SSR	0.750945	95	0.007905
Unrestricted SSR	0.736045	94	0.007830

LR test summary:

	Value	df
Restricted LogL	101.1614	95
Unrestricted LogL	102.1535	94

Unrestricted Test Equation:

Dependent Variable: LNEXR

Method: Least Squares

Date: 04/06/16 Time: 23:46

Sample: 1 99

Included observations: 99

HAC standard errors & covariance (Bartlett kernel, Newey-West fixed

bandwidth = 4.0000)

Variable	Coefficien t	Std. Error	t-Statistic	Prob.
I	-0.067771	0.052124	-1.300182	0.1967
LNFER	-0.290312	0.237126	-1.224292	0.2239
LNEXIM	4.055843	3.249096	1.248299	0.2150
C	5.359999	3.864782	1.386883	0.1688
FITTED^2	-0.795316	0.985038	-0.807396	0.4215

R-squared	0.706909	Mean dependent var	1.178679
Adjusted R-squared	0.694437	S.D. dependent var	0.160080
S.E. of regression	0.088489	Akaike info criterion	-1.962697
Sum squared resid	0.736045	Schwarz criterion	-1.831630
Log likelihood	102.1535	Hannan-Quinn criter.	-1.909667
F-statistic	56.67982	Durbin-Watson stat	0.606063
Prob(F-statistic)	0.000000	Wald F-statistic	55.47522
Prob(Wald F-statistic)	0.000000		