UNRAVELING THE DETERMINANTS INFLUENCING INTEREST RATE IN DEVELOPED COUNTRIES

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Unraveling The Determinants Influencing Interest Rate In Developed Countries

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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.

(3) Equal contribution has been made by each group member in completing the research project.

(4) The word count of this research report is 14,965 words.

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<td>BM</td>
<td>Between Models</td>
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<tr>
<td>BP</td>
<td>Breusch-Pagan</td>
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<td>EXCHANGE</td>
<td>Exchange Rate</td>
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<td>FEM</td>
<td>Fixed Effect Model</td>
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<td>GDP</td>
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<td>IMF</td>
<td>International Monetary Funds</td>
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<td>IR</td>
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<td>RON</td>
<td>Romanian Leu</td>
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<td>RR</td>
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PREFACE

This research project is part of requirements that need to fulfill by the Bachelor of Finance (HONS) course. The title we have chosen for our research is “Unraveling The Determinants Influencing Interest Rate In Developed Countries”.

There are some macroeconomic variables that will bring an impact toward a country’s interest rate. Thus, we have chosen Gross Domestic Product (GDP) Growth, Inflation, Exchange Rate and Money Supply as the independents variables in order to identify how these variables affect the interest rate by using Pooled Ordinary Least Square (POLs) method.

By providing the relationship between the macroeconomic variables and the interest rate, market participants are able to gain a better understanding on the changes of a country’s interest rate.

In additions, this research also includes the implication for government and market investors. Besides that, this research is intended to establish a significant contribution to those parties who have concern about the movement of interest rate in developed countries as well as an economy overall situation.
ABSTRACT

This study aims to determine the relationship between Interest Rate and Inflation Rate, Gross Domestic Product Growth Rate (GDP), Exchange Rate and Money Supply. The data collection for each independent variable was adopted and taken from many sources such as The Data World Bank. The annual data set includes total panel (Unbalanced) observations 101 which are ranging from years 2007 to 2016.

Panel Data Analysis is applied in order to examine the statistical relationship between the dependent variable and independent variable in the 3 models. In addition, several tests have been run and carried out for diagnostic checking process by using Eviews.

The empirical results indicate that money supply have a positive and significant impact on interest rate in developed countries. However, for inflation, GDP growth rate and exchange rate shows that there are negative and insignificant impact on interest rate in developed countries.
Chapter 1: Research Overview

1.0 Introduction

Interest rate is an important economical factor that can affect the economy condition of a developing or developed country. When the interest rate of borrowing and saving is going down, which means that resident of the country will spend more money because saving in the bank with low interest rate is not worth, and the business will borrow more money to expand their business because the borrowing cost is lower, this would increase the job opportunity in the country and so the economy condition of the country will get boost up. Other than that, when interest rates of borrowing or saving is going up, people would save more money in the bank and high interest rates would fascinate foreign investor make investment across different countries. So interest rate is considered as one of the important factors that control a country’s economy, but there are also many factors that are affecting the interest rate level.

In this chapter, we will be discussing about the determinants that affect interest rate and their relationship with each other. Throughout this chapter, we will deeply understand each characteristics and relationships between the determinants which are inflation (INFLATION), Gross Domestic Product growth (GDP), money supply (MS) and exchange rate (EXCHANGE) which we will be referring this as the four major variables and the dependent variable which is interest rate (IR) based on past researches. Other than these factors, there are still some of the factors influencing Interest Rate in developed countries such as unemployment rate, government policy, internationals force, political condition and others but we will only be focusing on main factors that have strong relationship with interest rate in our research.
1.1 Research Background

Interest rate has a major role playing in policy instrument which shows significant impact towards developed countries’ economy. It represents the cost of borrowing or realize of savings in a specific country. Different countries will have different implementation and policy of interest rate adjusting to the current economic condition of a country. Many studies were conducted to deeply understand the impact of interest rate in a country. In conjunction to that, studies on the determinant that affect interest rate were also often conducted to have better understanding and control over the interest rate as its impact play a big role in a country’s economy especially developed countries. Examples of study conducted for the determinants of interest rate (IR) are inflation (INFLATION), gross domestic product growth (GDP), money supply (MS) and exchange rate (EXCHANGE).

From macroeconomic point of view, interest rate holds a very important role in affecting a country’s economy level and development of the country. Interest rate is also one of the main reason affecting foreign countries to make investment in home country. Because if a country providing a high saving interest rate, foreign investor will invest their money in the financial instrument in that country. But when the opposites situation happened, which means that the country is providing a low borrowing interest rate, foreign investor will plan to borrow money from the foreign country and build up their subsidiaries company at the country because the cost of borrow is lower comparing with those investor home country. While for the local resident, when the interest rate of their country is lower, local resident would invest their money on foreign financial instrument and this will cause outflow of the money from the country. But on the other sides, local businessman will borrow more money from the country and expanding the business and this boost the economy up.
Inflation is the increasing of general price level of good and services in the country, consequently reducing the purchasing power of consumer in the country. This can be explained by the increasing price of goods and services over past years and the worthiness of money. When the inflation occurs in a country, this conclude that the demand for goods and services are greater than product capacity or it may also be the increasing amount of money supply by the central bank. To overcome the problem, the interest rate of the country will be increased to slow down the inflation. When the interest rate is increasing in the country, this means that people tend to save more in the bank to earn a higher interest rates whilst people will borrow less as the cost of borrowing is increased. While in the opposite situation, when deflation happens, central bank would lower the interest rates of the country to allow more money to circulate in the market. When the interest rates is lower, people will spend more rather than save their money in bank, because saving in a bank will worth less as the interest rate decreases. Businesses in the country will also tend to take advantage of the low cost of borrowing to borrow more money from the bank to expand their businesses.

Gross Domestic Product growth (GDP) is one of the best sign to determine a country’s economy situation and it is also an important factor to compare two countries economy performance. GDP is the combination of consumption + investment + government spending + (export – import). The GDP growth of a country is normally expected to be constant therefore when the GDP growth rate of a country is increasing or decreasing too much, the country will know that there is a problem in the economy. When a problem occurs, central bank will then take the responsibility to change the interest rate of the country. As GDP increases at abnormal rate, the central bank will tend to either decrease or increase the interest rates adjust the abnormal growth of GDP.

Exchange rate can be measured by the value of a home country’s currency in terms of another country’s currency. Exchange rate will fluctuate depending on the request of the currency in the global market, but government can also apply fixed exchange rate regime to fix their home currency in relation to another country’s currency. Exchange rate is also one of the factors that will affect the interest rate level. When exchange rate
is decreasing, this means that the demand of home currency on the global market is decreasing as well. Therefore, the central bank will increase the interest rate to attract more foreign investors and thus increasing the cash inflows deposited to the country because when foreign investors have increased in interest to make investment other than their home country, they need to hold other country’s currency, so this will cause the demand of the home currency to increase and exchange rate will also increase. However, if the exchange rate increases at an abnormal rate will not be a good phenomenon for a country. So central bank will then lower the interest rate level to decrease the demand of the home currency.

Money supply is the total amount of money that is currently circulating in the market. Money supply can have a huge impact on the interest rate level. As the money supply level of an economy going too high, central bank will increase the interest rate level to decrease the money supply as the cost of borrowing increases. When there are too much of money in the market, it will result to inflation. This is because when everyone has a lot of money in hand, they are willing to pay more to get what they are demanding, so this will cause inflation to boost up drastically. Furthermore, when the level of money supply of an economy is too low, central bank will decrease the interest rate level to increase the money supply level as cost of borrowing decreases and people tend to borrow more money. According to Wuyah & Amwe, (2016) when the market has does not have enough money, people will tend to spend less and business will apply conservative strategy that they will not expand their business easily. If this situation happened, it will be a big obstacle for the development of the economy.

1.2 Problem Statement
As discussed above, interest rate plays an important role in affecting a country’s economy. Therefore, it is utmost important for a developed country to have clear understanding on how interest rate works and the impact it brings to the economy. But for that to be achieved, a thorough research of factors affecting interest rate must be done so that a country to have better control over its interest rate. The major factors for the research are inflation (INFLATION), Gross Domestic Product growth (GDP), money supply (MS), and exchange rate (EXCHANGE).

In case of inflation, relating to Fisher’s hypothesis framework, it is proved that when risk of inflation is higher, it will significantly increase the interest rates of a country. The raising of inflation uncertainty causes the nominal interest rate to increase (Berument, 1999). When a country’s economy is growing, natural inflation will be formed. This is because people possesses more money to spend and leading to an increase in demand. Thus, when the economy is advancing too fast, so will the inflation rate. Therefore, rising of interest rates will reduce the amount of cash supply in the economy (Churchill et al. 2014). This will lead the inflation of the economy to a lower and suitable level.

Furthermore, the relationship between microcredit interest rates and foreign currency debt using GDP growth and interest rates as variable proves that higher GDP growth will increase interest rate as the income of household increases (Azam & Karim, 2017). In terms of exchange rate, according to Andrieş et al. (2017), in the short term, exchange rate and interest rate shares a negative relationship with each other confirming the sticky-price model while in the long term, a positive relationship exist confirming the Purchasing Power theory.

In addition, if changes in money supply do not affect output or prices, it will affect interest rate (Thornton, 2008). Increase in money supply generally reduces liquidity in a country, implying that when total money supply is expanding, it will be followed by a change in interest rate (Schabert, 2009). When total circulation of money in a country...
gradually increases, more money in the market means a lower value to it and thus will act as a barrier for economic development. Therefore, interest rate will be toyed by regulators to overcome the barrier.

Hence, this indicates that all these factors are crucial in affecting the interest rate of a country. The problem caused will affect a country’s economy in terms of macroeconomic variables whereby it generally indicates the inflation level which affects the people of a country. Developed countries will have a higher impact on interest rate caused by the factors as it differs with developing countries in terms of fluctuations and development of the economy. Based on such evidences of the relationship between interest rates and inflation, GDP, exchange rate and also money supply, it encourages a deeply investigate on each factors in this paper. It also enables to further study the impact of each factors bring upon interest rates in developed countries.
1.3 Research Objective

1.3.1 General Objective

The general objective of this research is to study the impact of the four major variables on real interest rate (IR) in the chosen developed country (Singapore, Hong Kong, Switzerland, Poland, Brunei Darussalam, United Kingdom, Romania, Estonia, Czech Republic and New Zealand).

1.3.2 Specific Objective

1. To study about how the inflation (INFLATION), Gross Domestic Product growth (GDP), money supply (MS), and foreign exchange rate (EXCHANGE) lead to changes on interest rate on chosen developed country.

2. To investigate the relationship between four major variables and real interest rate (IR) on chosen developed country either it is positive or negative relationship.
1.4 Research Question

Research Question:

1. How did the independent variable (inflation, gross domestic product, exchange rate, money supply) impact the dependent variable (interest rates) on chosen developed countries (Singapore, Hong Kong, Switzerland, Poland, Brunei Darussalam, United Kingdom, Romania, Estonia, Czech Republic and New Zealand)?

2. What relationship exists between the inflation (INFLATION), Gross Domestic Product growth (GDP), money supply (MS), and exchange rate (EXCHANGE) and the dependent variable (Interest Rate) on chosen developed countries (Singapore, Hong Kong, Switzerland, Poland, Brunei Darussalam, United Kingdom, Romania, Estonia, Czech Republic and New Zealand)?
1.5 Hypothesis of the Study

After reviewing the theoretical framework proposed by Berument (1999), nominal interest rate will be increased when the expected inflation is increasing. Moreover, according to Azam & Karim (2017), as growth in GDP leads to the increased of household’s income, this will increase the interest rate. In addition, based on Andrieș et al. (2017), a negative relationship exists between exchange rate and interest rate during the short run but positive during the long run. Based on Thornton (2008), when money supply increases, it would cause the value of the money to decrease, thus accompanied by a change in interest rate to revalue the money circulating in the market.

1.6 Significance of Study

Highlights of the research includes the importance of studying and understanding the relationship between inflation (INFLATION), Gross Domestic Product growth (GDP), money supply (MS), and exchange rate (EXCHANGE) on the interest rate in developed countries. This study is to provide more detail of information to other researcher about and policy maker who is going to restructure the level of interest rate in most of the developed countries. Useful strategies and tools can be designed to overcome the inflation (INFLATION), Gross Domestic Product growth (GDP), money supply (MS), and exchange rate (EXCHANGE) that will affect the interest rate depending on certain countries. Inflation can be a key factor that affecting the interest rate in the countries as inflation rate is known as purchasing power of their resident in the country. When the inflation rate increase, it means to the resident have reduce their purchasing power as the price of good increase continuously. Therefore, increase in interest rate of the country might help to slow down the speed of inflation as resident would like to save more in the bank to hedge against the inflation rate. In opposite, when interest rate decrease, people will spend more on goods and services as they know the value of money is keep depreciating and it is not worth to save rather than spend. Therefore, it
might good to some sector like consumer product sector to increase their revenue due to consumer are more willing to spend. Besides, inflation is important in financial market and act as an indicator to investor to determine how much the value of money today can generate future income. For example, to shareholder in stock market, they use inflation rate as key component to motivate them to take on the risk exposure on market and hope to get higher return from it.

In addition, gross domestic product is a measurement of country economy. GDP also can be a component to compare different countries economic performance as GDP is the combination between Consumption+ Investment + Government Spending + (Export- Import). GDP growth is usually moving at their equilibrium point as usual, it won’t move exist or lower than the GDP percentage point. Thus, when the GDP rate increase rapidly or decrease rapidly, it significantly indicates that there is problem on the financial market. When real GDP increases, it will cause the average interest rate in an economy on the country to increases as well. When GDP growth, it means that economic is strong and businesses and firm can hire more workers and can effort to pay higher salary to their employee and lead consumer to spend more on the consumer product and services.

Next, exchange rate is the value of a base currency in relation to other nation currency. Exchange rate is fluctuating due to demand and supply on the nation, so the price of currency is based on the demand and supply on both currencies on the countries. To maintain the exchange rate, government can have implied pegged exchange rate which is a type of exchange rate regime to fix the currency value against the value of other currencies. If the exchange rate decreases on the country, it means that the value of home currency have been decreased and government will try to increase the interest rate to attract new foreign investor invest in the nation. Therefore, when foreign investor and domestic investor bring back the cash flow to the nation, it will have cash inflow to the country and bringing up the economic level. This affected the currency rate increase.
Moreover, total amount of money circulating in overall market of a nation is known as money supply. The money supply is calculated not only by the nation’s currency but also the liquid asset of the nation. For example, if the money supply in the country is too high, this means that the money in circulation is too high. Therefore, government will impose the policy and change the interest rate to higher in order to attract investor or household to manage the money and invest in to different kind of investment or saving. This can reduce the money supply in the nation and reach the equilibrium point in for the purpose slowing down the economic phases and inflation rate. This is because if the money supply is too high in the nation, resident is holding too much of cash or liquid asset that cause increasing demand on goods and product while it leads to demand more than supply and driving up the inflation rate as people are more willing to pay more toward the product. Therefore, money supply is considered as a factor which directly affects the interest rate of the nation.

1.7 Chapter Layout

Five chapters are being discussed in this study which are: Chapter 1 explain overall of this research while Chapter 2 discuss an overview of the current studies regarding the relationship between the four major variables on Interest rate (IR). While Chapter 3 is discussing about the model developed for the study and data issues. For Chapter 4, fact findings are discussed in the chapter. Lastly, Chapter 5 will cover on conclusion and policy implication of the topic.
1.8 Conclusion

This chapter mainly covers on the effect of four major variables on Interest rate (IR). Besides, the problem research, research objective, research question, hypothesis and significance of study had been included in this chapter. The other details will be discussing on following chapter.
Chapter 2: Literature Review

2.0 Introduction

The main focus of this study is on determinants of interest rate based on previous study done by other researches. As the topic had already been reviewed by other researches, we will deeply cover more on how the independent variables affect the interest rate of developed countries. Any relevant research and studies will act as a guideline to support this research project. Besides that, any relevant theory and its frameworks applied by past researches will also be taken into consideration under this chapter.
2.1 Review of the Literature

2.1.1 Interest Rate

Interest rate is a type of policy instrument used by policymakers to affect currency values be it domestically or internationally. It also represents the effect of borrowing and saving in a bank, the ‘additional’ money whether gaining or losing. In logical terms, a higher interest rate will result in a higher savings and lower borrowings while a lower interest rate will attract more borrowers than savers. In this modern financial market, interest rates are crucially important to almost all the countries in the world due to its nature of value-measurement of money. The change of interest rates is signaling the possibility of monetary policies of the country tightening or easing (Wang, Yana & Chenc, 2016). On the other hand, in Islamic country which practices Islamic banking in compliant with Shari’ah law, it was argued that interest rate is an unequal distribution of wealth as when interest rate are high, people who are rich can take the opportunity to become richer by saving more in the bank, leaving the poor at a disadvantage to share the wealth (Mushtaq & Siddiqui, 2017).

In this globalization era, changes of interest rates in a country will affect not only the economy of the country but also other factors such as exchange rate and inflation. In this research, we will discover that interest rates sometimes play the role of a dependent variable; its fluctuations are caused by other factors including exchange rate and inflation. This means that interest rates can be said to have mutual interconnection with its factors.

When we talk about interest rate and exchange rate, a logical explanation is that when the exchange rate of a country is increasing, it will push the economy growth too far. From a developed country’s point of view, in order to for the country to maintain its economy growth, the government will tend to decrease the interest rate. This will cause the demand of that country’s currency to fall and thus reducing the exchange rate to its
normal position. When the interest rate of the country had hugely increased, exchange rate crisis will worsen due to business failures. On the other hand, exchange rate fluctuations are also caused by increasing interest rate. (Saraç & Karagöz, 2016).

When a country is facing inflation, the government will tend to improve the interest rate by decreasing it to allow residents to borrow more money to adjust for inflation. When the Central Bank focuses on inflation control, the bank’s reputation will be judged based on analysis of the impact on the inflation rates, and on the expected inflation rates affected by shifts in the interest rates. If the fluctuations of the interest rate are not the expectation of the public or not fulfilling the inflation control based on the Central Bank’s objective, it is considered wrong (Moreira, 2012).

2.1.2 Exchange Rate and Interest Rate

Exchange rate is defined as the price of foreign currency (Frankel, n.d.). It can be explained as two components that are the home currency and a foreign currency exchange with each other’s and quoted either directly or indirectly. Direct quotation indicates that the value of overseas currency is expressed in term of home currency. Conversely, indirectly quotation is opposite of the direct quotation which show the value of home currency is expressed in term of oversea currency. Besides, it can be named as foreign exchange rate or forex.

Firstly, Andrieş et al. (2017) revisit exchange rate (EXCHANGE) and interest rate (IR)’s relationship in a developing economy using wavelet-based methodologies. They analyzed the data of the relationship between the Euro and Romanian Leu (RON) exchange rate series and interbank interest rate (ROBOR). The data used are daily data for the period between February 1999 and December 2014. To have a direct comparison between both variable, they expressed all series into continuously compounded return (log-first difference). As result, for short run, the study proved that
the relationship between interest rate (IR) and exchange rate (EXCHANGE) are negative, refer to the sticky-price model. While for long run, the relationship between interest rates and exchange rates are positive based on the Purchasing Power Parity theory.

Besides, Hacker, Karlsson and Månsson (2014) investigate relation on time scale of exchanges rate and interest rate differentials. They investigate the relationship by using seven countries pair data for the nominal interest rates and spot exchanges rates. They use causality test to test the time varying relation by applied wavelet filtered data. Moreover, when they investigate the response of relationship between exchange rates (EXCHANGE) and interest rates (IR), more frequently result show a negative effect at the lower wavelet scale. This study resulted their investigation prove a strong causal relation in long term period. Based on impulse responses sign corresponding the exchange rate (EXCHANGE) and interest rate (IR), the adverse relationship can be observed more than positive in short run based on studies done by Hacker et al. (2014).

Other than that, Saraç and Karagöz (2016) study the impact of short term interest rate on exchange rate by using monthly data 2003 to 2015 to determine efficient level of short run of interest rate (IR) on exchange rate (EXCHANGE). Therefore, their research proves that no evidence that when interest rate (IR) increase, it will have a lower exchange rate (EXCHANGE) by frequency domain Granger causality test. In contrast, the Central Bank put forward that the relationship between exchange rate (EXCHANGE) and short-term interest rate (IR) have multi-dimensional and different kind of nature and it was not guaranteed that the exchange rate will increase when interest rate was reduced. (Karaca, 2005).

Based on our research, higher interest rate in a country increase the value of the country’s currency as we can say as exchange rate while holding others variable constant. Basurto and Ghosh (2011) conclude that the relationship of higher interest rate on exchange rate still remain a theoretical matter. This is due to higher interest rate may able to attract more foreign investment such as forex trading and increase the
demand for the country exchange rate. Conversely, when there is low interest rate, it will lead to unfavorable and non-attractive to foreign to invest in the country. Therefore, the exchange rate would be affected due to interest rate and there is positive relationship between exchange rate (EXCHANGE) and inflation rate (IR).

2.1.3 Inflation Rate and Interest rate

As the price of goods and services are gradually increasing, it will lead to high inflation and thus, decreasing consumers’ purchasing power of an economy (Churchill et al. 2014). This shows that if the general prices level of goods and services goes up, consumers will buy fewer on goods and services at each unit of currency. Inflation is one of the factors that shared an important character in influencing the interest rate on the economy. Based on the literature studies, there is an impact in real balances on decreasing the supply of currency when the general prices level rises. Inflation had exposed in consumer’s purchasing power, the real value in the internal exchange will be influenced in the economy. Other than that, the unit of account within the economy can be affected by falling on the interest rates. These impacts can contribute the actions of consumers to spend more and put more in borrowing power in the hands. Therefore, natural inflation is formed when the economy grows. If the economy is growing too fast, raising the interest rates will result a falling of the amount of cash supply in economy (Churchill et al. 2014). Some researchers studied that the higher the interest rates lead to the raising in user cost of capital and results of increasing the cost of production. The impacts of inflation will influence money supply tend to be increased when the level of interest rates is rised.

Furthermore, Berument (1999) conducted a research found that Fisher effect theory is used to investigate the effect of estimated inflation and the threat of inflation on interest rates. Several countries are examined between the correlation of interest rates and inflation, including United States and Canada. The research found clearly that the
models influenced the time varying inflation and integrate the risk into the relationship between inflation and interest rates. This study proved that the higher the inflation risk would increase the interest rates which are positively related within Fisher hypothesis framework.

In addition, Anari and Kolari (2016) found that Fisher and Wicksell cycle shares an offsetting effect where inflation and interest rate shares a vital relationship. The Fisher’s theory proved that inflation and nominal interest rates contribute to a positive relationship whereas the inflation rates and interest rate are testing by Gangsar causality theory. Besides that, Wicksell’s theory conducted a negative relationship between expected inflation and real interest rates.

According to Lardic and Mignon (2003) found that inflation and interest rate can be carried out in long run. The raising of inflation uncertainty contributes the increased in nominal interest rates (Berument, 1999). The long run relationship between expected inflation and interest rate has been examined that Federal Reserve can lower the interest rates when inflation happened; raise the interest rate when inflation rate is low.

### 2.1.4 Gross Domestic Product and Interest Rates:

In accordance with Neumeyer & Perri (2004), Bosworth (n.d.), they investigated the relationship between the GDP (output) and interest rate in developing countries compared with developed countries. The empirical result showed that developing countries more volatile than the developed countries due to the fluctuation net export, interest rate and GDP. Feldmann (2015) had conducted a study of used 68 developing countries that period from 1979 to 2008 find how the expected sign between real interest rate, rate of jobless and employment rate. This regressions explained about the unemployment rate and employment rate when real interest rate met output gap substituted for GDP growth rate.
However, many scholar believed that there is **negative** relations between Interest Rate and GDP Growth Rate [Lee & Werner (2018); Baum (2009) & Lucas & Robert (1975)]. Gopalan & Rajan (2017) studied that used 57 developed and emerging countries included Malaysia that period from 1995-2009 how the impact of foreign bank presence (GDP) to interest rate on domestic monetary policy in developing countries by using Global Financial Development Database. They strongly stated that foreign banks assets are one of share of GDP as the most important for foreign bank presence. This investigation paper included Fisher-Type Panel Unit Roots Test, Augmented Dickey-Fuller Test: Shapiro–Wilk W test to forecast impact of high and low gate of foreign bank presence included GDP on the interest rate.

Azam & Karim (2017) examined that the relationship between foreign debt and interest rates that period from 2003-2014 by using data from IMF and the World Bank. They used GDP growth as one of the macroeconomics (country-level) variable that affect to the interest rate (independent variables) by using descriptive statistics, correlation matrix, ordinary least square (OLS), between models (BM), Iteratively Reweighted Least Squares (IRLS) and Robust Regression (RR). Further, they strongly believed the higher GDP growth might increase interest rate due to the increase of households’ income. Although empirical result seen GDP growth insignificant affect to interest rate but the result cannot be representative for actual GDP growth.

### 2.1.5 Money Supply and Interest Rates

Total amount stock of money circulating in an economy can be defined as money supply of the economy. There are several types of money such as safe assets, coins, printed notes balance in savings accounts and in the form of other liquid assets. Money supply (MS) plays an important role to affect a country economy situation. When the MS of the country is increasing, meaning that the resident of the country is holding more money in hand and their purchasing power will become higher. To avoid high inflation rate of the country the government or central bank of the country will increase
the interest rates of borrowing and saving. This is how the MS affecting interest rates in an economy. While in the Thornton (2008) study, stated that when the productivity of the economy or the product prices of the economy is not affect by changes of MS, then the interest rate will be affected. In the Thornton (2008) study also stated that MS will only affect interest rates when the prices and productivity of the economy product did not respond to the changes of money supply initially.

In the study of Thornton (2008) the principal reason that economists will believe the money supply of an economy can make changes to interest rate is because of the theory of Sticky prices. Sticky prices are referring to the prices of goods and services in an economy did not adjust immediately when the economy condition changed. Other than this, based on the study of Thornton (2008) stated that large changes of interest rate could because of money supply changes that cause by external reasons. While according to Fiedman, even the money supply of an economy is control under the central bank and others authorities, interest rates changes may not be central bank and authorities’ expectation. It would change based on the growth of money transactions Mankiw (2014). While in the study of Lucas and Robert (1975) is also stating that specific money supply policy is needed to comply when the economy is required for specific interest rates.

Besides, in the Kaplan & Gungor (2017) stated that interest rate can be influence by money supply but the account owner, entrepreneur, political, government of the economy can also influence the interest rate level. When the money supply of an economy is increased, the interest rates probably will be forces up to lower the money supply level. But when the political, entrepreneur use their scope of power to influence and put forces on interest rates, the interest rates will go to the opposite direction.

**2.2 Review of Relevant Theoretical Models**

In this part, previous studies related journal will be summarize, evaluate and explain, because it providing a theoretical basis and helping to determine the nature of this research.
2.2.1 Interest Rates

Interest rates are always concern by world investor since many years ago. The determinants of increasing or decreasing of interest rates are great quantity, but only few determinants will be choose in this research. There are many empirical literatures explaining the relationship between determinants and interest rates such as, (Wang et al. 2016), (Mushtaq & Siddiqui, 2017), (Saraç & Karagöz, 2016), (Berument, 1999), (Anari and Kolari, 2016), (Lardic and Mignon, 2003), (Hacker, Karlsson and Månsson, 2014), (Andrieș, Căpraru, Ihnatov and Tiwari, 2017), (Thornton, 2008).

2.2.2 Panel Data Analysis

Based on the research of Assefa, Esqueda, and Mollick (2016), panel data model was applied in order to examine the relationship between interest rates and the determinants. Time period data from year 1999 to 2013 was collected from 21 developed countries and 19 developing countries. They found that the coefficients on Interest rates appeared more significant in developed countries while appeared insignificant in developing countries. In all else constant condition, when the interest rate increase by 10% the stock return of developed countries would drop for 1%.

Next, in the research of Perera and Wickramanayake (2016) also used panel data analysis to test between the determinants and commercial bank interest rate. In this research they use 122 of countries as sample data and collecting the data over the period 1996-2010. Based on their result, the key macroeconomic factor remains as the level of financial market improvement and found the important of policy implications. Monetary policy could effectively control the retails interest rates through short term market interest rates.
Besides of that, in the study of Horioka and Wan (2006) they applied generalized-method-of-moments (GMM) estimator into dynamic models by using panel data to find out how the interest and other variables affect the household saving in China. They collect the data from the period of 1995-2004. In the result, they found that real interest rate is one of the main determinants to cause saving rate in China increase.
2.3 Proposed Theoretical Framework

Figure 2.1: Framework for Determinants of Interest rate

* Figure 2.1: Indicates that the dependent variable is influenced by four major independent variables. This research is to study the effect of Inflation, Exchange Rate, GDP Growth and Money Supply towards Interest rate.
2.4 Hypothesis Development

I. To measure the causal relationship between variables.

A. To research the relationship between Exchange Rates and Interest Rates in Developed Countries.

\[ \text{Ho: There is no significant relationship between Exchange Rates and Interest Rates in Developed Countries.} \]

\[ \text{H}_1: \text{There is significant relationship between Exchange Rates and Interest Rates in Developed Countries.} \]

According to Hacker, Karlsson and Månsson (2014), the investigators uses causality test to study the relationship between exchange rate and interest rate. The studies proved that there is a negative impact at the lower wavelet scale. Based on Hacker et al. (2012), the researchers found that there is a powerful causal relationship between interest rate and exchange rate in the long-term period. Negative effects appeared more frequently as compared to positive effects in short run according to the sign of impulse responses corresponding to the interest rate and exchange rate.
B. To study the relationship between Inflation Rates and Interest Rates in Developed Countries.

**Ho:** There is no significant relationship between Inflation Rates and Interest Rates in Developed Countries.

**H1:** There is significant relationship between Inflation Rates and Interest Rates in Developed Countries.

Inflation rate is one of the vital factors affecting interest rate in the market. There are few studies showed that the relationship between inflation rate and interest rate are positively related (Berument, 1999). According to Anari and Kolari (2016), the researchers found that Fisher effect proved that the nominal interest rates and inflation shares a positive relationship according to the Gangsar causality theory. Other than that, Wicksell’s theory conducted a negative relationship between expected inflation and real interest rates.

C. To test the relationship between Gross Domestic Products and Interest Rates in Developed Countries.

**Ho:** There is no significant relationship between Gross Domestic Products and Interest Rates in Developed Countries.

**H1:** There is significant relationship between Gross Domestic Products and Interest Rates in Developed Countries.

Gross Domestic Growth (GDP) is the most important instrument for foreign bank presence in developing countries. Based on the studies by Azam and Karim (2017), GDP growth is used as one of the macroeconomics variable which affects the interest rate as independent variables. The researchers investigate that the higher the GDP growth of the country will lead to the higher interest rate in the market because of the increasing in households' income.
D. To test the relationship between Money Supply and Interest Rates in Developed Countries.

\textbf{Ho}: There is no significant relationship between Money Supply and Interest Rates in Developed Countries.

\textbf{H}_1: There is significant relationship between Money Supply and Interest Rates in Developed Countries.

Based on the studies from Thornton (2008), the researchers found output or prices are strongly influenced by the changes in money supply, otherwise it will affect the interest rate in the market directly. According to Schabert (2009), the studies proved that interest rate are positively related to money supply. The outcome showed a country with higher money supply circulating will lead to a higher nominal interest rates.

\textbf{2.5 Conclusion}

This chapter discuss about the review of literatures of the dependant variables and independent variables as theoretical frameworks under this section. From the results from all relevant journals showed that interest rate (dependant variables) has the relationship between inflation, GDP growth, exchange rate and money supply (independent variables) among each other.
Chapter 3: METHODOLOGY

3.0 Introduction

The purpose of this chapter is to discuss on data collection and the methodology approaches to obtain the data. For a research, data is important because it is including huge amount of information to let us complete our research study. Secondary and panel data were collected from the World Bank database. Besides of data, theoretical model that have been used is another important factor. This chapter will describe those theoretical models used in detail.

3.1 Research Design

The purpose of research design is to fix the process constitute a question to analyze and report data at the end. A research design is an arrangement of rule by collecting data and analyzing the correctness of the data toward our research goal. Besides, there are many types of research design can be categorized such as quantitative, qualitative or mixed method. In our research study, qualitative method is used due to numeric and quantitative data collected. According to Creswell (2002), the research stated that quantitative research is a process of gathering, examining, understanding and writing the outcomes of a study. Meanwhile, qualitative research is the method to collecting data, examination, and report writing opposing from the traditional, quantitative approaches. Qualitative research focuses on numeric, logic and an objective stance. Quantitative research start with recognizes the problem of the research, analyzing the literature and defines the theoretical framework. After the process of introduction phase,
it will be further continued with studying of population and sampling followed by collection and analysis of data. Other than that, qualitative research design applies the mathematic and statistical method to estimate and examine the data. By doing quantitative search, the correlation between the four major independent variable affecting the dependent variable can be determined. In our research, secondary data from Bursa Malaysia and Bloomberg is used due to data can be obtained easily and reduced time spend compare to primary data.

Our research study use panel data which are from year 2007 to 2016. The sampling size of the research consist 10 years of data that including independent variable and dependent variable. FEM, REM and OLS method are used in our research study. The table 3.1 shows the description of dependent and independent variables. The regression model that used in the study the Factor that affecting the Interest Rate for Developed Countries in the following Model:

**Model**

Interest Rate = \( \beta_0 + \beta_1 \) GDP Growth + \( \beta_2 \) Inflation + \( \beta_3 \) Exchange Rate + \( \beta_4 \) Money Supply + \( \varepsilon \)
Table 3.1: Description of dependent and independent variable

<table>
<thead>
<tr>
<th>Variables</th>
<th>Proxy</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest Rate (Y)</td>
<td>IR</td>
<td>Real Interest Rate (%)</td>
<td>World Bank</td>
</tr>
<tr>
<td>GDP Growth (β1)</td>
<td>GDP</td>
<td>GDP Growth (Annual %)</td>
<td>World Bank</td>
</tr>
<tr>
<td>Inflation (β2)</td>
<td>INFLATION</td>
<td>Inflation, GDP Deflator (Annual %)</td>
<td>World Bank</td>
</tr>
<tr>
<td>Exchange Rate (β3)</td>
<td>EXCHANGE</td>
<td>Official Exchange Rate (LCU per US $, period average)</td>
<td>World Bank</td>
</tr>
<tr>
<td>Money Supply (β4)</td>
<td>MS</td>
<td>Board Money Growth (Annual %)</td>
<td>World Bank</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New Zealand: Board Money (Annual Percentage Charge %)</td>
<td>Reserve Bank of New Zealand</td>
</tr>
</tbody>
</table>

GDP growth and interest rate have a negative relationship. It means that once GDP Growth increase, the Interest Rate will be decrease. Interest rate shares a negative relationship with inflation as when the interest rate is low, people tend to spend more and cause the economy to grow and inflation to increase. All else being equal, a larger Money Supply will lower down the market Interest Rate. Therefore, Interest Rate and Money Supply will have a negative relationship. Furthermore, exchange rate will have a direct relationship with interest rate. This is because when interest rate rises, it tends to fascinate more external capital. Hence, the exchange rate will be rise by this situation.

3.2 Data Collection Method
In our research studies, four major independent variables have been chosen, there were Inflation, Exchange Rate, Money Supply and GDP Growth. By way of we mention above, we used secondary data in our research for answering the hypotheses and investigation question in our study. Primary data is not being used due to it is more difficult to find out several countries of our variable such as Inflation, Exchange Rate and others. Secondary data is data that collected by others user based on their resources. Therefore, secondary data are used as our research data collection method due to it save a lot of time and easy to carry out analysis. All data were collected from online resources such as World Bank Open Data and other published sources that available in the Internet. The data collected was from year 2007 to 2016. In our research, yearly data are being used as larger as 10 years and around 268 developed countries are chosen as our sample. The larger sample size will provide us the unbiased result during our test. Hence, it helped us to save cost and time by using Secondary Data Collection Method.

3.3 Sampling Design

There are 11 developed countries that have been selected for this research to investigate the determinants that affect interest rates of the country. All the countries are selected following to the ranking of Gross Domestic Product (GDP) that conducted by World Bank Data according by highest millions of US dollars. We have chosen the 11 developed countries randomly, which are Australia, Singapore, Hong Kong, Switzerland, Poland, Brunei Darussaam, United Kingdom, Romania, Estonia, Czech Republic and New Zealand from World Bank Data. These countries were selected because their countries economy is much more stable comparing to developing countries. The independent variables chosen are GDP, exchange rates, money supply, inflation rate and the dependent variable is interest rates. The data used for this research is secondary data and panel data. The time of the data is from year 2007 to year 2016.
These data have been chosen because we are finding out recently how the variables affected interest rates. These data are found in the World Bank database. By having these data, we are able to improve our research and find out the result more accurate.

### 3.4 Data Processing

This paper will be examined using Panel data method which combines and more allow more flexibility in the Interest Rates and the four major variables over time and across developed countries. In Real World Data, it can have produced inconsistent, abnormal and potential misleading measure the value of the data. This research paper used obtained and selected from Website of World Bank Open Data which included secondary data. After that, we take out missing, noisy and inconsistent data. Some country (Singapore and Canada) have several years undefined value in World Bank Open Data. Next, we rearrange to ensure that the most appropriate and validity of data and using E-views Software for empirical tests and diagnostic checking in our research. At the same time, we eliminate irrelevant data special for our research purpose to make well-formed data.
Table 3.2: Process of Data in this research.

- Real World Data
  - Well-formed Data
    - Data Reduction
      - Data Transformation
        - Data Cleaning
          - Data Consolidation
3.5 Data Analysis

3.5.1 Descriptive Analysis

Descriptive analysis is focusing on summarizing a given data set from the population or a sample data of the research (Thompson, 2009). It will help of purpose to analyse, interpret, and forecast the result from the data in an easier understanding method. Descriptive analysis is a measurement to carry out central tendency. Central tendency indicators are consisting of the mean, median and mode, which measures the most familiar patterns of the data collected being analysed. In addition, descriptive analysis can help to measure the variability by determining the key characteristics outlining from the data used (Thompson, 2009). Variability indicators are used to figure out the variance, standard deviation, the minimum and maximum variables, kurtosis and skewness from the data collected of a research. It will help to communicate how the data is distributed by showing the shape and spread of the data collected.
3.5.2 Correlation Analysis

Correlation analysis is carried out to examine the strength of relation between two continuous variables’ relationship (Mikheev & Kazakov, 2017). As a researcher who wants to construct for the possible relationship between the variables, this correlation analysis is the best tools for the researchers. Continuous variables can be the connection between either both independent variables, or between a dependent variable and an independent variable. Pearson’s coefficient is the tools for measuring the correlation and ranges between +1 and -1. There are two possible outcomes for correlation analysis based on the continuous variables measured, which is positive or negative. When one variable increases simultaneously with the other, it indicates that there exists a positive correlation. Strongest positive correlation represents +1 while strongest negative correlations represent -1 from the continuous variables itself. The coefficient worked out can helps to estimate the future trends between the two variables.

3.5.3 Hypothesis Testing
3.5.3.1 Variables (T-Test)

**Exchange rates**

Ho: There is no significant relationship between Exchange Rates and Interest Rates in Developed Countries.
H1 : There is significant relationship between Exchange Rates and Interest Rates in Developed Countries.

Decision rule: Reject null hypothesis (H₀) while p-value is smaller than significant level (1%, 5%, 10%) and the value of test statistics is larger than critical value. Otherwise, do not reject H₀.

**Inflation Rates**

Ho: There is no significant relationship between Inflation Rates and Interest Rates in Developed Countries.
H₁: There is significant relationship between Inflation Rates and Interest Rates in Developed Countries.

Decision rule: Reject null hypothesis (H₀) while p-value is smaller than significant level (1%, 5%, 10%) and the value of test statistics is larger than critical value. Otherwise, do not reject H₀.

**Gross Domestic Product**
Ho: There is no significant relationship between Gross Domestic Products and Interest Rates in Developed Countries.

H1: There is significant relationship between Gross Domestic Products and Interest Rates in Developed Countries.

Decision rule: Reject null hypothesis (H₀) while p-value is smaller than significant level (1%, 5%, 10%) and the value of test statistics is larger than critical value. Otherwise, do not reject H₀.

Money Supply

Ho: There is no significant relationship between Money Supply and Interest Rates in Developed Countries.

H₁: There is significant relationship between Money Supply and Interest Rates in Developed Countries.

Decision rule: Reject null hypothesis (H₀) while p-value is smaller than significant level (1%, 5%, 10%) and the value of test statistics is larger than critical value. Otherwise, do not reject H₀.

3.5.4 Models
Pooled Ordinary Least Square (OLS) Model

Based on the data collected, we are using the data as the model called Panel data. Panel data defines as the data collecting from the same cross-sectional of units and comply with multiplied points in time. We used 11 developed countries and run the hypothesis test for 10 years. Pooled Ordinary Least Square (OLS) Model is one of the types of panel data. The assumptions of Pooled OLS included as it is observed for the time dummy variable model. It was a very common way of testing the differences for interception slope coefficients between times is the use of period dummies. It was used to prevent the dummy-variable tap when including time dummies to alone. According to Nwakuya and Ijomah (2017), POLS Model helps to investigate in the research as a reference of statistical.

Fixed Effect Model (FEM)

One of the statistical model which is FEM where the parameters of the model are fixed or non-random quantities. Regression model in panel data analysis can be refer by FEM. FEM helps to study the effect of variables fluctuate time on time (Mushtaq & Siddiqui, 2017). The model is testing the connection between predictor and outcome variables. In panel data analysis, we applied fixed effect model to estimate i) Least Square Dummy Variable (LSDV) regression and ii) within effect estimation methods. Fixed effect estimator can be name as within estimator which focus on an estimator for the coefficient in the regression model. Least Square Dummy Variable (LSDV) can be carried out for differential intercept dummy technique by using the dummy variable technique. According from the research of Bhattarai (2016), we found that Hausman test statistic is carried out to differentiate fixed effect model with random effect model in the previous research. Based on the research, FEM is suggested for the empirical analysis on the previous research.

Random Effect Model (REM)
In panel data analysis, a random effect model (REM) name as Error Component Model which is a type of model under hierarchical linear model (Mushtaq & Siddiqui, 2017). Most of the researchers may use REM to admit a possible effect based on a factor whose specific, fixed values are not of interest. As contrast, REM is collecting data based on the random sample from a larger population. In statistic of panel data analysis, REM state any regressors is not easily to correlated with individual effect and estimate error variance specific to group (or times). REM emphasis on specific random heterogeneity compare to FEM. This will results the confidence interval and variance of REM will spread wider from the variables selected. Breusch and Pagan LM test is used to estimate the relationship between pooled OLS and REM.

3.5.5 Inferential Analysis
Poolability F Test (Partial F Test)

The poolability F test is commonly used to determine the most suitable model to be used in empirical analysis. Poolability is defined as a calculation for all coefficients which include also the intercept and slopes that are same across cross sections and time (Jager, 2008). Overall significance of a regression model can be determined by F test. In the case to decide between which model is better, fixed effect hypothesis testing is applied and pooled regression model is used as the benchmark for comparison. The hypothesis testing for partial F test is stated as below:

H₀: Pooled OLS model preferred.
H₁: FEM model preferred.

The decision rule stated that null hypothesis (H₀) should be rejected if the value of the test statistics is larger than critical value or the p-value is smaller than significance level (1%, 5%, 10%). Otherwise, do no reject H₀. The test statistic is shown below:

\[
F = \frac{(R^2_{FEM} - R^2_{pooled})/(k_{FEM} - k_{pooled})}{(1 - R^2_{FEM})/(n - (k_{FEM} + 1))}
\]

Breusch-Pagan LM Test
Heteroskedasticity can be tested and act as linear function of all independent variable using (BP) test in regression models. Besides that, the test can also act as function of either one or more of the independent variable in the model. The hypothesis testing for Breusch-Pagan LM test is stated as below:

H$_0$: Pooled OLS model preferred. (Homoskedasticity)
H$_1$: REM model preferred (Heteroskedasticity)

The decision rule stated that null hypothesis (H$_0$) should be rejected if the value of the test statistics is larger than critical value or the p-value is smaller than the significance level (1%, 5%, 10%). Otherwise, do not reject H$_0$. The test statistics of the Breusch-Pagan LM test is shown in below:

$$F = \frac{R^2_{\text{REM}}}{1 - R^2_{\text{REM}}} = \frac{\chi^2}{n - 2}$$
Hausman Test

The Hausman test help decide the appropriateness of FEM model or the REM model in empirical panel data analysis. If there are no correlation between the regressors and effects, then the FEM model or REM model are both consistent, but FEM is inefficient. If correlation exists, FEM is consistent while REM is inconsistent. The hypothesis testing for Hausman test is stated as below:

\[ H_0 : \text{REM model preferred. (REM is consistent and efficient)} \]
\[ H_1 : \text{FEM model preferred. (REM is inconsistent and inefficient)} \]

The decision rule stated that null hypothesis \((H_0)\) should be rejected if the value of the test statistics is larger than critical value or the p-value is smaller than the significance level (1%, 5%, 10%). Otherwise, do not reject \(H_0\). The test statistics for Hausman test is shown in below:

\[ x^2 = (\hat{\beta}^{FEM} - \hat{\beta}^{REM})[\text{var}(\hat{\beta}^{FEM}) - \text{var}(\hat{\beta}^{REM})^{-1}](\hat{\beta}^{FEM} - \hat{\beta}^{REM}) \]

3.6 Conclusion

This chapter is important because it help our study to collect data and analyse data. From the result of the data analysis we will further explain how it affects the interest rates in following chapter
Chapter 4: Data Analysis

4.0 Introduction

This chapter will discuss about the empirical results that we done in previous chapter including with 11 developed countries between 2007 years and 2016 years. Developed countries that we used to conduct this research study including Australia, Singapore, Hong Kong, Switzerland, Poland, Brunei Darussalam, United Kingdom, Romania, Estonia, Czech Republic, New Zealand. Further, we will show the result that interest rate change depending on the main macroeconomic variables.

4.1 Descriptive Analysis

The table below shows that the measurement of central tendency of every variable based on 11 developed countries which including 535 observations. We computed this measurement table by E-views that content Mean, Median and Maximum.
Firstly, the first variables Interest Rate (IR) have an overall mean of 4.14, median of 3.48505 and standard deviations of 5.3946. Next, Inflation Rate (Inflation) have overall lowest mean of 2.0943, median of 1.7566 and standard deviations of 4.8010. After that, GDP Growth Rate (GDP) have overall mean of 2.1265, median of 2.2861 and lowest standard deviations of 3.3903. Further, Exchange Rate (EXCHANGE) have overall mean of 4.3984, lowest median of 1.42 and highest standard deviations of 5.8614. Lastly, Money Supply (MS) have overall highest mean of 7.2934, highest median of 7.3479 and standard deviations of 5.6015.

For maximum values, the highest maximum value of variable is Interest Rate (IR) which is 35.41512. Second highest maximum value of variable is Money Supply (MS) which is 33.8334 follow by Exchange Rate (EXCHANGE) which is 24.5986, Inflation Rate (INFLATION) which is 20.1805 while GDP Growth Rate (GDP) smallest maximum value which is 15.2404.
For minimum values, the highest minimum value of variables is Inflation Rate (INFLATION) which is -22.0914. Next, second highest minimum value of variable is GDP Growth Rate (GDP) which is -14.7244 follow by Interest Rate (IR) which is -12.2154, Money Supply (MS) which is -9.1575 while Exchange Rate (EXCHANGE) smallest minimum value which is 0.499772.
4.2 Correlation Analysis

Table 4.2 Correlation Analysis.

<table>
<thead>
<tr>
<th></th>
<th>IR</th>
<th>INFLATION</th>
<th>GDP</th>
<th>EXCHANGE</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR</td>
<td>1.000</td>
<td>-0.8177</td>
<td>-0.2296</td>
<td>-0.0375</td>
<td>-0.1042</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-0.8177</td>
<td>1.0000</td>
<td>0.2285</td>
<td>0.0237</td>
<td>0.3301</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.2296</td>
<td>0.2285</td>
<td>1.0000</td>
<td>-0.0692</td>
<td>0.5052</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>-0.0375</td>
<td>0.0237</td>
<td>-0.0692</td>
<td>1.0000</td>
<td>-0.0575</td>
</tr>
<tr>
<td>MS</td>
<td>-0.1042</td>
<td>0.3301</td>
<td>0.5052</td>
<td>-0.0575</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Where, IR = Interest Rate (\%)  
INFLATION = Inflation Rate (annual %)  
GDP = GDP Growth Rate (%)  
EXCHANGE = Exchange Rate (LCU per US Dollar)  
MS = Money Supply (Annual %)
The table 4.2 shows that Correlation table result that generated via E-view for developed countries. There are 9 ranges of correlation coefficient between independent variables and dependent variable in a model:

- +1.00 denote as **perfect positive correlation**
- 0.50 to 0.99 denote as **strong positive correlation**
- 0.30 to 0.49 denote as **medium positive correlation**
- 0.01 to 0.29 denote as **weak positive correlation**
- 0 denote as **no correlation**
- -0.01 to -0.29 denote as **weak negative correlation**
- -0.30 to -0.49 denote as **medium negative correlation**
- -0.50 to -0.99 denote as **strong negative correlation**
- -1.00 denote as **perfect negative correlation**

The table shows that Interest Rate (IR) has a strong negative relationship with Inflation Rate (INFLATION) at -0.8177. After that, the second higher negative relationship is GDP Growth Rate (GDP) which is -0.2296 follow by Money Supply (MS) which is -0.1042 while Exchange Rate (EXCHANGE) is -0.0375.
4.3 Models

4.3.1.1 Pooled OLS Model

Table 4.3 Pooled OLS Table

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Pooled OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
</tr>
<tr>
<td>C</td>
<td>4.935124</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-0.964288</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.265771</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>-0.012461</td>
</tr>
<tr>
<td>MS</td>
<td>0.261936</td>
</tr>
</tbody>
</table>

Note: The asterisks indicate rejection of null hypothesis at *10%, **5% and ***1% significance level respectively.

\[
IR = 4.935124 - 0.964288 \text{ INFLATION} - 0.265771 \text{ GDP} - 0.012461 \text{ EXCHANGE} + 0.261936 \text{ MS} + \epsilon_i
\]

Where,

IR = Interest Rate (%)

INFLATION = Inflation Rate (annual %)

GDP = GDP Growth Rate (%)

EXCHANGE = Exchange Rate (LCU per US Dollar)

MS = Money Supply (Annual %)
4.3.1.2 Interpretation of Pooled OLS

I. Coefficient ($\beta_0$)
When Inflation Rate (INFLATION), GDP Growth Rate (GDP), Exchange Rate (EXCHANGE) and Money Supply (MS) are equal to zero, on average, Interest Rate (IR) is equal to 4.9351%.

II. Inflation Rate ($\beta_1$)
If the Inflation Rate (INFLATION) increases by 1%, the Interest Rate (IR) will decrease by 0.9643 percent, on average, holding other variables constant.

III. GDP Growth Rate ($\beta_2$)
If the GDP Growth Rate (GDP) increase by 1 %, the Interest Rate (IR) will decrease by 0.2658 percent, on average, holding other variables constant.

IV. Exchange Rate ($\beta_3$)
If the Exchange Rate (EXCHANGE) increase by 1%, the Interest Rate (IR) will decrease by 0.0125 percent, on average, holding other variables constant.

V. Money Supply ($\beta_4$)
If the Money Supply (MS) increase by 1 %, the Interest Rate (IR) will increase by 0.2619 percent, on average, holding other variables constant.
4.3.1.3 Hypothesis Testing of Pooled OLS

I. Inflation Rate ($\beta_1$)

$H_0$: There is no significant relationship between Inflation Rate and Interest Rate.

$H_1$: There is significant relationship between Inflation Rate and Interest Rate.

P-value: 0.0000

Decision Rule: Reject $H_0$ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject $H_0$.

Decision Making: Reject $H_0$ since the p-value (0.0000) is less than significance level 1%, 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between Inflation Rate and Interest Rate at the significance level of 1%, 5% and 10%.
II. GDP Growth Rate (β₂)
H₀: There is no significant relationship between GDP Growth Rate and Interest Rate.
H₁: There is significant relationship between GDP Growth Rate and Interest Rate.

P-value: 0.0094

Decision Rule: Reject H₀ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject H₀.

Decision Making: Reject H₀ since the p-value (0.0094) is less than significance level 1%, 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between GDP Growth Rate and Interest Rate at the significance level of 1%, 5% and 10%.

III. Exchange Rate (β₃)
H₀: There is no significant relationship between Exchange Rate and Interest Rate.
H₁: There is significant relationship between Exchange Rate and Interest Rate.

P-value: 0.8071

Decision Rule: Reject H₀ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject H₀.

Decision Making: Reject H₀ since the p-value (0.8071) is greater than significance level 10%.

Conclusion: There is not sufficient evidence to conclude that there is significance relationship between Exchange Rate and Interest Rate at the significance level of 10%.
IV. Money Supply ($\beta_4$)

$H_0$: There is no significant relationship between Money Supply and Interest Rate.

$H_1$: There is significant relationship between Money Supply and Interest Rate.

P-value: 0.0001

Decision Rule: Reject $H_0$ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject $H_0$.

Decision Making: Reject $H_0$ since the p-value (0.0001) is less than significance level 1%, 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between Money Supply and Interest Rate at the significance level of 1%, 5% and 10%.
4.3.2.1 Fixed Effect Model

Table 4.4: Fixed Effect Model.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Fixed Effect Model</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Standard Error</td>
<td>T-Statistic</td>
</tr>
<tr>
<td>C</td>
<td>8.055931</td>
<td>1.102991</td>
<td>7.303717</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-1.041345</td>
<td>0.041037</td>
<td>-25.37582</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.157392</td>
<td>0.066875</td>
<td>-2.353531</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>-0.518892</td>
<td>0.230955</td>
<td>-2.246727</td>
</tr>
<tr>
<td>MS</td>
<td>0.138683</td>
<td>0.040833</td>
<td>3.396383</td>
</tr>
</tbody>
</table>

Note: The asterisks indicate rejection of null hypothesis at *10%, **5% and ***1% significance level respectively.

\[
IR = 8.055931 - 1.041345 \text{ INFLATION} - 0.157392 \text{ GDP} - 0.518892 \text{ EXCHANGE} + 0.138683 \text{ MS}
\]

Where,

\[
IR = \text{Interest Rate (\%)}
\]

\[
\text{INFLATION} = \text{Inflation Rate (annual \%)}
\]

\[
\text{GDP} = \text{GDP Growth Rate (\%)}
\]

\[
\text{EXCHANGE} = \text{Exchange Rate (LCU per US Dollar)}
\]

\[
\text{MS} = \text{Money Supply (Annual \%)}
\]
4.3.2.2 Interpretation of Fixed Effect Model

I. Coefficient ($\beta_0$)
When Inflation Rate (INFLATION), GDP Growth Rate (GDP), Exchange Rate (EXCHANGE) and Money Supply (MS) are equal to zero, on average, Interest Rate (IR) is equal to 8.0559%.

II. Inflation Rate ($\beta_1$)
If the Inflation Rate (INFLATION) increases by 1%, the Interest Rate (IR) will decrease by 1.0413 percent, on average, holding other variables constant.

III. GDP Growth Rate ($\beta_2$)
If the GDP Growth Rate (GDP) increase by 1 %, the Interest Rate (IR) will decrease by 0.1574 percent, on average, holding other variables constant.

IV. Exchange Rate ($\beta_3$)
If the Exchange Rate (EXCHANGE) increase by 1%, the Interest Rate (IR) will decrease by 0.5189 percent, on average, holding other variables constant.

V. Money Supply ($\beta_4$)
If the Money Supply (MS) increase by 1 %, the Interest Rate (IR) will increase by 0.1387 percent, on average, holding other variables constant.
4.3.2.3 Hypothesis Testing of Fixed Effect Model

I. Inflation Rate ($\beta_1$)

$H_0$: There is no significant relationship between Inflation Rate and Interest Rate.

$H_1$: There is significant relationship between Inflation Rate and Interest Rate.

P-value: 0.0000

Decision Rule: Reject $H_0$ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject $H_0$.

Decision Making: Reject $H_0$ since the p-value (0.0000) is less than significance level 1%, 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between Inflation Rate and Interest Rate at the significance level of 1%, 5% and 10%.
II. GDP Growth Rate (β₂)

H₀: There is no significant relationship between GDP Growth Rate and Interest Rate.
H₁: There is significant relationship between GDP Growth Rate and Interest Rate.

P-value: 0.0209

Decision Rule: Reject H₀ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject H₀.

Decision Making: Reject H₀ since the p-value (0.0209) is less than significance level 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between GDP Growth Rate and Interest Rate at the significance level of 5% and 10%.
III. Exchange Rate ($\beta_3$)
H$_0$: There is no significant relationship between Exchange Rate and Interest Rate.
H$_1$: There is significant relationship between Exchange Rate and Interest Rate.

P-value: 0.0272

Decision Rule: Reject H$_0$ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject H$_0$.

Decision Making: Reject H$_0$ since the p-value (0.0272) is less than significance level 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between Exchange Rate and Interest Rate at the significance level of 5% and 10%.

IV. Money Supply ($\beta_4$)
H$_0$: There is no significant relationship between Money Supply and Interest Rate.
H$_1$: There is significant relationship between Money Supply and Interest Rate.

P-value: 0.001

Decision Rule: Reject H$_0$ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject H$_0$.

Decision Making: Reject H$_0$ since the p-value (0.001) is less than significance level 1%, 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between Money Supply and Interest Rate at the significance level of 1%, 5% and 10%. 
4.3.3.1 Random Effect Model

Table 4.5: Random Effect Model

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Random Effect Model</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>T-Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>5.988415</td>
<td>0.823095</td>
<td>7.275481</td>
<td>0.0000</td>
</tr>
<tr>
<td>INFLATION</td>
<td></td>
<td>-1.026722</td>
<td>0.040580</td>
<td>-25.30142</td>
<td>0.0000***</td>
</tr>
<tr>
<td>GDP</td>
<td></td>
<td>-0.187616</td>
<td>0.065460</td>
<td>-2.866105</td>
<td>0.0051***</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td></td>
<td>-0.072618</td>
<td>0.097328</td>
<td>-0.746110</td>
<td>0.4574*</td>
</tr>
<tr>
<td>MS</td>
<td></td>
<td>0.155523</td>
<td>0.040432</td>
<td>3.846516</td>
<td>0.0002***</td>
</tr>
</tbody>
</table>

Note: The asterisks indicate rejection of null hypothesis at *10%, **5% and ***1% significance level respectively.

IR = 8.055931 - 1.041345 INFLATION - 0.157392 GDP - 0.518892 EXCHANGE + 0.138683 MS

Where, IR = Interest Rate (%)
INFLATION = Inflation Rate (annual %)
GDP = GDP Growth Rate (%)
EXCHANGE = Exchange Rate (LCU per US Dollar)
MS = Money Supply (Annual %)
4.3.3.2 Interpretation of Random Effect Model

I. Coefficient ($\beta_0$)
When Inflation Rate (INFLATION), GDP Growth Rate (GDP), Exchange Rate (EXCHANGE) and Money Supply (MS) are equal to zero, on average, Interest Rate (IR) is equal to 5.9884%.

II. Inflation Rate ($\beta_1$)
If the Inflation Rate (INFLATION) increases by 1%, the Interest Rate (IR) will decrease by 1.0267 percent, on average, holding other variables constant.

III. GDP Growth Rate ($\beta_2$)
If the GDP Growth Rate (GDP) increase by 1 %, the Interest Rate (IR) will decrease by 0.1876 percent, on average, holding other variables constant.

IV. Exchange Rate ($\beta_3$)
If the Exchange Rate (EXCHANGE) increase by 1%, the Interest Rate (IR) will decrease by 0.0726 percent, on average, holding other variables constant.

V. Money Supply ($\beta_4$)
If the Money Supply (MS) increase by 1 %, the Interest Rate (IR) will increase by 0.1555 percent, on average, holding other variables constant.
4.3.3.3 Hypothesis Testing of Random Effect Model

I. Inflation Rate ($\beta_1$)

$H_0$: There is no significant relationship between Inflation Rate and Interest Rate.

$H_1$: There is significant relationship between Inflation Rate and Interest Rate.

P-value: 0.0000

Decision Rule: Reject $H_0$ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject $H_0$.

Decision Making: Reject $H_0$ since the p-value (0.0000) is less than significance level 1%, 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between Inflation Rate and Interest Rate at the significance level of 1%, 5% and 10%.
II. GDP Growth Rate ($\beta_2$)

H$_0$: There is no significant relationship between GDP Growth Rate and Interest Rate.
H$_1$: There is significant relationship between GDP Growth Rate and Interest Rate.

P-value: 0.0051

Decision Rule: Reject H$_0$ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject H$_0$.

Decision Making: Reject H$_0$ since the p-value (0.0051) is less than significance level 1%, 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between GDP Growth Rate and Interest Rate at the significance level of 1%, 5% and 10%.

III. Exchange Rate ($\beta_3$)

H$_0$: There is no significant relationship between Exchange Rate and Interest Rate.
H$_1$: There is significant relationship between Exchange Rate and Interest Rate.

P-value: 0.4574

Decision Rule: Reject H$_0$ if the test statistic is greater than the critical value or the P-value is less than significance level. Otherwise, do not reject H$_0$.

Decision Making: Do not reject H$_0$, since the p-value (0.4574) is greater than significance level 10%.

Conclusion: There is not sufficient evidence to conclude that there is significance relationship between Exchange Rate and Interest Rate at the significance level of 10%.
IV. Money Supply ($\beta_4$)

H₀: There is no significant relationship between Money Supply and Interest Rate.
H₁: There is significant relationship between Money Supply and Interest Rate.

P-value: 0.0002

Decision Rule: Reject H₀ if the test statistic is greater than the critical value or the P-value is less than significance level (1%, 5% and 10%). Otherwise, do not reject H₀.

Decision Making: Reject H₀ since the p-value (0.0002) is less than significance level 1%, 5% and 10%.

Conclusion: There is sufficient evidence to conclude that there is significance relationship between Money Supply and Interest Rate at the significance level of 1%, 5% and 10%.
4.4 Model Selection

Table 4.6: Regression Results of Dependent variable (Interest Rate).

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Pooled OLS</th>
<th>Fixed Effect Model</th>
<th>Random Effect Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Probability</td>
<td>Coefficient</td>
</tr>
<tr>
<td>C</td>
<td>4.935124</td>
<td>0.0000</td>
<td>8.055931</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-0.964288</td>
<td>0.0000***</td>
<td>-1.041345</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.265771</td>
<td>0.0094***</td>
<td>-0.157392</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>-0.012461</td>
<td>0.8071*</td>
<td>-0.518892</td>
</tr>
<tr>
<td>MS</td>
<td>0.261936</td>
<td>0.0001***</td>
<td>0.138683</td>
</tr>
</tbody>
</table>

Note: The asterisks indicate rejection of null hypothesis at *10%, **5% and ***1% significance level respectively.

Where, IR = Interest Rate (annual %)
GDP = GDP Growth Rate (%)
EXCHANGE = Exchange Rate (LCU per US Dollar)
MS = Money Supply (Annual %)
INFLATION = Inflation Rate (annual %)
4.4.1 Poolability F-Test

Table 4.7: Poolability F-Test.

<table>
<thead>
<tr>
<th>Test</th>
<th>Probability (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poolability F-Test</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

$H_0$: Pooled OLS Model preferred.
$H_1$: Fixed Effect Model preferred.

Decision Rule: Reject $H_0$ if P-value of Poolability F-Test is less than significance level (1%, 5% and 10 %). Otherwise, do not reject $H_0$.

Decision Making: Reject $H_0$, since the P-value (0.0000) is less than significance level of 1%, 5% and 10 %.

Conclusion: There is sufficient evidence to conclude that Fixed Effect model is preferred at the significance level of 1%, 5% and 10 %.
4.4.2 Breusch-Pagan Lagrange Multiplier Test

Table 4.8: Breusch-Pagan LM Test.

<table>
<thead>
<tr>
<th>Test</th>
<th>Probability (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breusch-Pagan LM Test</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

H₀: Pooled OLS Model preferred. (Homoskedasticity)
H₁: Random Effect Model preferred. (Heteroskedasticity)

Decision Rule: Reject H₀ if P-value of Breusch-Pagan LM Test is less than significance level of 5% and 10 %. Otherwise, do not reject H₀.

Decision Making: Reject H₀, since the P-value (0.0000) is less than significance level of 5% and 10 %.

Conclusion: There is sufficient evidence to conclude that Random Effect Model is preferred at the significance level of 5% and 10 %.
4.4.3 Hausman Test

Table 4.9: Hausman Test.

<table>
<thead>
<tr>
<th>Test</th>
<th>Probability (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hausman Test</td>
<td>0.0079</td>
</tr>
</tbody>
</table>

H₀: Random Effect Model preferred.
H₁: Fixed Effect Model preferred.

Decision Rule: Reject H₀ if P-value of Hausman Test is less than significance level (5% and 10 %). Otherwise, do not reject H₀.

Decision Making: Reject H₀, since the P-value (0.0079) is less than significance level of 5% and 10 %.

Conclusion: There is sufficient evidence to conclude that Fixed Effect model is preferred at the significance level of 5% and 10 %.
4.5 Multicollinearity

There are 2 methods to determine the presence of Multicollinearity in our research.

4.5.1 Variance Inflation Factor (VIF)

Table 4.10: Variance Inflation Factor (VIF)

<table>
<thead>
<tr>
<th>No Multicollinearity</th>
<th>VIF = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Serious Multicollinearity</td>
<td>1 &lt; VIF &lt; 10</td>
</tr>
<tr>
<td>Serious Multicollinearity</td>
<td>VIF ≥ 10</td>
</tr>
</tbody>
</table>

Table 4.11: Results of each variable for VIF.

<table>
<thead>
<tr>
<th>Variables</th>
<th>R²</th>
<th>VIF = 1 - R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest Rate</td>
<td>0.7200</td>
<td>3.5714</td>
</tr>
<tr>
<td>Inflation Rate</td>
<td>0.7380</td>
<td>3.8168</td>
</tr>
<tr>
<td>GDP Growth Rate</td>
<td>0.3118</td>
<td>1.4531</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>0.0085</td>
<td>1.0086</td>
</tr>
<tr>
<td>Money Supply</td>
<td>0.4084</td>
<td>1.6903</td>
</tr>
</tbody>
</table>

Since our result above is between 1 and 4, so we consider as no serious multicollinearity.

4.5.2 Tolerance Level (TOL)
Table 4.12: Tolerance Level (TOL).

<table>
<thead>
<tr>
<th>TOL = 1</th>
<th>No Multicollinearity</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOL close to 0</td>
<td>Serious Multicollinearity</td>
</tr>
</tbody>
</table>

Table 4.13: Results of each variable for TOL.

<table>
<thead>
<tr>
<th>Variables</th>
<th>TOL = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VIF</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>0.2800</td>
</tr>
<tr>
<td>Inflation Rate</td>
<td>0.2620</td>
</tr>
<tr>
<td>GDP Growth Rate</td>
<td>0.6882</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>0.9915</td>
</tr>
<tr>
<td>Money Supply</td>
<td>0.5916</td>
</tr>
</tbody>
</table>

Almost all the TOL that we calculated is close to 0, thus we consider there is serious multicollinearity problem among the variables except Exchange Rate is close to 1 which is 0.9915. The result of VIF and TOL contains multicollinearity. So as the result, we conclude that this model is facing multicollinearity issue.
4.6 Conclusion

As an overall of the chapter 4, we used diagnostic checking to discover this model which may have contains multicollinearity, normality distributed, heteroscedasticity, and autocorrelation problem and model specification error. Besides, we identify the model such as Pooled OLS Model, Fixed Effect Model and Random Effect Model to select which is best model suitable in our research. In addition, we are using T-test and F-test to examine hypothesis testing in this chapter. Anyway, we proceed to Chapter 5 for further discussion and recommendation of this research purpose.
Chapter 5: Discussion, Conclusion and Implication

5.0 Introduction

Under chapter 5, we will summarize the research based on whole previous chapter that we argued. As can be seen, we disclose that there were some elements (E g: Inflation Rate, GDP Growth Rate and Money Supply) that play a vital role to effect undulation of interest rate on developed countries. So, this chapter will be a summary for Statistical Analysis, Discussion of Major Findings, Implication of the Study, Recommendation for Future Research and Conclusion.
## 5.1 Summary of Statistical Analysis

Table 5.1: Results of Statistical Analysis.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Pooled OLS</th>
<th>Fixed Effect Model</th>
<th>Random Effect Model</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>P-value</td>
<td>Descriptive of Results</td>
<td>P-value</td>
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<tr>
<td><strong>INFLATION</strong></td>
<td>0.0000</td>
<td>Significant <em>,<strong>,</strong></em></td>
<td>0.0000</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td>0.0094</td>
<td>Significant <em>,<strong>,</strong></em></td>
<td>0.0209</td>
</tr>
<tr>
<td><strong>EXCHANGE</strong></td>
<td>0.8071</td>
<td>Insignificant <em>,<strong>,</strong></em></td>
<td>0.0272</td>
</tr>
<tr>
<td><strong>MS</strong></td>
<td>0.0001</td>
<td>Significant <em>,<strong>,</strong></em></td>
<td>0.0010</td>
</tr>
</tbody>
</table>

**Model Selection**

<table>
<thead>
<tr>
<th>P-value</th>
<th>Descriptive of Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poolability F-Test</td>
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<tr>
<td>Breusch-Pagan LM Test</td>
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</tr>
<tr>
<td>Hausman Test</td>
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</tr>
</tbody>
</table>

*Note: The asterisks indicate *10%, **5% and ***1% significance level respective.*
5.2 Discussion of Major Finding

In this research, we found that the results of each factors almost have similar sign compared with expected sign that we discuss in previous chapter.

Table 5.2: Result of Dependent and Independents Variable

<table>
<thead>
<tr>
<th>Variables</th>
<th>Expected Sign (+/-)</th>
<th>Empirical Sign (+/-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation Rate</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GDP Growth Rate</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Exchange Rate</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Money Supply</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
5.2.1 Inflation

Inflation represents one of the factors that played an important role in affecting the interest rate in this study. Based on our statistical analysis, we found out that inflation and interest rate does share a relationship with each other. This study performs an outcome that the dependent variable (interest rate) and the independent variable (inflation) are negatively related. This statement is proved by some previous studies. From the previous studies, Anari and Kolari (2016) proved that inflation and interest rate shares an inverse relationship conducted by Wicksell’s theory. In spite of the fact that in the same studies Fisher effect is supported that there is a positive relationship between inflation and interest rate, the researcher found that the federal funds rate is aimed to improve and enhance the Wicksell effect. According to Baum (2009), the Fisher-Wicksell model is supported of the negative relationship between interest rate and inflation. The offsetting effect from the Fisher-Wicksell cycle is conducted.

Moreover, according to Churchill, Kwaningc and Ababio (2014), the research showed that there is an impact on interest rate when inflation as a rise in general prices and services on the economy. When inflation happened in a country, consumers will buy less on goods and services where lead to less purchasing power of consumers. In this fact, the real value of foreign exchange rate will also be affected in the economy as consumers tend to spend fewer at each unit of currency. Therefore, the government tends to decrease the interest rate to spend more on purchasing goods and services rather than putting money in the bank when there is inflation. In short, the research found that inflation and interest rate is negatively related.
5.2.2 Gross Domestic Product (GDP)

GDP represents one of the main characters that affect the movements of interest rate in a country. Based on the results of our study, GDP growth rate (independent variable) and interest rate (dependent variable) shares a negative relationship in which when the GDP growth of a country increases, the interest rate of that country will decrease, vice versa. Supporting the results of our study are Engen and Hubbard (2004), whose study are based on the debt-to-GDP and its effect on interest rates. According to their study, by deriving the effect of government debt on the interest rate of the country, they concluded that an increase in debt by 100 basis point of GDP will most probably increase the real interest rate by 2 to 3 basis point. From the results of their study, we are able to understand that when the debt of the country relative to its GDP is higher, and the interest rate increases, means that the a lower GDP growth will results in a higher interest rate, thus supporting our results of a negative relationship between the two variable. Based on Engen and Hubbard (2004), by using Cobb-Douglas production function, their results show that a government surplus of 1% of GDP will expectedly decrease the interest rate by 2.4 basis points. While debt-to-GDP ratio measures the efficiency of the country’s production and sales of goods and services to repay their debts, a high ratio will indicate that the country will require a higher debt to finance its old debts. Therefore when the GDP growth of a country is high, the debt-to-GDP ratio will decrease and thus leading to a decrease in interest rate.

However, in the study done by Azzam and Mimouni, which focuses on GDP growth and microcredit interest rates, argues that both this variable shares a positive relationship. This is explained as when the growth of GDP which measures overall progress of a country is increasing, micro-enterprise may have increased returns and will demand microcredit to further expand their business and thus causing microfinance institutions (MFI) to charge higher interest rates. At the same time, they also argued that a higher GDP growth leads to higher income level of households, which will then reduce the demand for microcredit hence decreasing the interest rate. As a result from
their study, they concluded that the impact of GDP growth appears to be insignificant towards interest rate.

5.2.3 Exchange Rate

Exchange rate have serve as an important character in the study which affecting the interest rate of developed countries. When exchange rate increase, the interest rate will decrease, holding other variables constant. This result shows that there is a negative relationship between exchange rate and interest rate on developed countries. This statement can be supported based on previous researcher investigation. According to previous research, this output is similar with the Andrieş et al. (2017), they had proved that the relationship is negative when in the short-term period by using confirming the sticky-price model.

Besides, Hacker, Karlsson and Mansson (2014) study also mention that the exchange rate is negatively and significantly affects the interest rate on developed countries. The result proved negative by using causality test with wavelet filtered data to study the time varying relation. After they run all the data, the investigation more frequently shows negative impact to the interest rate at the lower wavelet scale. Moreover, they proved it based on the sign of impulse responses corresponding to the exchange rate and interest rate as the negative relationship can be observed more frequently compare to positive relationship based on the study run by Hacker et al. (2014).

Other than that, Saraç and Karagöz (2016) study the impact on short term interest rate on exchange rate for determining the efficient level of short term interest rate on exchange rate. By using Granger causality test, the research shows that no evidence that lower exchange rate will affected by higher interest rate. As the central bank proved that there is no guarantee that the exchange rate will increase when interest rate was reduced (Karaca, 2005).
However, some researcher proved that higher interest rate will lead to a higher exchange rate. Based on Basurto and Ghosh (2011), their research show that the relationship between higher interest rate lead to higher exchange rate can been see due to higher interest rate in the country had attract a lot of new investor from foreign country and invest in the country. Therefore, it creates a demand on the country currency and lead to increase in that country’s exchange rate as demand more than supply theory. This shown direct relationship between interest rate and exchange rate by the favorable movement of investor on cash inflow on the country currency. Conversely, when interest rate decrease on the country, it lead to the investor will make cash outflow and put their money into higher interest rate country and cause the country currency depreciated due to the interest rate no longer attract the investor’s demand.

5.2.4 Money Supply

In this research, money supply is one of the independent variables and it is also one of the important variables because it effecting interest rates direct and indirectly. This is also stated in the study of Thornton (2008) stated that interest rate is expecting to change when the level of Money Supply (MS) is changed. The money supply can control an economy short term interest rates easily as when money supply have increase drastically, it will caused interest rates decrease.

In this study, it shown how the Interest rate(IR) which is dependent variable affected by the independent variable Money Supply(MS). The dependent (IR) and independent (MS) variable have a positive relationship which is found out by the methodology and test running part. When it shows positive relationship which means that when the money supply is increasing will cause interest rate to increase, vice versa. The positive relationship of IR and MS is also proven by others previous studies. According to Schabert (2009) study, stated that when the level of MS is increase, generally it will come with a higher nominal interest. Because of the MS increase, meaning that the resident holding more money in hand and have higher purchasing power. When the
amount of money in the market is too much and that causing high inflation rate, central bank will increase the interest rates of borrowings and savings to reduce the amount of money in the market.

In other hand, there is also some of the previous studies show different result from this study. In the Wuyah & Amwe (2016) research stated that the OLS result shown MS and IR have negative relationship. Mean that when the level of MS in the economy is decreasing, the IR of the economy will increase, vice versa. So the result in Wuyah & Amwe (2016) different from this study because the result of this study is positive relationship but Wuyah & Amwe (2016) study was negative relationship. While in the study of Wuyah & Amwe (2016) also explaining that although increase in the level of MS will cause the interest rate decrease but the investment level will increase so the country economy growth will be boosted up.

5.3 Implication of the Study

5.3.1 Managerial Implications

Policymakers such as the government can make use of the research to better handle the interest rate of the country. Since they have access to the four major determinants studied, they can stabilize the growth of the economy as well as improving the lives of the residents. Besides that, they can easily control the interest rate in their favor to either fluctuate the value of the country’s currency or to control the money supply level of the country. Meanwhile, market investors can gain knowledge on the interest rate will be affected by the four major variables. By observing the exchange rate (EXCHANGE), when exchange rate (EXCHANGE) goes down, the interest rate (IR) might be going up. Thus, investor might able to take this advantage in the countries with when their currency goes down, the countries interest rate (IR) might go up, so market investor has opportunity to move their investment to the high interest rate countries which
generate higher profit or capital gain to them. Besides, inflation rate (INFLATION) for a country consider as one of the big impact to the investor as in high inflation rate (INFLATION) cause a low interest rate (IR) in a country. This indicate that the market investor will not interest on invest in the countries when the countries inflation rate (INFLATION) is high. This is because when the inflation rate (INFLATION) is high, consumer must pay higher price to the product and lower their purchasing power and cause them to have low cash in hand. Therefore, the interest rate (IR) is low as the inflation rate (INFLATION) it high act as an indicator to the market investor in performing their portfolio selection. Meanwhile, Gross Domestic Product growth (GDP) have an inverse relationship with interest rate (IR) as GDP also serve as an indicator to judge the movement of interest rate (IR) of the country. The result shows that GDP have a negative relationship with IR. Therefore, market investor can look on the country GDP to decide whether the IR of the countries will go up or go down. Furthermore, market investor can consider the money supply of the counties and determine the money circulation on their country. So, they can know more detail about the money supply that affecting the interest rate in the country.

5.4 Limitation of the Study

Limitation represents a barrier that constricts us to further analyze on this study and also a contribution for future improvement. Based on our previous study, one of the limitations is scarce of data required for analysis. During the process of data searching, a number of developing countries’ data was unattainable from databases such as World Bank. For instance, Denmark and Belgium which are both developed country has limited data insufficient enough for us to carry out analysis. Hence, the study excluded many developed countries which can contribute to a larger number of samples for research purposes.
Besides, our research only study on developed countries which had excluded developing countries, therefore this may cause limited knowledge gain and possible outcome. Moreover, we only used 11 developed countries as our data due to other countries data is not easily to find and tally with our researcher data year from 2007 to 2016. More than that, our research only to find data until most recent 2016 as some countries for 2017 data is not complete or cannot be found on World Bank or Bloomberg. Therefore, the study only can update until 2016 data and it is more worth to carried out for factors affecting Interest Rate like exchange rate, inflation, money supply and GDP when including developing countries or worldwide. Thus, our research encourages future researcher to explore on developing countries by using different kind of test and data.

On the other hand, another limitation faced throughout the study is that the information to support our findings is insufficient as there are limited number of research that have been done related to the topic’s variables. For example, research on the determinants affecting interest rate are very limited as more research are done using interest rate as an independent variable instead of the dependent variable as our main focus of the study is to deeper understand interest rate as a whole.
5.5 Recommendation for Future Research

As a recommendation for the problem of limited and insufficient data, World Bank can put more effort on collecting the missing piece of developed, developing and third world country data, so that researcher can more full sample data to run their research and come out with more accurate result. Besides of this, World Bank can also open a sub-website that only authorize for student to access to their database. Some of the student research may be not that accurate because of the missing and unattainable data.

We are suggested to encourage more research studies to be carried out related to the topic’s variables to resolve the problem of limitation in research projects. From our studies, we found that most of the research project is more related on interest rate as an independent variable that influenced to other dependent variables. Interest rate is a powerful factor that influence the entire economy, government is advised to publicize the importance of interest rates and encourage more citizens understands deeply about interest rate.

5.6 Conclusion

This research purpose is to determine whether strong, weak or no connection between Interest Rate and its determinants such as Inflation Rate, GDP Growth Rate, Exchange Rate and Money Supply in Developed Countries. Since this research is about 11 developed countries with years between 2007 and 2016, so we using as panel data regression models and found that Fixed Effect Model is more suitable on this research. So we consider that all determinants are significance affecting to the Interest Rate in Developed Countries.

REFERENCES
Unraveling The Determinants Influencing Interest Rate In Developed Countries


Unraveling The Determinants Influencing Interest Rate In Developed Countries


APPENDIX
## Appendix 1.1: Descriptive Analysis

<table>
<thead>
<tr>
<th></th>
<th>IR</th>
<th>INFLATION</th>
<th>GDP</th>
<th>EXCHANGE</th>
<th>MS</th>
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<td>2.094334</td>
<td>2.126515</td>
<td>4.398360</td>
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<td>Median</td>
<td>3.480503</td>
<td>1.756624</td>
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<td>1.419947</td>
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<tr>
<td>Maximum</td>
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<td>20.18051</td>
<td>15.24038</td>
<td>24.59875</td>
<td>33.83388</td>
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<td>Minimum</td>
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<td>-22.09142</td>
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<td>0.499772</td>
<td>-9.157527</td>
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<tr>
<td>Std. Dev.</td>
<td>5.394634</td>
<td>4.801012</td>
<td>3.390328</td>
<td>5.861454</td>
<td>5.601447</td>
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<td>Skewness</td>
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<td></td>
<td>230.3767</td>
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## Appendix 1.2: Correlation Analysis

<table>
<thead>
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<th>EXCHANGE</th>
<th>MS</th>
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<tbody>
<tr>
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<tr>
<td>INFLATION</td>
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<td>0.22844969...</td>
<td>0.0236854...</td>
<td>0.33013452...</td>
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<td>0.22844969...</td>
<td>1</td>
<td>-0.0691689...</td>
<td>0.50523727...</td>
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<td>0.50523727...</td>
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<td>1</td>
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</table>
Dependent Variable: IR
Method: Panel Least Squares
Date: 01/27/18   Time: 23:29
Sample: 2007 2016
Periods included: 10
Cross-sections included: 11
Total panel (unbalanced) observations: 101

<table>
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<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
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<td>GDP</td>
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<td>4.098054</td>
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</tr>
</tbody>
</table>

R-squared       0.720013         Mean dependent var  4.257881
Adjusted R-squared 0.708347         S.D. dependent var       5.555601
S.E. of regression 3.00297         Akaike info criterion  5.083537
Sum squared resid 864.1708         Schwarz criterion       5.212998
Log likelihood    -251.7186        Hannan-Quinn criter.  5.135947
F-statistic       61.71833        Durbin-Watson stat  0.514091
Prob(F-statistic) 0.000000

Appendix 1.3: Pooled OLS Model

Dependent Variable: IR
Method: Panel Least Squares
Date: 01/27/18   Time: 23:31
Sample: 2007 2016
Periods included: 10
Cross-sections included: 11
Total panel (unbalanced) observations: 101

<table>
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<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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<tbody>
<tr>
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</table>

Effects Specification

Cross-section fixed (dummy variables)

R-squared       0.909562         Mean dependent var  4.257881
Adjusted R-squared 0.894840         S.D. dependent var       5.555601
S.E. of regression 1.801596        Akaike info criterion  4.151479
Sum squared resid 279.1342         Schwarz criterion       4.539863
Log likelihood    -194.6497        Hannan-Quinn criter.  4.308708
F-statistic       61.78054        Durbin-Watson stat  0.925193

Appendix 1.4: Fixed Effect Model
Appendix 1.5: Random Effect Model

Dependent Variable: IR
Method: Panel EGLS (Cross-section random effects)
Date: 01/27/18   Time: 23:31
Sample: 2007 2016
Periods included: 10
Cross-sections included: 11
Total panel (unbalanced) observations: 101
Swamy and Arora estimator of component variances

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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<tbody>
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Effects Specification

<table>
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<th>Rho</th>
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<tr>
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<tr>
<td>Idiosyncratic random</td>
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</table>

Weighted Statistics

R-squared: 0.871065
Adjusted R-squared: 0.865692
S.E. of regression: 1.895135
F-statistic: 162.1400
Prob(F-statistic): 0.000000

Unweighted Statistics

R-squared: 0.701479
Sum squared resid: 921.3768
Unraveling The Determinants Influencing Interest Rate In Developed Countries

Redundant Fixed Effects Tests
Equation: FEM
Test cross-section fixed effects

<table>
<thead>
<tr>
<th>Effects Test</th>
<th>Statistic</th>
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<tbody>
<tr>
<td>Cross-section F</td>
<td>18.024714</td>
<td>(10,86)</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cross-section Chi-square</td>
<td>114.137846</td>
<td>10</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Cross-section fixed effects test equation:
Dependent Variable: IR
Method: Panel Least Squares
Date: 01/27/18   Time: 23:34
Sample: 2007 2016
Periods included: 10
Cross-sections included: 11
Total panel (unbalanced) observations: 101

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.935124</td>
<td>0.552467</td>
<td>8.932877</td>
<td>0.0000</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-0.964288</td>
<td>0.063895</td>
<td>-15.09185</td>
<td>0.0000</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.265771</td>
<td>0.100263</td>
<td>-2.650747</td>
<td>0.0094</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>-0.012461</td>
<td>0.050904</td>
<td>-0.244802</td>
<td>0.8071</td>
</tr>
<tr>
<td>MS</td>
<td>0.261936</td>
<td>0.063917</td>
<td>4.098054</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

R-squared 0.720013  Mean dependent var 4.257881
Adjusted R-squared 0.708347  S.D. dependent var 5.555601
S.E. of regression 3.000297  Akaike info criterion 5.083537
Sum squared resid 864.1708  Schwarz criterion 5.212998
Log likelihood -251.7186  Hannan-Quinn criter. 5.135947
F-statistic 61.71833  Durbin-Watson stat 0.514091
Prob(F-statistic) 0.000000

Appendix 1.6: Poolability F-Test

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

<table>
<thead>
<tr>
<th>Test Hypothesis</th>
<th>Cross-section</th>
<th>Time</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breusch-Pagan</td>
<td>126.3736</td>
<td>1.807058</td>
<td>128.1806</td>
</tr>
<tr>
<td>Honda</td>
<td>11.24160</td>
<td>-1.344268</td>
<td>6.998470</td>
</tr>
<tr>
<td>King-Wu</td>
<td>11.24160</td>
<td>-1.344268</td>
<td>6.827943</td>
</tr>
<tr>
<td>Standardized Honda</td>
<td>12.94666</td>
<td>-1.123894</td>
<td>4.778538</td>
</tr>
<tr>
<td>Standardized King-Wu</td>
<td>12.94666</td>
<td>-1.123894</td>
<td>4.581964</td>
</tr>
<tr>
<td>Gourieroux, et al.*</td>
<td>--</td>
<td>--</td>
<td>126.3736</td>
</tr>
</tbody>
</table>

Appendix 1.7: Breusch-Pagan Lagrange Multiplier Test
Appendix 1.8: Hausman Test

Cross-section random effects test comparisons:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Fixed</th>
<th>Random</th>
<th>Var(Diff.)</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFLATION</td>
<td>-1.041345</td>
<td>-1.026722</td>
<td>0.000037</td>
<td>0.0167</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.157392</td>
<td>-0.187616</td>
<td>0.000187</td>
<td>0.0272</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>-0.518892</td>
<td>-0.072618</td>
<td>0.043867</td>
<td>0.0331</td>
</tr>
<tr>
<td>MS</td>
<td>0.138683</td>
<td>0.155523</td>
<td>0.000033</td>
<td>0.0032</td>
</tr>
</tbody>
</table>

Cross-section random effects test equation:
Dependent Variable: IR
Method: Panel Least Squares
Date: 01/27/18   Time: 23:33
Sample: 2007 2016
Periods included: 10
Cross-sections included: 11
Total panel (unbalanced) observations: 101

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>8.055931</td>
<td>1.102991</td>
<td>7.303717</td>
<td>0.0000</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-1.041345</td>
<td>0.041037</td>
<td>-25.37582</td>
<td>0.0000</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.157392</td>
<td>0.066875</td>
<td>-2.353531</td>
<td>0.0209</td>
</tr>
<tr>
<td>EXCHANGE</td>
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<td>0.230955</td>
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<td>MS</td>
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<td>0.040833</td>
<td>3.396383</td>
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</tr>
</tbody>
</table>

Effects Specification

Cross-section fixed (dummy variables)

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-squared</td>
<td>0.909562</td>
<td>Mean dependent var</td>
<td>4.257881</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.894840</td>
<td>S.D. dependent var</td>
<td>5.555601</td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>1.801596</td>
<td>Akaike info criterion</td>
<td>4.151479</td>
<td></td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>279.1342</td>
<td>Schwarz criterion</td>
<td>4.539863</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-194.6497</td>
<td>Hannan-Quinn criter.</td>
<td>4.308708</td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>61.78054</td>
<td>Durbin-Watson stat</td>
<td>0.925193</td>
<td></td>
</tr>
<tr>
<td>Prob(F-statistic)</td>
<td>0.000000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix 1.8: Hausman Test
Appendix 1.9: Pooled OLS Model (R^2 of IR for Multicollinearity)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.935124</td>
<td>0.552467</td>
<td>8.932877</td>
<td>0.0000</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-0.964288</td>
<td>0.063895</td>
<td>-15.09185</td>
<td>0.0000</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.265771</td>
<td>0.100263</td>
<td>-2.650747</td>
<td>0.0094</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>-0.012461</td>
<td>0.050904</td>
<td>-0.244802</td>
<td>0.8071</td>
</tr>
<tr>
<td>MS</td>
<td>0.261936</td>
<td>0.063917</td>
<td>4.098054</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

R-squared: 0.720013  Mean dependent var: 4.257881
Adjusted R-squared: 0.708347  S.D. dependent var: 5.555601
S.E. of regression: 3.000297  Akaike info criterion: 5.083537
Sum squared resid: 864.1708  Schwarz criterion: 5.212998
Log likelihood: -251.7186  Hannan-Quinn criter.: 5.135947
F-statistic: 61.71833  Durbin-Watson stat: 0.514091
Prob(F-statistic): 0.000000

Appendix 1.10: Pooled OLS Model (R^2 of INFLATION for Multicollinearity)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3.529461</td>
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</tr>
<tr>
<td>IR</td>
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<td>0.048340</td>
<td>-15.09185</td>
<td>0.0000</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.157618</td>
<td>0.088900</td>
<td>-1.772973</td>
<td>0.0794</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>0.002481</td>
<td>0.044289</td>
<td>0.056017</td>
<td>0.9554</td>
</tr>
<tr>
<td>MS</td>
<td>0.267302</td>
<td>0.053734</td>
<td>4.974589</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared: 0.737948  Mean dependent var: 2.071421
Adjusted R-squared: 0.708347  S.D. dependent var: 4.994911
S.E. of regression: 2.609671  Akaike info criterion: 4.804563
Sum squared resid: 653.7970  Schwarz criterion: 4.934025
Log likelihood: -237.6304  Hannan-Quinn criter.: 4.856973
F-statistic: 67.58489  Durbin-Watson stat: 0.549488
Prob(F-statistic): 0.000000
Appendix 1.11: Pooled OLS Model (R² of GDP for Multicollinearity)

Dependent Variable: GDP
Method: Panel Least Squares
Date: 02/25/18   Time: 21:18
Sample: 2007 2016
Periods included: 10
Cross-sections included: 11
Total panel (unbalanced) observations: 101

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.160676</td>
<td>0.725006</td>
<td>1.600918</td>
<td>0.1127</td>
</tr>
<tr>
<td>IR</td>
<td>-0.256614</td>
<td>0.096808</td>
<td>-2.650747</td>
<td>0.0094</td>
</tr>
<tr>
<td>INFLATION</td>
<td>-0.201157</td>
<td>0.113458</td>
<td>-1.772973</td>
<td>0.0794</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>-0.026947</td>
<td>0.049959</td>
<td>-0.539381</td>
<td>0.5909</td>
</tr>
<tr>
<td>MS</td>
<td>0.343372</td>
<td>0.058366</td>
<td>5.883109</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared 0.311770
Mean dependent var 2.047654
Adjusted R-squared 0.283094
S.D. dependent var 3.481930
S.E. of regression 2.948161
Akaike info criterion 5.048478
Schwarz criterion 5.177939
Log likelihood -249.9481
Hannan-Quinn criter. 5.100888
F-statistic 10.87207
Durbin-Watson stat 1.927400
Prob(F-statistic) 0.000000

Appendix 1.12: Pooled OLS Model (R² of EXHCANGE for Multicollinearity)

Dependent Variable: EXCHANGE
Method: Panel Least Squares
Date: 02/25/18   Time: 21:19
Sample: 2007 2016
Periods included: 10
Cross-sections included: 11
Total panel (unbalanced) observations: 101

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>5.168468</td>
<td>1.402581</td>
<td>3.684969</td>
<td>0.0004</td>
</tr>
<tr>
<td>IR</td>
<td>-0.050064</td>
<td>0.204507</td>
<td>-0.244802</td>
<td>0.8071</td>
</tr>
<tr>
<td>INFLATION</td>
<td>0.013174</td>
<td>0.235188</td>
<td>0.056017</td>
<td>0.9554</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.112123</td>
<td>0.207874</td>
<td>-0.539381</td>
<td>0.5909</td>
</tr>
<tr>
<td>MS</td>
<td>-0.034375</td>
<td>0.138825</td>
<td>-0.247614</td>
<td>0.8050</td>
</tr>
</tbody>
</table>

R-squared 0.008471
Mean dependent var 4.500967
Adjusted R-squared -0.032842
S.D. dependent var 5.917351
S.E. of regression 6.013736
Akaike info criterion 6.474207
Schwarz criterion 6.603668
Hannan-Quinn criter. 6.526617
Durbin-Watson stat 0.026350
Prob(F-statistic) 0.935043
Unraveling The Determinants Influencing Interest Rate In Developed Countries

Dependent Variable: MS
Method: Panel Least Squares
Date: 02/25/18   Time: 21:20
Sample: 2007 2016
Periods included: 10
Cross-sections included: 11
Total panel (unbalanced) observations: 101

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.826761</td>
<td>1.085427</td>
<td>1.682989</td>
<td>0.0956</td>
</tr>
<tr>
<td>IR</td>
<td>0.568425</td>
<td>0.138706</td>
<td>4.098054</td>
<td>0.0001</td>
</tr>
<tr>
<td>INFLATION</td>
<td>0.766720</td>
<td>0.154127</td>
<td>4.974589</td>
<td>0.0000</td>
</tr>
<tr>
<td>GDP</td>
<td>0.771736</td>
<td>0.131178</td>
<td>5.883109</td>
<td>0.0000</td>
</tr>
<tr>
<td>EXCHANGE</td>
<td>-0.018568</td>
<td>0.074987</td>
<td>-0.247614</td>
<td>0.8050</td>
</tr>
</tbody>
</table>

R-squared  0.408396  Mean dependent var  7.331925
Adjusted R-squared  0.383746  S.D. dependent var  5.630190
S.E. of regression  4.419804  Akaike info criterion  5.858305
Sum squared resid   1875.328  Schwarz criterion  5.987767
Log likelihood     -290.8444  Hannan-Quinn criter.  5.910715
F-statistic        16.56767  Durbin-Watson stat  1.398031
Prob(F-statistic)  0.000000

Appendix 1.13: Pooled OLS Model (R² of MS for Multicollinearity)