

DETERMINANTS OF HOUSING PRICE IN
MALAYSIA

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DECLARATION

We hereby declare that:

- (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 paper research project has been submitted in support of any application for any other degree of 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.
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LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
ARCH	Autoregressive Conditional Heteroscedasticity
ARDL	Autoregressive Distributed Lag Model
BLR	Base Lending Rate
BLUE	Best Linear Unbiased Estimators
BNM	Bank Negara Malaysia
BTS	Build then Sell
CIA	Central Intelligence Agency
CNLRM	Classical Normal Linear Regression Model
DV	Dependent Variable
ER	Exchange Rate
ETP	Economic Transformation Programme
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GST	Goods and Services Tax
HPI	Housing Price Index
IV	Independent Variable
KLCI	Kuala Lumpur Composite Index
LR	Lending Rate
MHLG	Ministry of Housing and Local Government
MHPI	Malaysia Housing Price Index
NAPIC	National Property Information Centre
OLS	Ordinary Least Square
PG	Population Growth
PIR	Price-Income-Ratio
PPP	Purchasing Power Parity
RESET	Ramsey Regression Equation Specification Error Test

RPGT	Real Property Gains Tax
RGDP	Real Gross Domestic Product
SE	Standard Error
STB	Sell Then Build
TOL	Tolerance
UR	Unemployment Rate
UTAR	Universiti Tunku Abdul Rahman
VIF	Variance Inflation Factor
VPSD	Valuation and Property Services Department

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PREFACE

In Malaysia, housing activities are vital in macro-economic policy to adjust cyclical movements and maintain economic growth. Hence, the study on the determinants of housing price has been popular over the years. The determinants of housing prices such as unemployment rate, lending rate, population growth and exchange rate influences the housing price.

This study is conducted based on the guidelines that consists of 3 main sections:

First section: Preliminary pages that include copyright pages, declaration, acknowledgement, contents page, list of tables, list of figures, list of abbreviation, list of appendix, preface and abstract.

Second section: The body (content) of the research

Chapter 1: Research Overview

Chapter 2: Literature Review

Chapter 3: Methodology

Chapter 4: Data Analysis

Chapter 5: Discussions, Conclusion and Implications

Third section: The end materials consist of references and appendixes

Fulfilling the above criteria completes this research study. This study provides various types of information about housing sector in Malaysia which will be useful for future researchers.

ABSTRACT

This study aims to examine the determinants of Housing Price in Malaysia from 2007 until 2014. The continuous increase of housing price in Malaysia is becoming one of the hot issues discussed these days. Thus, this study would like to investigate the significant relationship among the housing price and macroeconomics variables that affect the housing prices. The macroeconomics variables chosen are unemployment rate, lending rate, population growth and exchange rate in Malaysia. Ordinary Least Square (OLS) method is implemented to this study. This study will be done based on quarterly time series data over the period from 2007 Quarter 1 until 2014 Quarter 4 with 32 observations. The findings benefit various parties such as investors, policy makers, housing developers, speculators and home buyers. The results concluded that lending rate and population growth have the major effects in determining the housing price.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

In this particular study, Malaysia's housing price situation will be discussed in the first chapter. It is vital to study the background as it enhances the understanding of determinants such as exchange rate, lending rate, unemployment rate, and population growth in affecting the Malaysia Housing Price Index (MHPI). Malaysia Housing Price Index (MHPI) is important in the perspective of households, investors and policy makers. This is because an increase or decrease of MHPI can affect the efficiency and effectiveness of the economy in Malaysia, decision making of investors and wealth of households. Therefore, to enhance the forecasting skills in the housing market, a deeper understanding on the relationship between the MHPI and its determinants would be useful. This study aims to explore the quarterly performance of MHPI that influenced by the determinants of exchange rate, lending rate, unemployment rate and population growth from 2007 Quarter 1 until 2014 Quarter 4. Next, this chapter will continue with problem statement which provides readers an in-depth understanding of this study, followed by research questions and objectives of this study. The hypothesis and significance of study along with the chapter layout will be outlined briefly and conclusion will be presented.

1.1 Research Background

1.1.1 Research Background of Malaysia

According to The World Factbook by Central Intelligence Agency, CIA (2015), Malaysia has become an emerging multi-sector economy from a producer of raw materials in 1970s. The Malaysian government strives to accomplish the high-income status by year 2020. Exports of products such as oil and gas, palm oil, electronics and rubber are crucial to the economy of Malaysia as more than 80% of the country's GDP is made up by the gross exports of goods and services. As an oil and gas exporter, Malaysia's government revenue was contributed by around 29% from this sector in year 2014. However, the continuous budget deficits have induced the government to reduce the energy and sugar subsidies as well as imposed the implementation of the 6% goods and services tax (GST).

According to Malaysian Investment Development Authority (2015), Malaysia's economy is considered highly competitive as it was ranked 12th among 60 economies in the World Competitiveness Ranking 2014 released by the Switzerland-based IMD World Competitiveness Centre. Among countries in Asia, Malaysia is ranked third after Singapore and Hong Kong, and ahead of developed economies like Taiwan, Japan, South Korea, China and India. This is due to the higher degree of improved openness to foreign markets by Malaysia.

1.1.2 Research Background of Housing Market in Malaysia

In year 2012, the Malaysia's housing market was ranked 9th in the list of "The World's Hottest Real Estate Markets" by Knight Frank, which is real estate consultancy (Rajeshni, 2012). This is achieved by the rapid increase in overall property prices, openness to foreign investment and future growth potentials of the housing market.

In Malaysia, housing activities are very important in macro-economic policy to adjust cyclical movements as well as maintain economy growth. Housing activities have a great impact on economy as other activities such as furnishing, decoration, renovation, repairs, home appliances, or landscaping continue after the sales of house are closed (Tan, 2010). Le (2015) added that the changes in housing price affects the household wealth effects significantly as the portion of wealth spent by most of the households' is the largest for housing.

According to the statistics by the National Property Information Centre, NAPIC (2015), Malaysian housing market in 2014 consists of 72.7% of terraced house, 10.9% of high-rise residential property, 5.5% of detached house and 10.9% of semi-detached house. Terraced houses are the houses that share a wall with the other houses on both sides. Some of the terraced houses can consist up to three floors. High-rise residential properties in Malaysia consist of apartments and condominiums and are available in major towns and cities where the land is limited. Detached house is more common in Malaysia as bungalow or stand-alone house on its own land and it can be any size depends on the land area. Semi-detached house is different from terraced house as it is only joined to another house on one side.

However, this study will be based on the data of total Malaysian housing market. The research background of Malaysian housing price can be found in the following section of 1.1.4.1 below.

1.1.3 Research Background of Financial Crisis

United States had the sub-prime crisis in late 2007 that triggered the global financial crisis was mostly caused by the financial deregulation in mortgage markets that eased the household borrowings which started in the 1980s. The rapid increase in mortgage credit led the house prices in United States to increase (Hashim, 2010). The global financial crisis then happened due to the burst of property bubble from the subsequent collapse in local housing prices in the United States. This also proved that fluctuations in housing prices can significantly affect the regional economic activity (Lean, 2013).

Therefore, investors and policymakers in Malaysia should monitor the housing prices from time to time in order to identify structural changes and economic fluctuations. This study could help to detect if there is any formation of similar property bubble and thus prevent another similar financial crisis to happen.

1.1.4 Research Background of Factors of Housing Prices Changes in Malaysia

1.1.4.1 Trend of Housing Price in Malaysia

Figure 1.1: Malaysia Housing Price Index Changes from year 1999-2014 (2000=100), Source from Datastream - National Property Information Centre (NAPIC).

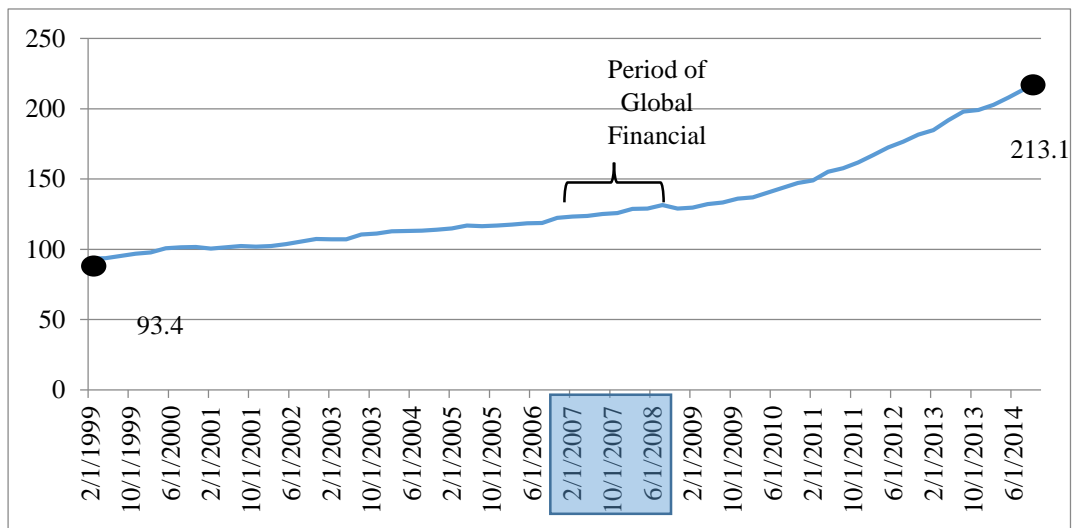
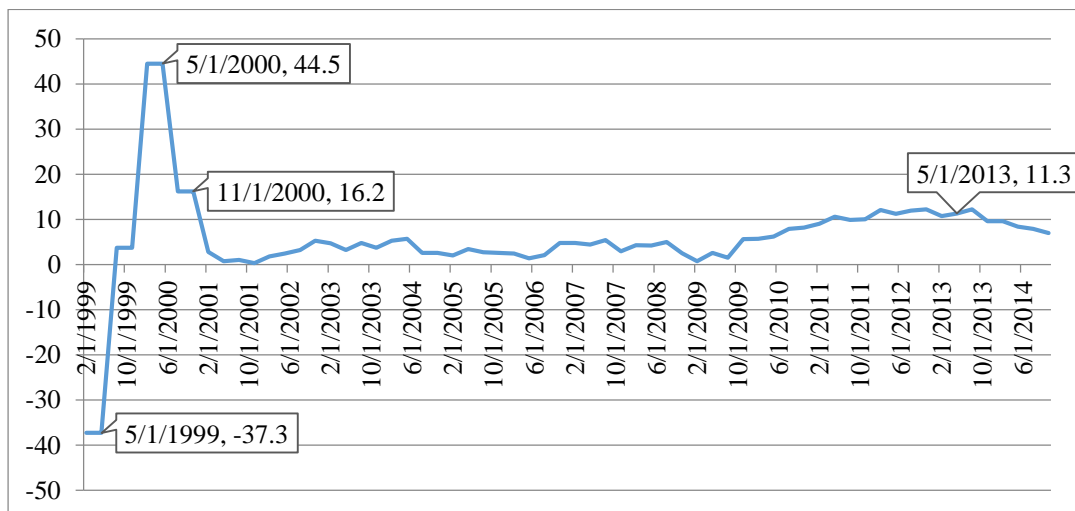


Figure 1.2: Malaysia Housing Price Index Changes from year 1999-2014 (%), Source from Datastream - National Property Information Centre (NAPIC).



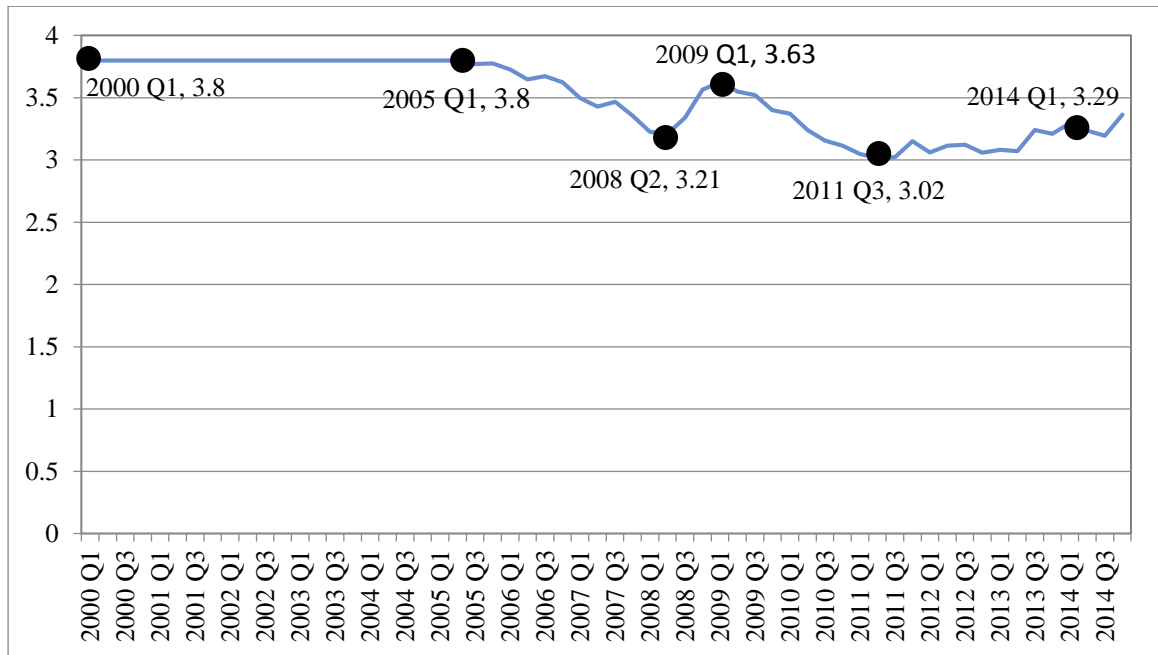
Rapid economic development in Malaysia during the recent years has led the demand of residential housing especially among urban areas to increase (Ong, 2013). The housing prices in Malaysia have gone through drastic price appreciation from index of 93.4 in year 1999 to 213.1 in year 2014 as shown by Figure 1.1. According to the statistic done by NAPIC, the housing price in Malaysia as shown by the Malaysian housing price index had increased steadily since year 1999 and the housing price index doubles when it reached year 2014. The positive housing price index changes from year 1999 to year 2014 also indicate that the housing prices were keep growing. The housing price index has the biggest changes between -37.3% in year 1999 and 44.5% increase year 2000. Then, the index dropped to an average of 5% increase yearly from year 2001 to year 2010. The index reached another high positive change of 11.3% increase in year 2013.

The global financial crisis occurred in year 2007 and 2008 seems to have little impact on the housing market in Malaysia as the housing price still having positive growth. The growth of the housing price slowed down after second quarter of year 2008 but recovered after the third quarter of year 2009.

The continuous increase of housing prices has led to investors' uncertainty on the future of Malaysia' housing prices and whether it will lead Malaysia to another housing bubble. A research done by Matt (2015) also showed that many residential property markets in Asia including Malaysia are following the same tracks of US housing bubble. With the changes in Real Property Gains Tax (RPGT) and implementation of Goods and Services Tax (GST) recently, the housing market activities are expected to cool down (Nadaraj, 2015).

1.1.4.2 Trend of Exchange Rate in Malaysia (Ringgit to 1 US Dollar)

Figure 1.3: Malaysia Exchange Rate (Ringgit to US Dollar) from year 2000 – 2014, Adapted from: Datastream – Bank Negara Malaysia (BNM).



This study measure the Malaysia currency exchange rate with the amount of Malaysian Ringgit to 1 US Dollar. According to the statistic done by Bank Negara Malaysia (BNM), Figure 1.3 showed that the Malaysia currency exchange rate remained constant at RM 3.80 / USD from year 2000 to year 2005. The Malaysian Ringgit strengthens as the exchange rate dropped to RM 3.20 / USD in year 2008 but fall to RM 3.63 / USD in year 2009. After year 2009, the Malaysia exchange rate fluctuated around RM 3.29 / USD and reached the lowest of RM 3.02 in year 2011.

In China, China’s competitiveness has been improved by the booms of international trade and foreign direct investment (FDI). This successfully attracts FDI flows into China and this will influence the exchange rate. The fluctuations of exchange rate

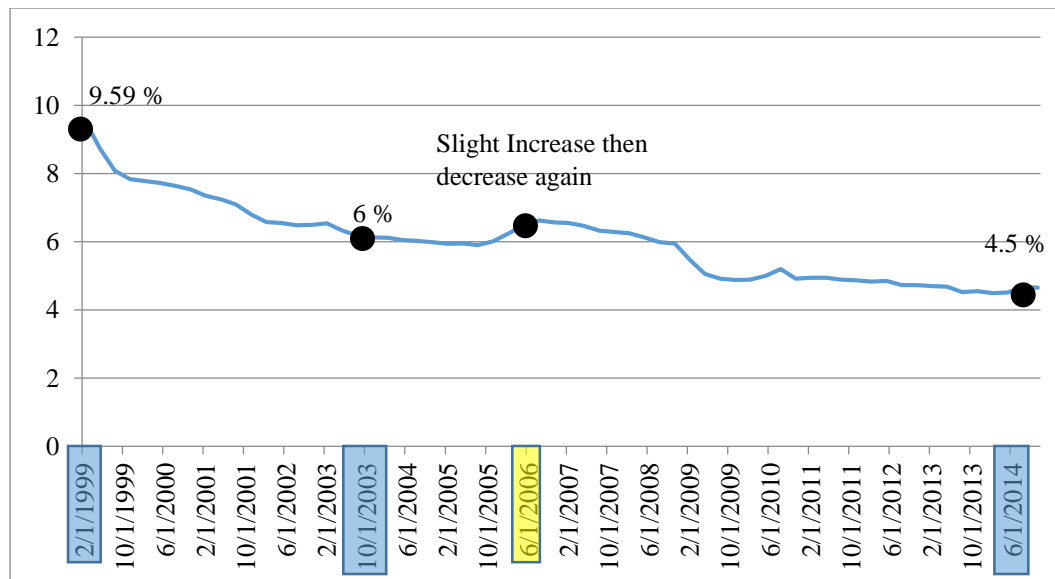
of RMB appreciation can influence house price changes through international reserve and credit expansion (Zhang, Hua, & Zhao, 2012).

Glindro, Subhanij, Szeto and Zhu (2011) stated that foreign investment plays an important role in the economy of Malaysia. An exchange rate appreciation is likely to be linked with housing booms.

There are rare studies about the relationship of exchange rate of RM to other currencies with the housing price in Malaysia.

1.1.4.3 Trend of Lending Rate in Malaysia

Figure 1.4: Malaysia Lending Rate from year 1999 – 2014 (%), Adapted from: Datastream – Bank Negara Malaysia (BNM).



Housing market is strongly influenced by the credit markets because most people do not have sufficient cash to purchase a house and credit purchases are done often

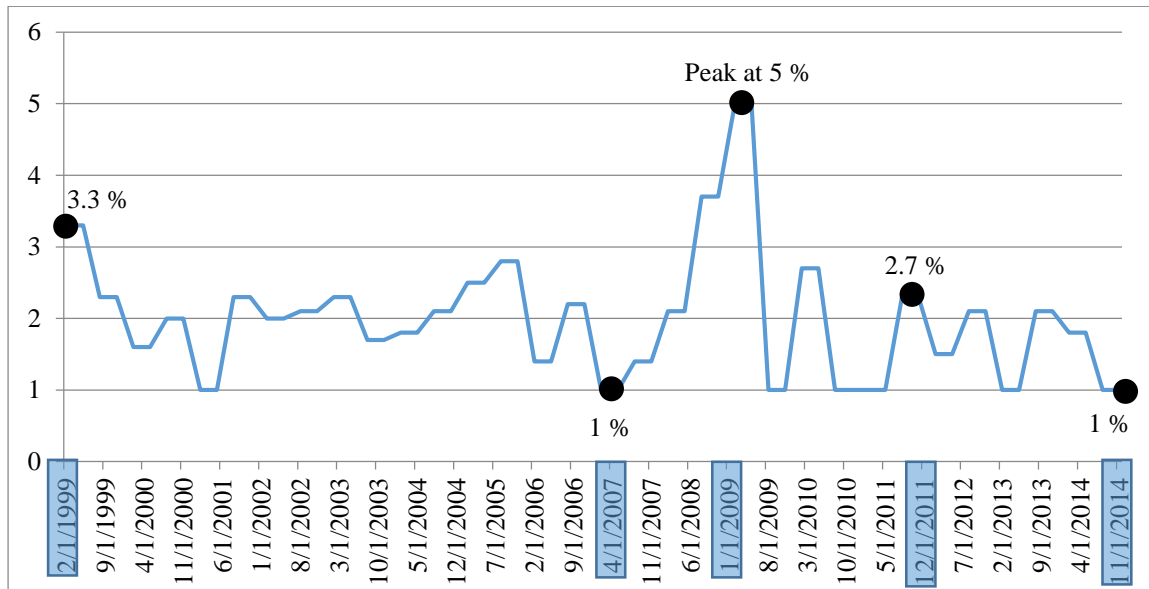
(Wachter, 2014). Average lending rate which can be also known as the interest rate refers to the weighted average lending rates on loans set by central bank, merchant banks, commercial banks, and finance companies.

According to the statistic done by Bank Negara Malaysia (BNM) in Figure 1.4, this study can observe that the lending rate in Malaysia decreased drastically from 9.59% in year 1999 to an average of 6% in year 2003 and remained constant between year 2003 to year 2005. The sharp decrease in lending rates was caused by the mortgage loan wars between the commercial banks (Tan, 2010). There was a slight increase of lending rate in year 2006. However, it continued to decrease after year 2007 and reached its lowest point of 4.5% in year 2014.

Lending rate has been related to the deciding factors of U.S. housing price bubble. In U.S., the continuous lowering of lending rate and reducing of cost of borrowing have created a credit boom which indirectly caused the hike in housing prices (Fitwi, Hein & Mercer, 2015). When lending rate is low, investors have more incentives to buy a new house through borrowing (Tan, 2010).

1.1.4.4 Trend of Unemployment Rate in Malaysia

Figure 1.5: Malaysia Unemployment Rate from year 1999 – 2014 (%), Adapted from: Datastream – Department of Statistics Malaysia.

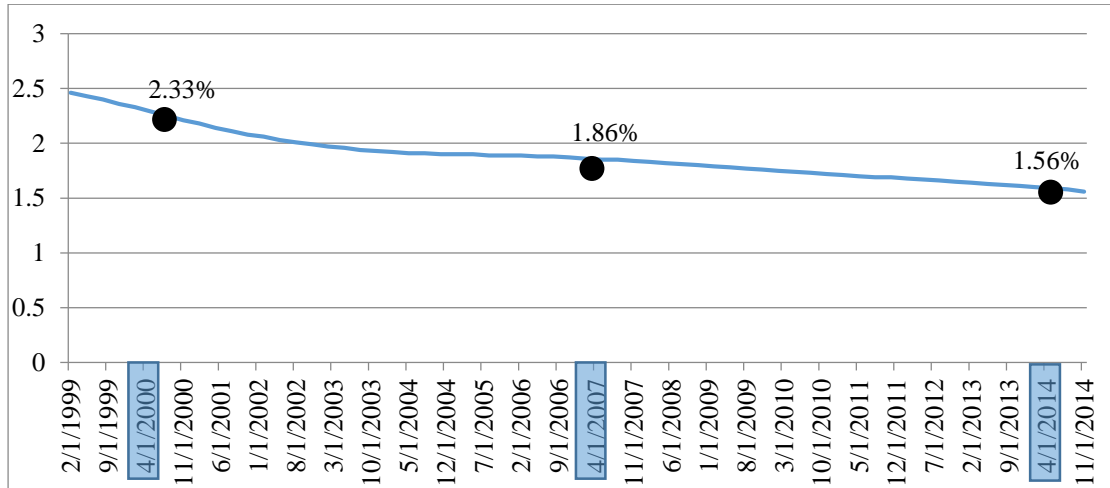


Based on the statistics by Department of Statistics Malaysia, the unemployment rate in Malaysia was fluctuating between 1% and 3.3% from 1999 to 2007. It increased steadily from year 2007 until it dropped sharply after its peak in year 2009. It then continued to fluctuate between 1% and 2.7% after the fall. Housing demand in Malaysia was proven to have a significant negative relationship with unemployment rate (Zainun, Abdul Rahman & Eftekhari, 2011). The housing demand will then directly affect the housing prices through the supply demand theory.

A research done by Ong (2013) showed that unemployment rate have a lagged effect to the Malaysian housing price. On the other hand, Blanco, Martin and Vazquez (2015) discovered that high employment rates is one of the factors associated with housing bubble.

1.1.4.5 Trend of Population Growth in Malaysia

Figure 1.6: Malaysia Population Growth rate from year 1999 – 2014 (%),
Adapted from: Datastream – Department of Statistics Malaysia.



Population growth rate can be defined as the average annual percent change in the population, resulting from the difference between number of births and deaths and the difference of migrants entering and leaving a country (Central Intelligence Agency, 2015).

According to the statistic done by Department of Statistics Malaysia in Figure 1.6, the population growth rate of Malaysia was declining from 2.33% in year 2000 to 1.56% in year 2014. Although the growth rates were on a downward trend, they were still positive every year. This implied that the total Malaysian population is increasing every year from only 23.3 million people in year 2000 to 30.4 million people in year 2014, based on the data of Department of Statistics Malaysia.

Ong (2013) stated that the production of housing properties in Malaysia slowed down due to the complication of laws, regulations and procedures. The increasing Malaysian population will need more houses to live as well which also accelerates the housing demand in Malaysia (Osmadi, Kamal, Hassan & Fattah, 2015). This

imbalance between housing demand and supply will affect the housing price to increase (Ong, 2013).

1.1.5 Conclusion of Research Background

The research background highlights the background of Malaysia's economy, housing markets, financial crisis caused by housing bubble and the factors of housing price changes. This study can be useful to detect if there is any formation of housing bubble in Malaysia that may lead to another financial crisis.

1.2 Problem Statement

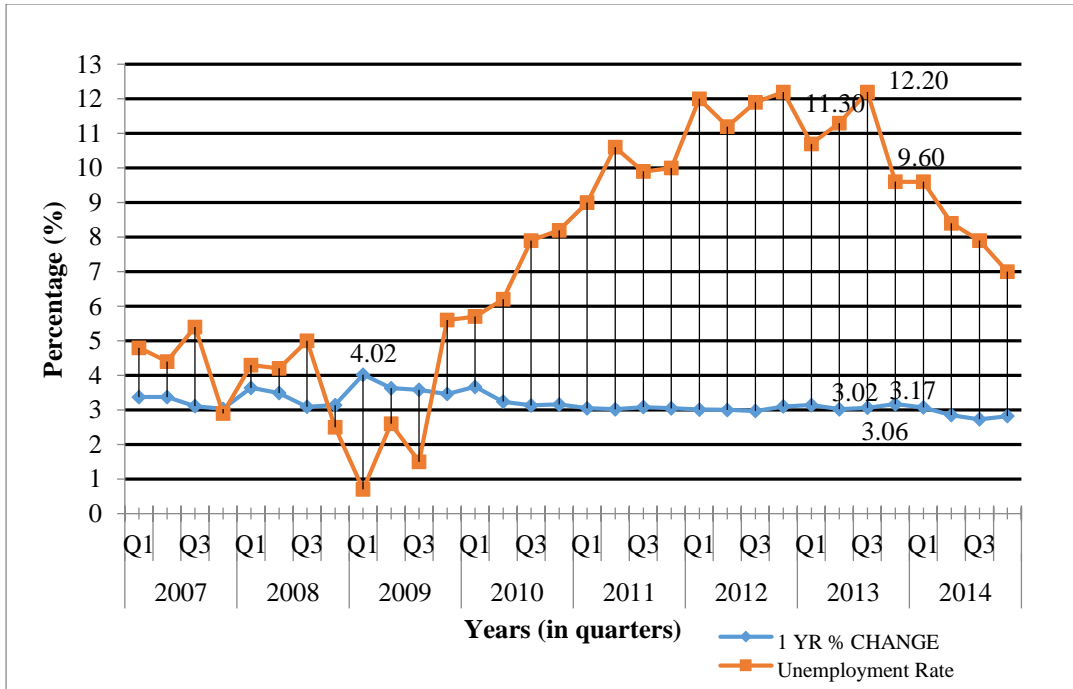
Price of houses have continuously rise and fall over the recent decades (Tsai & Peng, 2011). As noted by Mints (2008), Russia has experienced unforeseen boost in housing prices which makes it less affordable for the home buyers. The low interest rates contributed to increase in housing prices as the lending availability was eased that elevated the borrowings by households (Kim & Min, 2011). In China, housing affordability issues have been voiced out recently as it has become a socially and economically affecting issue. Rapid development of economy caused the house price to hike, thus making it unaffordable especially during Asian Financial Crisis in 1997 to 1998 (Husain, Rahman & Ibrahim, 2011). Hashim (2010) stated that considerable boost of the residential property market in Malaysia has can be observed over the past decade, especially at several states. A research done by Suhaida et al. (2011) found out that rapid development in Kuala Lumpur and Selangor has resulted in the drastic increase of housing prices within Malaysia. This statement can be further supported by a case study done by Haron and Liew (2013) where similar type of houses will often have different price level in Klang Valley

(Selangor & Kuala Lumpur). Recently, the housing market has taken a tough blow due to the Implementation of Goods and Services Tax (GST), weakening ringgit and lower commodity prices (Lee Cheng, 2015). With the unremitting exorbitant increase in housing prices, Malaysians find it hard to even feed themselves and what is left is not even enough to pay the monthly instalments of a small size apartment.

In addition, lacking of comprehensive housing policy and the support of government allows the speculation to continue preposterously in Malaysia (Husain, Rahman & Ibrahim, 2011). One of the policies is the Sell Then Build (STB) system which does not insured the possibility that the project might flunk and also the cost of financing the construction is mainly borne by the buyers (Tan, 2012). The construction of 800,000 units of housing as stated in the 7th Malaysian Plan promotes the speculation activities by the high-wage earners which results in elevating home prices year by year (Ong, 2013). The housing industry in Malaysia has been one of the most important sectors in contributing to the Gross Domestic Product (GDP) of the nation (Husain, Rahman & Ibrahim, 2011). Tsai & Peng (2011) identified that government's minimal involvement over the housing market may produce social and economic problems if the government chooses to be ignorant. For instance, the Build then Sell (BTS) system introduced is not eye-catching due to vague implementation and also the low incentives offered to developers.

Furthermore, due to the insufficient legal provisions to protect the purchasers, the abandonment of housing projects in Malaysia has been plaguing the housing industry (Dahlan et al, 2012). In line with the Ministry of Housing and Local Government (MHLG), projects that are under halt or uncompleted are known to be abandoned. As more housing projects are abandoned, the labour employed for the construction loses their job and increases the unemployment rate. Branch, Petrosky-Nadeau and Rocheteau (2015) stated that the housing prices and unemployment rate are negatively correlated with each other. A surge in unemployment rate will result in dropping of incomes and thus reducing capability of purchasing homes which in return allows housing prices to fall (Duke, 2015).

Figure 1.7: The relationship between percentage change (yearly) of HPI and unemployment rate against time from 2000-2014 (quarterly), Source from: Data Stream (Thomson)



Based on Figure 1.7, this relationship is proven in year 2009 Q1 when the unemployment rate is at its highest of 4.02% then the HPI 1 year-percentage change is 0.70 (lowest) which is true for Malaysia during the global financial crisis that hit in year 2008. However, from 2013 Q2 – Q4, the inverse relationship of unemployment rate (3.02, 3.06, 3.17) and housing price (11.30, 12.20, 9.60), respectively, did not uphold. The unemployment rate was observed to be increasing but the percentage change in yearly housing price was also increasing. This fact is rather surprising and worrying and is one of the reasons this study is conducted to address the issue and identifying the effect of this positive relationship.

In addition, the housing market has taken a tough blow due to the implementation of Goods and Services Tax (GST), weakening ringgit and lower commodity prices such as oil (Thean, 2015). With the unremitting exorbitant increase in housing prices, Malaysians find it hard to even feed themselves and what is left is not even enough to pay the monthly instalments of a small size apartment.

In brief, boost in housing industry, lack of comprehensive housing policies and legal provisions, implementation of GST, weakening ringgit against other currencies and lower commodity prices has shape the housing market as what it is today. Hence, this study is to identify and determine the various determinants that directly or indirectly influence the housing industry as a whole.

1.3 Research Questions

Research Questions have been stimulated by the problem statement and objectives below. The following research questions are proposed:

1.3.1 Main Research Question

What are the macroeconomic factors of fluctuation housing price in Malaysia from year 2007 Quarter 1 until year 2014 Quarter 4?

1.3.2 Specific Research Questions

- i. Would exchange rate have a significant effect on housing price index in Malaysia from year 2007 Quarter 1 until year 2014 Quarter 4?
- ii. Could the population growth influence housing price index of Malaysia from year 2007 Quarter 1 until year 2014 Quarter 4?
- iii. Would lending rate affect the housing price index in Malaysia from year 2007 Quarter 1 until year 2014 Quarter 4?
- iv. Does unemployment rate have a significant relationship with housing price index in Malaysia from year 2007 Quarter 1 until year 2014 Quarter 4?

1.4 Research Objectives

Research Objectives have been stimulated by research question in order to achieve several objectives and form investigation direction.

1.4.1 General Objective

This study is mainly to explore the macroeconomic determinants that influence the fluctuation of housing price index in Malaysia from year 2007 Q1 until year 2014 Q4, quarterly.

1.4.2 Specific Objectives

- i. To explore the association between exchange rate and housing price index in Malaysia from year 2007 Quarter 1 until year 2014 Quarter 4.
- ii. To examine the association between lending rate and housing price index in Malaysia from year 2007 Quarter 1 until year 2014 Quarter 4.
- iii. To study the association between unemployment rate and housing price index in Malaysia from year 2007 Quarter 1 until year 2014 Quarter 4.
- iv. To investigate the association between population growth and housing price index in Malaysia from year 2007 Quarter 1 until year 2014 Quarter 4.

1.5 Hypotheses of this Study

1.5.1 Exchange Rate

H₀: Housing price index and exchange rate of RM against USD have no important association in Malaysia.

H₁: Housing price index and exchange rate of RM against USD have an important association in Malaysia.

Exchange rate in this study refers to the average of the ringgit against USD for quarterly basis measured in RM/USD. According to the journal of Meidani, Zabihi, and Ashena, (2011), they indicated that macroeconomic variables will influence the house prices, such as liquidity, inflation, exchange rate, stock prices and so forth. Exchange rate is important because it will affect the demand of housing market.

Mahalik and Mallick (2011) found that housing prices are negatively related with housing stocks, equity prices, mortgage rates, exchange rate and unemployment rate in long run relationship. This is because exchange rate will affect the attractiveness of housing market to foreign investors. Lower exchange rate will attract foreign investors to invest in domestic housing market, because the price of the house is cheaper to them and thus possessing greater affordability (Lo, 2011). This indicates that if the exchange rate is undervalued against their currency, it would consequently lead to increase in housing price, vice versa is also true (Mahalik & Mallick, 2011).

Normally, the effect of exchange rate on house price may be indirect through the import mechanism (Meidani, Zabihi, & Ashena, 2011). As the exchange rate is lower, the costs of importing raw materials, technologies and labour would be

higher and pricier due to inflation (Wheeler, 2013). As a result, inflation would raise the price level which would subsequently lead to increasing house prices (Wong, Hui, & Seabrooke, 2003).

This study expects that housing price index and exchange rate of RM against USD have an inverse and important association in Malaysia, which rejects the null hypothesis.

1.5.2 Lending Rate

H₀: Housing price index and lending rate have no important association in Malaysia.

H₁ Housing price index and lending rate have an important association in Malaysia.

Lending rate or base lending rate also, can be known as mortgage rate. Lee (2009); Zhang, Hua and Zhao (2012); Erdem, Coskun and Oruc (2013), all found that interest rate affects housing price. This is supported by the journals of De Vries and Boelhouwer (2005), they stated that housing price is strongly affected by macroeconomic factors, such as anticipated prices, income and interest rates. This is because lending rate is associated to the cost of housing, hence it is an essential element to be considered when buying a house (Wang & Zhang, 2014). Using the Granger-Causality test, Hui (2013) proved that housing price is granger caused by interest rate.

Pashardes and Savva (2009); Rahman, Khanam & Xu (2012); Ben David (2013); Li and Chand (2013); Holstein, O'Roark, and Lu (2013); Choudhury (2014); Ibrahim and Law (2014); Kuang and Liu (2015), all mentioned that housing prices

are negatively related with lending rate. According to Tan (2010); Ong (2013); Zeren, Erguzel and Ass (2015), they stated that higher lending rate will cause the housing demand to drop which consequently lead to a decline in housing price, owing to the higher lending rate that tags along with higher credit cost, limiting the individual purchasing power on a house.

However, some found that housing prices and mortgage interest rates are strongly and positively related (Tse, Rodgers & Niklewski, 2014). Real housing price changes is affected by interest rates and positively (Shi, Jou, & Tripe, 2014).

Nevertheless, Le (2015) said that lending rate does not Granger-cause Malaysian housing price. This shows that lending rate is insignificant to housing price (Lind, 2009).

This study expects housing price index and lending have an inverse and important association between in Malaysia, which rejects the null hypothesis.

1.5.3 Unemployment Rate

H₀: Housing price index and unemployment rate have no important association in Malaysia.

H₁: Housing price index and unemployment rate have an important association in Malaysia.

Unemployment rate is refers to those people who are 16 years old or above, not working, available for work and have made efforts in seeking for jobs more than 1 month.

Based on the journal written by Le (2015), the country's labour force Granger-causes the housing price. For instance, the housing price is Granger-caused by the lending rate, unemployment rate and weekly earning in Victoria. Smet (2015) discovered that income and unemployment rates are significantly affects housing price.

Lee (2009); Rosli (2011); Shi, Jou and Tripe (2014) found that unemployment rate and housing price are negatively correlated. This is because employment rates is related with housing bubble, which means that the more houses are being built, the more job opportunities are created (Blanco, Martin & Vazquez, 2015). When employment rate rises, it would generate demand on housing, leading to increase in housing price as people can now afford to buy a house (Taltavull de La Paz (2013). In addition, to meet the overwhelming demands, more labourers are needed to shorten completion period, which would increase the cost of construction and subsequently housing price will increase also (Ong, 2013).

However, population growth rate and unemployment rate are not important to housing price (Ren, Xiong, & Yuan, 2012).

This study expects housing price index and unemployment rate have an inverse and important association between in Malaysia, which rejects the null hypothesis.

1.5.4 Population Growth

H₀: Housing price index and population growth have no important association in Malaysia.

H₁: Housing price index and population growth have an important association in Malaysia.

Population growth defined as the growth rate of all residents irrespective of legal status or citizenship excluding refugees which are considered as part of the population of origin country measured in percentage.

Burda (2013) asserted that housing price is significantly affected by population growth. This is supported by Taltavull de La Paz (2003), Lee (2009) and Rosli, (2011), they all found that population growth is one of the significant factors to housing prices. This is because population growth would affect the demand of housing (Karantonis, 2008). For example, if the population growth increases, then the demand of housing would also increase, subsequently lead to house price increases, vice versa (Mulder, 2006). Therefore, there is a direct (positive) connection between housing price and population density growth (Miles, 2012).

However, population growth rate and unemployment rate might not be significant to housing price also (Ren, Xiong, & Yuan, 2012).

This study expects housing price index and population growth have a positive and important association between in Malaysia, which rejects the null hypothesis.

1.6 Significances of this study

This study will scrutinize the significance of Malaysia's housing price upward movement against the exchange rate, lending rate, population growth and unemployment rate. This study also will determine the significant relationship between macroeconomic factors with housing value.

Recommendations would be discussed for investor to assess the best timing from factors like macroeconomic factors to make any decision to purchase a house as part of their investment planning (Ong & Chang, 2013). Besides, investors, speculators and house buyers can also know the factors that account for the housing investment decision through this study (Ong, 2013). Home buyers, can thus evaluate the timing from those factors to purchase their house (Ong & Chang, 2013). Ibrahim and Law (2014) also stated that the understanding of housing cycles and their relationship to market will be important for investors. With the understanding and knowledge about housing market, investors can know about the factors that affect their investment and hence know which investment to be selected (Ibrahim & Law, 2014).

In addition, this study provide valuable insights on how the monetary policy to control money supply for managing asset price (Zhang, Hua & Zhao, 2012). For policy makers, it is useful to stabilize and control the rising trend of housing price and strengthening the market with healthy demand supply chain (Haron & Liew, 2013). Research done by Suhaida, Tawil, Hamzah, Che-Ani, Basri and Yuzainee (2011) also stated that the housing policy for the country in future will have improvement with the understanding and knowledge about vitality of housing affordability.

Besides, this study provides a good platform for housing developers to assess the needs and wants of households in buying house. Hence, they can plan for their

products to fulfil the requirements of Malaysians. Construction firms will also pay close attention to the information about housing market and the factors because it provides an indication if there is changes in the market (Ibrahim & Law, 2014). Tan (2009) stated that the study on housing owning motivation will help housing developers to recognize the importance of orienting their activities. Housing developers should design their products to fulfill Malaysians' needs and wants and take recognize on the changing lifestyles of Malaysians (Tan, 2009).

In short, the outcomes of this study would contribute to investors, speculators, home buyers, government execution and housing developers on future planning or investment that have relationship with the fluctuation of Malaysian housing price index.

1.7 Chapter Layout of the Study

The plan of this study is constructed as the following sequence: Firstly, Chapter 2 provides the literature reviews about the factors of housing price and also the relevant theories of housing price. Then, Chapter 3 deliberates about the methodology applied for this study. Chapter 4 presents the analysis of result of this study. Lastly, Chapter 5 discusses about the findings, policy implications, recommendations and limitations of this study. The overall of study will also be concluded at the end. The details are presented as following:

1.7.1 Chapter 1: Research Overview

In the first chapter, an introduction and research background of the topic will be indicated, followed by the problem statement of this study. Then, research

question and research objectives will also be stated. Next, hypotheses of the study and significances of the study will also be figured out.

1.7.2 Chapter 2: Literature Review

In the second chapter of this study, it mainly focuses on the review of the literature. This part will review the past researches on how did they conduct their studies, theories used, findings and results on their studies.

1.7.3 Chapter 3: Methodology

In the third chapter, data collection method, the sources of data, sample size, and the methods that will be stated to carry out this study.

1.7.4 Chapter 4: Data Analysis

In the fourth chapter, the results will be generated by the methodologies stated in chapter 3. And then, the results generated will be used for analysis and comparison with the outcomes that generated by past researchers.

1.7.5 Chapter 5: Discussion, Implications and Conclusion

In this chapter, an outline will be given. Moreover, the policy implications that government and other parties should implement to improve this study would be stated. Lastly, recommendation and limitations will also be stated.

1.8 Conclusion

In brief, Chapter 1 introduces about research background, problem statement, research objectives and questions, hypotheses of this study, significances of this study, and chapter layout used in analysing the Malaysian housing price index. The rationale of this study is to examine the determinants of Malaysian housing price index, which are exchange rate, lending rate, unemployment rate, and population growth. It is important to households, investors and policy makers as it provides the knowledge when planning for a detailed housing investment decisions.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In chapter 2, numerous numbers of journals have been reviewed on the topic of determinants of housing price. The journals consists of different countries past researches, such as China, Turkey, Hong Kong and so forth. Nevertheless, this study discovered that the research on determinants affecting Malaysia's housing price is rare as there were only few journals found. Conversely, there was large number of journals on various developed countries found. Hence, this study will primarily concentrate on the situation of housing price in Malaysia. Firstly, this chapter will summarize the literature review of foreign and local studies in order to have a deep understanding on how past or other researchers towards determinants of housing prices. In addition, the layout of this chapter will be as following: review of the literature, which will review the past studies done by past researchers. Review of relevant theoretical models will be the next, which is to study the theories and concepts applied on determinants of housing price by referring to the past studies. Followed by proposed theoretical or conceptual framework, which will discuss about the relationships between housing price index and exchange rate, unemployment rate, lending rate and population growth. Either they are positively or negatively correlated with the dependent variable (housing price index). Lastly, there will be a brief conclusion about chapter 2.

2.1 Review of the Literature

In every country, housing price index plays an important role in housing market as housing market is strongly correlated with the growth of economy (Afiqah, Lizam & Omar, 2012). It is also one of the major factors that affect the decision of household or individual to buy or sell house. This is because it concerns them about the effect of exchange rate, unemployment rate, lending rate and population growth towards housing price index before buying or selling of a house. By paying attention on this, investors are able to have a detailed and careful planning in the future about investment on house. There is a number of researches have been done between housing price index and exchange rate, unemployment rate, lending rate and population growth. Either these variables have positive or negative relationship with housing price index. Consequently, by acquiring the knowledge on these variables and economic conditions, investors can make a better investment decision and have a deeper understanding about housing price index.

From the past till today, it is rare to find any research to have combined variables such as exchange rate, unemployment rate, lending rate and population growth. Hence, this study will explore the impacts of these variables on housing price index in Malaysia from 2007Q1 to 2014Q4.

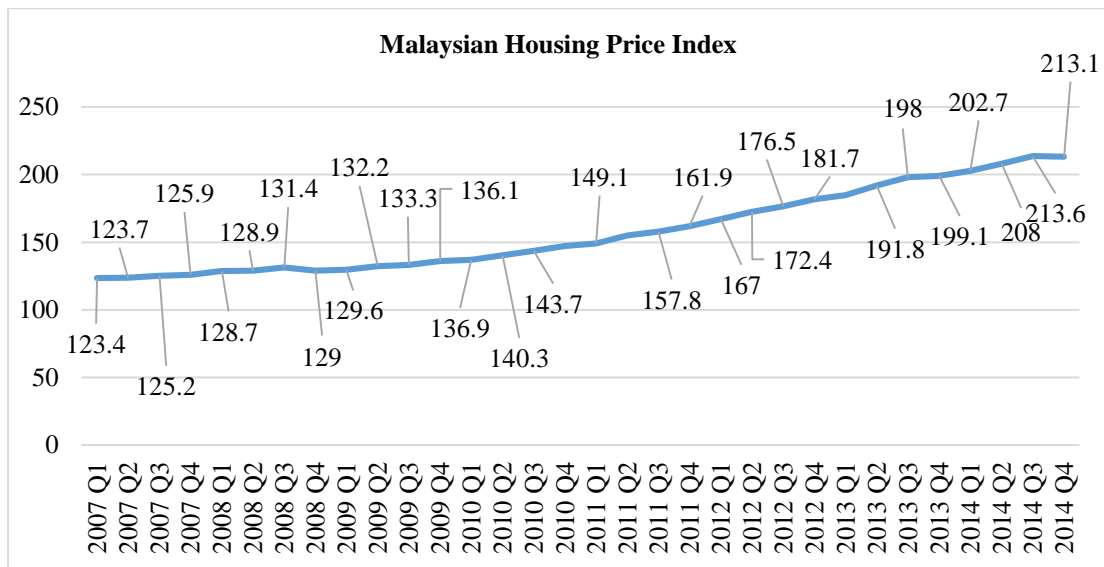
2.1.1 Housing Price Index (HPI)

In Malaysia, housing price index is called as Malaysian House Price Index (MHPI), created by Valuation and Property Services Department (VPSD). The objective of MHPI is to control the changes of housing prices on timely basis. In addition, MHPI is also helpful in creating the economic national policy for the property development (Afiqah, Lizam & Omar, 2012). The method of constructing MHPI is

done by using hedonic method. Hedonic method is widely used in many countries, such United States, United Kingdom and so forth.

On the other hand, MHPI consists of all types of housing index, such as high-rise unit price index, terraced house price index, detached house price index and semi-detached house price index and. MHPI is calculated based on overall Malaysia (NAPIC, 2014).

Figure 2.1: Trend of Malaysian Housing Price Index, source from NAPIC, from 2000 to 2014 (Quarterly)



Currently, Malaysia’s residential property market is said to be experiencing a bubble and that bubble has been growing ever since the last Asian Financial Crisis in late 1997 (Ong, 2013). Based on Figure 2.1, it is observable that the HPI from 2007 Q1 to 2014Q4 has been escalating steadily though there was a slight decrease in the HPI in 2008 Q4 due to the global financial crisis. The peak was in 2014 Q3, around 213.6, but the lowest was in 2007 Q1, around 123.4. **(By referring Appendix 2.1)**

Based on the report of NAPIC (2014), HPI increased by around 7% in 2014 Q4 from 2013 Q4. Ong and Chang (2013) stated that this increase in housing prices is due to the rapid economic growth of Malaysia. Malaysians are afraid that their annual income may not be able to cope up with the soaring housing prices. A local newspaper company, The Star, reported that Malaysians are wondering whether they can even afford to pay for the instalments for a roof to shelter them.

In addition, there were a great number of past researches that reviewed about the determinants of the housing price index in the particular country. They ran a test to know whether HPI is positively or negatively correlated with its determinants. For example, Mahalik and Mallick (2011) indicated that housing prices have inverse relationship with exchange rate and unemployment rate in long run relationship. On the other hand, through different liquidity effects, lending rate can also affect the housing price, which can be fixed by discounting the expected future cash flows. For example, if banks increase credit availability, which means that current and future economy activities can be stimulated by lowering lending rate. However, this would make the housing price rises because households are able to borrow at lower cost (Ong, 2013). De Vries and Boelhouwer (2005) and Lee (2009) also asserted that anticipated prices, income and interest rates could impact housing price. Apart from that, Le (2015) said that the lending rate, unemployment rate and weekly earning would affect the housing price in Victoria. Furthermore, Karantonis (2008) said that population growth would affect the demand of housing, leading to an increase of housing price.

2.1.2 Exchange Rate

Exchange rate refers to the currency exchange of RM to USD. In layman terms, it means how much of RM can be exchange for 1 USD.

According to the journal of Mahalik and Mallick (2011), they found that exchange rate can affect the housing prices in a negative way due to import and the ability of purchasing power. For example, when the exchange rate is higher, the import costs of raw materials, technologies and labour would be reduced (Wheeler, 2013). This would reduce the foreign investors to invest in domestic country, and the domestic and foreign investors would choose to buy house in the foreign country due to cheaper price and greater affordability. As a result, the house price in domestic would decline due to low demand, while house price in foreign country would rise due to high demand (Lo, 2011). Therefore, domestic housing price and exchange rate are negatively related (Wong, Hui & Seabrooke, 2003).

2.1.3 Lending Rate (LR)

Previously, lending rate is called as base lending rate (BLR), which means the charges on loan. From the journals reviewed, past researches have different results on the connection between lending rate and housing price.

For instance, De Vries and Boelhouwer (2005) tested that housing price is strongly influenced by macroeconomic factors, such as interest rates, anticipated prices and level of income. Lee (2009) agreed also with this result and mentioned that macroeconomic variables as interest rate and income have significant impacts on housing price.

Besides that, Shi, Jou and Tripe (2014) asserted that interest rate and housing price are positively correlated. This is supported by Tse, Rodgers and Niklewski (2014), as they added that interest rates have a strong and positive relationship with housing price.

However, Ibrahim and Law (2014), discovered that interest rate is negatively related with housing price. Holstein, O'Roark, and Lu (2013) and Choudhury (2014) agreed with this statement that housing price is negatively affected by mortgage rate. Typically, higher lending rate would make the cost of buying a house increases by taking new housing loans and lead to low demand on houses (Bank Negara Malaysia, 2012). Therefore, base lending rate has a significant and negative correlation with housing activities (Tan, 2010).

Nevertheless, some found that there is no significant connection between lending rate and housing price (Ong, 2013). Le (2015) also said that lending rate does not Granger-cause housing price in Malaysia.

2.1.4 Unemployment Rate

Unemployment rate refers to those who have no job and currently seeking for jobs over the past 4 weeks.

In theory, past studies had proven that unemployment rate is significant to housing price (Le, 2015). Lee (2009) said that housing price and unemployment rate are negatively correlated.

However, Ren, Xiong and Yuan (2012) did not agree with this statement, they mentioned that housing price is not affected by population growth rate and unemployment rate.

2.1.5 Population Growth

Population growth is the natural change (differences between births and deaths) and net migration (differences between immigration and emigration). It only includes residents who have legal citizenship.

Rosli (2011) asserted that housing price is significantly affected by population growth. This is supported by Taltavull de La Paz (2003), Lee (2009) and Burda (2013), they all found that population growth is one of the significant factors to housing prices. This is because population growth would affect the demand of housing (Karantonis, 2008). Therefore, there is a direct association between housing price and population density growth (Miles, 2012). However, population growth rate and unemployment rate might not be significant to housing price also (Ren, Xiong, & Yuan, 2012).

2.2 Review of Relevant Theoretical Models

2.2.1 Housing Price

2.2.1.1 Wealth Effect

In *The Global Financial Crisis: Genesis, Policy Response and Road Ahead* written by Nayak (2013), he stated that both the originator of The General Theory of Employment, Interest and Money as well as wealth effect was none other than Keynes in 1936. This effect was brought up by Keynes when he discussed about

the functional relationship between tendency to consumption and income level of an individual. This definition was enhanced by Case, Quigley and Shiller (2005) as to how the exogenous changes in wealth cause the effect upon consumption behaviour. They mentioned that the changes in housing wealth will exert effects on household behaviour. Sierminska and Takhtamanova (2007) had mentioned wealth effect is the relationship between wealth and consumption. The concept of wealth effect proposed by Smith (2014) was simple which is to overflow the economy with credit and non-interest money in order to boost the housing industry.

Case, Quigley and Shiller (2005) stated that because there are lesser updates on the real estate value, thus people are less attentive about the short run changes in their wealth of property. Hence they said it is reasonable to expect that the effects of property and housing value are different with other wealth effects such as stock market wealth. Case, Quigley and Shiller (2005) also stated that the changes in housing wealth could have different impact towards the consumption behaviour of renters, younger cohorts of consumers and also older homeowners.

From the study of Chan and Woo (2013), they stated that the housing wealth effects are depending on several factors, for example the saving behaviour of buyers, credit market and prevalent housing prices. Potential house buyers will need to save more money for down payments when there is unfavourable credit market, which reduce the consumer spending (Chan & Woo, 2013). Many researchers had found insignificant effects for housing wealth effects (Dvornak & Kohler, 2003). Even the research made by Calomiris, Longhofer and Miles (2009) also made same conclusion and conclude that the decline in housing price is not likely to exert an independent negative effect on consumption and the house price is drive by combinations of housing bubble bursting, recession and credit crunch. However there are still some researchers believe that the housing wealth effects are significant and cannot be ignored (Chan & Woo, 2013).

Goodhart and Hofmann (2008) added that real house prices persistently and consistently deviate from the usual trend would be when housing prices is seen to be amplifying. Based on a research done by Chu (2014), for the period of study of 10 years from 1995-2005, real house prices increased significantly by more than 60% when real rents only increased by about 8% in United States. According to Lean (2012), it is evident that the whole of Malaysia experienced wealth effect whereby escalating price of houses drives the stock market as more wealth is in the hands of public.

2.2.1.2 Theory of Risk over Return / Modern portfolio theory

Modern portfolio theory was developed by Markowitz (1952). The theory is also known as risk over return theory because it defined how investors make their investment decisions to maximize their profit with the given level of risk.

Markowitz (1991) suggests that rational investors would require different levels of return based on the evaluation of risk of investment where investment with best returns and least amount of risk would be favoured. This theory was implemented by Tan (2009) in his research on determination of home owning motivation in Malaysia. Tan (2009) stated that the volatility of share returns is larger than housing return. Therefore, a rational investor would theoretically accept a lower level of return for residential housing investment which is less volatile.

The theory can be linked to this study as with the availability of internet, Malaysians are able to get the information easily when making an investment decision. They are able evaluate the risks and returns of the assets before incorporating them into the portfolio.

2.2.1.3 Neighbourhood Effect

The neighbourhood theory was first discovered in William Julius Wilson's (1987) documentation. The documentation discussed about the characteristics of the world's cities serious problems, which were linked to the neighbourhood level and effects (Wilson, 1987). Neighbourhood effect is defined as the independent causal effect of neighbourhood on any number of health and/or social outcomes (Jenks & Mayer, 1990). Krupka and Noonan (2009) stated that the neighbourhoods are the result of a complicated interaction between residential choice, housing supply and also the effect of a larger metropolitan system on its component parts. Lupton (2003) had done research regarding to the neighbourhoods and revealed that it reflects a growth in interest in the effects of neighbourhoods on individual social and economic outcomes. Even though there are some researchers argue about the neighbourhood effects, Lupton (2003) still believe that the effects of neighbourhoods have influence over the investment in area-based programmes. Research done by Ioannides (2000) also found that valuations of individual on their properties and behaviour of maintenance is influenced by their neighbours.

Research done by Ioannides (2010) found that the endogenous neighbourhood effect do have an indirect effect on affecting an individual's demand for housing. He also found that the neighbourhood effects are important in estimating the housing structure demand especially when the choice of neighbourhood is accounted for (Ioannides, 2010). Ioannides (2010) also stated that the housing price functions are consistent with hedonic valuation of neighbourhood attributes, which individuals will choose neighbourhoods while recognizing their characteristics and others factors.

Zahirovich-Herbert and Gibler (2014) had found that neighbourhood effect will affect the housing price. They said that researchers have debated on the relative housing value of different floor area or size. Haurin (1988) stated that those house that do not fit in neighbourhood are normally sold for less. Zahirovich-Herbert and

Gibler (2014) stated that minority of buyers would strongly prefer houses that are different with the neighbourhood houses in the area, so if developers built these atypically houses in the area may find it difficult or might need to lower the price in order to sell them out. Turnbull et al. (2006) also found that smaller house can sell at a premium in neighbourhood of larger houses. They found that buyers may pay a premium for a slightly smaller house among larger house relative to a homogeneous neighbourhood even the different in house size is significant (Turnbull et al., 2006). This is because typical buyers will prefer average house in the neighbourhood and avoid house that are different in size compare to average ones. Hence, this shows that houses that are larger and smaller than average houses in the neighbourhood sells at a discount or premium then normal price (Turnbull et al., 2006).

2.2.1.4 Domino Effect

The first appearance of domino theory was in 1954 by President Dwight D. Eisenhower during his speech at press conference about Cold War (History, 2015). Eisenhower said that the victory of communist in Vietnam will lead to similar communist stories in neighbouring countries in Southeast Asia (History, 2015). Domino effects can be described as the cumulative impact that occur from a chain of unwanted events, with severe consequences (Kardell & Loof, 2014). It is often described as the synonym to a combination of accidents, in which the consequences of a previous accident are increased by the following accident (Kardell & Loof, 2014).

Reniers (2010) classify the domino effects into two categories, which are internal and external domino effects. The author stated that the internal domino effects refers to the escalation of accident that are happen within the boundaries of an industry while the external domino effects are the escalation outside the boundaries.

Research studies made by Ho, Ma and Haurin (2007) have found that the shock in wealth to the housing market result in domino effects in price and transactions. They found that when a positive wealth shock of renter households occurs will increase the demand for lowest tier owner-occupied houses, which in turn increase the price and subsequently, lead to greater demand and price increase in higher quality tiers of housing market (Ho, Ma & Haurin, 2007). It also increase the transactions of market for both low tier and high tier. The negative price shock will result in similar effect but in opposite direction, thus create pressure on house price and transaction volume reductions (Ho, Ma & Haurin, 2007). The study of Choudhury (2014) also found the domino effect of widespread mortgage defaults was resulted from the peak of housing market and declined in home price index. Choudhury (2014) also mentioned that the domino effect prolonged the spill over effect of housing crisis spread into other financial and economic markets.

2.2.1.5 Anchoring Effect

Anchoring effect was first developed by Amos Tversky and Daniel Kahneman in their study. They stated that anchoring happen when the starting point is given to the subject and also when the subject is based on the estimate on the incomplete computation results (Tversky & Kahneman, 1974). Lots of estimates usually start with an initial value which serves as the anchoring; the initial values can get through different ways (Tversky & Kahneman, 1974). However, different starting point will have different estimates and results, which are biased towards the initial values (Tversky & Kahneman, 1974).

Northcraft and Neale (1987) stated that anchoring seems relevant to the property's actual selling price because of the bargaining setting. For example, the first value of bidding process might serve as an anchor. Anchoring is interpreted as selecting

predictions that are too close to some easily visible prior or arbitrary point of departure, which cause forecast in underweight new information and thus give rise to predictable forecast errors (Campbell & Sharpe, 2009).

Zhou, Gibler and Zahirovic-Herbert (2015) showed that housing price and the house buyers' origin city have a significant and positive association. The result stated that non-local buyers will actually anchoring to higher prices compare to local buyers due to less information on the market and values (Zhou, Gibler & Zahirovic-Herbert, 2015). Leung and Tsang (2013) also found that when anchoring and loss aversion are present, both price dispersion and trade volume are correlated with average housing price positively. They conclude their research by stated that the anchoring effect and loss aversion play a significant role on observed cycles of house price (Leung & Tsang, 2013). Wu, Deng and Liu (2014) stated that one of the important role in influencing the pricing behaviour of housing market is the anchoring effect. This effect is significant in newly built house market because potential buyer can easily observed the past price path since the transactions is always concentrated within few months (Wu, Deng & Liu, 2014).

2.2.1.6 Life Cycle Model

In the early 1950s, Franco Modigliani and his student Richard Brumberg came out a theory of consumption in the fundamental of how the people spend at each stage of the life with the limited resources available (Modigliani & Brumberg, 1954). They observed that many people will build their asset possessions while working and during retirement they will make use of their stock of assets. The life cycle model is assumed that the life time resources and consumption are proportional to each other. The life cycle model is the wealth of the country in which when individuals had little amount of money when they were younger and become rich before retirement. The wealth of the country depends on the length of retirement span (Deaton, 2005).

Working people have to plan their retirement and tailor spending pattern at different stage with the income level at each age (Deaton, 2005). Many people will plan for their retirement by selling their assets. Hence, owning a house is important over the life cycle.

The fluctuations of income, interest rate and house price lead the people to prefer own a house rather than to rent (Attanasio, Bottazzi, Low, Nesheim & Wakefield, 2012). During the young time, they will plan and buy a house and other assets. But at retirement age, they will start to focus on interest rate along the life cycle (Yang, 2006). No matter housing price increase or decrease, it also will induce the youngsters to buy own house for investment. This is because owning a house can save the life span risk, retirement and enjoys services from housing as well as protects them from being abandoned by children when old age strikes (Yang, 2006). During economic boom, they can even sell their house at higher price in order to obtain extra income from investment.

2.2.1.7 Simple Model of Housing Supply and Demand

Alfred Marshall, “The founder of economics” developed the idea of supply and demand, marginal utility and cost of production (Marshall, 1920). In economy theory, law of supply and demand is fundamental to the economy. Demand can be defined as any products that the consumers are willing and able to purchase at certain price during a specific period of time. Housing demand can be determined by the housing price as well as demographic variables (Coleman & Scobie, 2009). Supply can be defined as the amounts of a product that supplier willing and able to make available for sale at certain price during specific period. Housing supply can be determined by housing price and input prices such as cost of labour, interest rate and GDP.

Simple model of demand and supply capture the demand to explore the purchase housing, supply of rental housing or build new houses (Coleman & Scobie, 2009). Besides, law of the demand and supply able to refer the factor of changing on price, quantities and home ownership.

The health of the country is based on the degree of unemployment in the country. Economic Transformation Programme (ETP) is implemented by Malaysia government in order to support domestic demand and enhance the consumer confidence such as tax reduction and bonuses for workers as well as decrease the unemployment rate. However, the increasing of demand by consumers in housing market, it will stimulate the increase of the housing price. The supply side (house maker) has to pay more for production costs in order to fulfil the demand of consumers. Hence, the price of house will be increased.

2.2.1.8 Price Effect, Income Effect, Substitution Effect

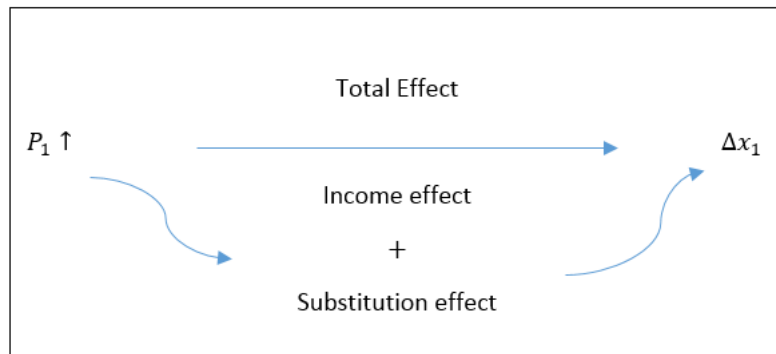
2.2.1.8.1 Price Effect

Alfred Marshall was the first to discover the price effects, income effects and also substitution effects. The three effects was discussed as a part of the Law of Demand. The price effect is actually divided into income effect and substitution effects. Marshall have found that the price effect will lead to substitution effect but failed to recognized the income effects, which later recognized by Sir John R. Hicks (McConnell, Brue, & Flynn, 2011).

Barreto (2009) stated that the effect of income can be either positive or negative, but it will always be negative effect when come to substitution effect, assuming well-behaved preferences. The reason why income effect is ambiguous as normal

goods and inferior goods, consumption and income is linearly related if good is normal, vice versa (Barreto, 2009).

Figure 2.2: The basic idea behind income and substitution effects (Source: Barreto, 2009)



From Figure 2.2, it showed the idea between the total effect, income effect and substitution effect. Barreto (2009) mentioned that the effects are directly observed through the figure and together they produce the observed total effects. He also said that the underlying motivation behind both effects, which is help to understand the demand curve and nature of response of consumers toward the price change. It also helps to know more about the law of demand via understanding the effects.

2.2.1.8.2 Income Effect

The income effects can reflect the price changes affect the optimal quantity demanded, by changing the purchasing power of consumer (Barreto, 2009). The author had stated the fact that the purchasing power will decrease if price increase (Eg: consumer can only buy half of what they bought before the price double, assume income level remain constant).

Li and Liu (2014) stated that the aggregate wealth effect is at least as the aggregate income effect on housing price appreciations and economic impacts of the two effects is similar. However, they also indicated that labour income component of personal income is very important for demand factor of house prices. The study they done found that only labour income growth has contemporaneous effect on the appreciation of house price, and also the change in financial wealth, and lead to the house price appreciations but not vice versa. The study done by Zhang (2015) stated that one of the important causes that led to growth in housing price in China is income inequality. Zhang (2015) has concerned about the poor household due to the rising in income inequality causes rise in product price (housing price). This showed that income does have a relationship with housing price.

2.2.1.8.3 Substitution Effect

The substitution effect is the idea that a price change in one good will alter the relative price faced by the consumer and lead to substitution of the relatively cheaper good rather than a relatively expensive good (Barreto, 2009). For instance, when price of good A increases, consumers will go for good B which is cheaper rather than good A.

In the research of Bajari et al. (2013), they concluded that the substitution effects had outweighed the income effects of reduced home prices. This will happen more frequent towards younger households if younger households was initially rent house for the saving of down payments. Thus, when the unfavourable home price shocks happen, these households can upgrade to a more comfortable house earlier in life and invest much in other area (Bajari et al., 2013). In another situation, the house price shock will prevent households from upgrading their house, due to the age at which the shocks is happen (Bajari et al., 2013). The author mentioned that the older

households have already obtained their optimal home size will reduce their expenses in nondurable consumption, financial wealth and also home equity when the negative house price shock happened. Thus, older households are less likely to be affected by the negative house price shocks since they have already obtained their optimal option for home.

2.2.2 Exchange Rate (ER)

2.2.2.1 Portfolio Balance Theory

According to MacDonald (2007), portfolio balance theory was originated from the research done by Mckinnon and Oates in 1966 and further developed by Branson (1968, 1975) and Mckinnon (1969). This model stated that exchange rates can be affected by the current-account imbalances as residence may shift their wealth between regions of different portfolio preferences (Dooley & Isard, 1979). Asset holders would choose to diversify their portfolios where they are compensated with a greater proportion at a lesser premium (Husted & Melvin, 2010). An article reported by The Malaysian Insider (2015), that the slide in ringgit due to low oil price engenders current foreign investors to leave Malaysia to prevent in hurting their pockets even more. The Economist (2014) reported that the oil price plummeted from US\$ 115 per barrel to below US\$ 70 which resulted in the weakening of ringgit.

Therefore, in order to prevent such situation from occurring, sterilization, an extension from the portfolio balance theory refers to a monetary approach on controlling a nation's value and reserves by altering the demand and supply of the currency (Husted and Melvin, 2010). In simpler terms, sterilization refers to when central bank sells or purchases equivalent amount of government bonds as the amount bought or sold of foreign currency to maintain domestic currency at the

same level, in other words, remains unchanged. Aizenman and Glick (2009) found that Thailand and Malaysia uses sterilization more frequent compared to Singapore to control the appreciation of ringgit. Ohno and Shimizu (2013) stated that the appreciation expectation of a currency would lead to increase in capital inflow. To add on, Lipscomb, Harvey and Hunt (2003) found that the raise of exchange rate lead to rise of real estate prices in Mexico. It's further supported when the house price in Honolulu increased to about 27 % when Japanese Yen appreciates 10 % against US dollar (Miller, Sklarz & Real, 1988).

However, one of the top Malaysian property developers, Mah Sing Group Berhad, disagrees that current slowdown of the real estate market is because of ringgit depreciation (The Star, 2015). His point of view was also supported by the chairman of Real Estate and Housing Developers Association in Penang, Datuk Jerry Chan and housing development committee chairman, Jagdeep Singh Deo whereby both mentioned that slump in ringgit would in contrary attract new foreign and local investors to purchase properties for investment in Malaysia as the government is keen in providing more affordable housing (Mok, 2015).

2.2.2.2 Foreign Direct Investment Theory

Aliber (1970) developed a theory of foreign direct investment based on the strength of currency. His theory suggested that a country with weaker currencies compared to stronger currencies could have a higher competence to draw foreign direct investment in order to take advantage of differences in the market capitalization rate.

Glindro, Subhanij, Szeto and Zhu (2011) also stated that the real effective exchange rate appreciation would have positive influence on property market prices, especially in Asia markets where there is substantial demand from foreigners for

investment purposes. In countries where foreign investment plays a significant role in the economy, an exchange rate appreciation is normally associated with housing booms.

The theory of foreign direct investment can be related to the fluctuation of Malaysian ringgit because the amount of foreign investment would indirectly affect the local housing prices.

2.2.2.3 Purchasing Power Parity Theory

Purchasing Power Parity (PPP) was developed by Cassel (1918). PPP involves the price level of 2 countries. It is the key factor of determining exchange rate, because it also indicates the amount of adjustment needed for exchange rate, different currencies have different currency purchasing power. Therefore, exchange rate is used to make the purchasing power to be equivalent and fair (Officer, 1976). In simple words, the theory stated that when countries have equal currency exchange rates, their purchasing power will be same. In other words, it is related to the domestic and foreign market. If one of the country has greater currency value than another, then it implies that the country which have higher currency value has higher purchasing power ability, vice versa (Mahalik & Mallick, 2011).

Chinn (2011) also stated that changes in exchange rates will accompany with more changes in domestic price level. Theoretically, when foreign countries' currency is stronger, their purchasing power will be higher. It will then increase demand for local goods and services and thus increase the domestic price.

For example, the Malaysia currency value is depreciating, therefore the import costs of raw materials, technologies and labour would be higher (Wheeler, 2013). It

would also result in attracting foreign investors to buy house in Malaysian housing market, because they have greater purchasing power due to higher currency value for their country (Meidani, Zabihi, & Ashena, 2011). As a result, the demand of housing in Malaysia would be higher, it causes the domestic house price to increase (Mahalik& Mallick, 2011).

This theory is related to the study as the fluctuation of ringgits will affect the cost of Malaysian housing developers as well as demand of foreign investors.

2.2.3 Lending Rate (LR)

2.2.3.1 Housing Affordability

The Parliament of United Kingdom passed an Act in 1967 which answers the long unanswered question of “What is a house?”. In that Act, it was stated that a house is any form of building that is designed, constructed or adapted for people to live in (Johnson, 2012). Shekarian and Fallahpour (2013) added that house is an asset that one can invest in, consume, long-lasting and takes up most of the income earned. Root word of affordability “afford” means possessing the capability in settling any form of obligations without sustaining any financial problems (Robinson, Scobie & Hallinan, 2006). Affordability conveys the dispute that each household experiences in order to strike a balance between its housing and non-housing expenditures which is necessary for living (Stone, 2006). Housing New Zealand Corporation (2005) stressed that affordability is not as simple as maintaining the housing costs and income levels instead it is the capability of securing a housing unit and live in it. Hence, this raise questions like what is housing affordability all about and how to measure it?

Ernst Engel, a German statistician, was said to be the first to have studied the housing affordability by analyzing the housing costs in the 1860s. Herman Schwabe, another German statistician was also found to have contributed in the housing affordability concepts by publishing the first detailed research on the housing expenses as part of the household budget. For the recent years, issues on housing affordability has been discussed and deliberated by many households especially in Australia as Australians find it hard to seek for an affordable, secure and decent housing (O'Neill et al, 2008). Shockingly, the housing affordability issue has been present as early as in the 1980s whereby it was proven by Kim and Min (2011) that housing prices in Korea escalated dramatically during that period of time. Furthermore, late 1980s Britain openly debate about the housing costs mounting and affordability issue amongst the citizens (Stone, 2006).

There is no doubt that Malaysia will not be affected by the housing booms and rigorous economic development for the past decade as Malaysians demand for housing has been driving up the prices of housing especially among urban areas (Ong & Chang, 2013). Ministry of Housing and Local Government stated that growth in Kuala Lumpur and Selangor were the main reason why the housing prices are soaring up to the sky (Suhaida et al., 2011). According to Gan and Hill (2009), reduction in affordability of all income levels especially the lower-wage earner stems from the housing market boom. A strong evidence of this event was the rapid economic growth prior to Asian Financial Crisis in 1997 that the housing prices were so high that it was unaffordable for the public (Husain, Rahman & Ibrahim, 2011).

In order to measure the presence housing affordability, several methods or indicators have been suggested by researchers around the world such as purchase affordability, repayment affordability and income affordability (Suhaida et al., 2011). Tsai and Peng (2011) define purchase affordability as the sufficient funds in the hands of the household to purchase a house. Another researcher stated that purchase affordability refers to the borrowing competency of households to secure housing and that it is one of the most imperative issues right now (McCord et al,

2011). Second indicator would be the repayment affordability which refers to the financial obligations that has to be satisfied in order to procure a house (Gan & Hill, 2009). As most households may not be able to purchase a house without taking up a loan or mortgage, repayment affordability also can be indicated by the ability of the household in repaying back (Tsai & Peng, 2011). Income affordability can be measured by the Price-Income-Ratio (PIR) which compares the current market value of the house owned with the aggregate yearly income of the household (Lau & Li, 2006). Husain, Ibrahim and Rahman (2011) added that the PIR is one of the basic markers in assessing the housing affordability and speculative housing bubbles.

2.2.4 Unemployment Rate

2.2.4.1 Rural-urban Migration and Urbanization Theory

The theory of rural-urban migration and urbanization theory was proposed by Chen, Guo and Wu (2011) during their research on the housing price in China. This theory stated that there are significant impacts of rural-urban migration and urbanization on the housing price, especially in urban areas. It can be explained that the migration of population from the rural area to the urban area will increase the demand of urban housing and cause the housing prices to increase.

This theory is formed by Chen et al. (2011) when they are investigating the determinants of housing price changes in China. The theory explained the relationship between economy growth, unemployment rate and housing demand and supply. When there is a rapid economic growth, there will be lower unemployment rate. With the higher employment opportunities, more people from the rural areas will migrate to the urban areas. This is supported by Wu, Gyourko

and Deng (2012), they stated that the urban population in China rose by more than 50%, from 373 million to over 562 million, from 1996 to 2005, where the economy growth was high. This theory summarizes that with more availability of employment opportunities, the demand and supply of urban housing will be affected and then cause the housing price changes.

Vermeulen and Van (2006) asserted that “people will migrate to another place where houses are built, but houses are not necessarily built in the area where people would want to live”. In view of the positive population growth in Malaysia, people need more houses to live in but the production of housing might be inefficient to accommodate the needs (Ong, 2013). The phenomena of rural-urban migration will affect the balance of housing demand and supply and further affect the housing prices.

This study can be related to the theory as Malaysia has a low unemployment rate throughout the recent 15 years. This can be seen a similar rural-urban migration and urbanization situation in Malaysia. Therefore, the employment opportunities available could be measured using the unemployment rate and the relationship between unemployment rate and the local housing price changes could be investigated. It can also be related to the positive Malaysian population growth that could further accelerate the rural-urban migration.

2.2.4.2 Augmented Mortensen–Pissarides Model

Mortensen-Pissarides model was a model developed by Mortensen and Pissarides (1994). In their research, Mortensen and Pissarides (1994) model a job-specific shock process in the matching model of unemployment with non-cooperative wage behavior. Their model consists of the potential large amount of job creation and job

destruction caused by idiosyncratic or specific shocks. The shocks would affect the firms to open new jobs or close existing ones.

The original Mortensen-Pissarides model found out that the job reallocation can differ during different phases of economic cycle given different levels of the parameters which are common component of price and variance of the idiosyncratic shock. The model concluded that the probability that an unemployed worker to get a job will increase and the probability that a job is destroyed will decrease when there are higher common components of labour productivity.

Branch, Petrosky-Nadeau, and Rocheteau (2014) then developed and improved the Mortensen-Pissarides model to contain a housing market and a goods market with explicit financial frictions. The housing market is where trading of housing properties can be bought or sold and housing services can be rented by households. The frictional goods market is where the consumption will be financed by the households with collateralized or unsecured loans. The augmented Mortensen-Pissarides model works by linking the labour, housing and goods markets together. Then, Branch, Petrosky-Nadeau, and Rocheteau (2014) used the model to investigate the effects of changes in households' eligibility for home equity loans on the housing prices and aggregate unemployment.

In the augmented model, it is found out that homeowners will utilize home equity as collateral to finance the idiosyncratic or unsystematic consumption opportunities. This financial innovation would reduce the unemployment and increase the housing prices. This is because the demand and supply of homes are affected as they could provide liquidity by acting as collateral for consumer loans. The model observed a sustained increase in home equity financed consumption in US was accompanied with a large house price boom and a decrease in the aggregate unemployment rate, vice versa. In overall, this augmented model suggests that the household eligibility for home equity loans will have significant impact on the unemployment rate and then housing prices.

The model can be related this study as Malaysia has observed a low unemployment rate in the previous years as well as increasing housing prices from time to time. The theory also suggests future research in the relationship of household eligibility for home equity loans and housing prices.

2.2.4.3 Rational Expectation Theory

In the early 1960s, John Muth “The father of the rational expectation revolution” developed the theory of rational expectations (Muth, 1961). It describes the outcome of an event depends on the expectation of the people. For example, the value of a currency and the rate of depreciation depends on the expectation of currency’s value to be in the future.

Rational Expectation Theory is prediction of future value of the economy based on the information about the current expectation in the economy (Sargent & Wallace, 1976). Rational expectation theory was developed in order to solve the flaws in theory of adaptive expectations. Under adaptive expectations, the prediction of future state of the economic variables is based on past values. For instance, the inflation of last year and previous years could be used to predict the current or next year inflation. Under adaptive expectations, people would assume to underestimate inflation of the economy suffers from constantly rising inflation (Sargent & Wallace, 1976). This is unrealistic as rational people will realize the trend and take action in forming their expectations.

Rational expectation can be applied to labour market (unemployment). It predicts that company and labour rely not only on past information but also predict for future where the labour market will generally be in equilibrium most of the time, so unemployment is at its natural rate (Sargent & Wallace, 1976). Although the government can come out the policy in order to reduce the unemployment rate, this will lead to higher price of the house. This is because the unemployment is at equilibrium most of the time, the intervention of government will disrupt the economy's price level (Wardhana, Azizan, Ramli & Tan, 2012). Malaysia government able to combat unemployment by imposed fiscal policy and monetary policy. Keynesian economic fiscal policy stated that government should cut the taxes and raise the income. When the income increase, the consumers will have greater demand in house or and goods, thus it increase the RGDP. In order to fulfil the demand of consumers, the developers will hire more workers as they are considered the main input of production (Wardhana, Azizan, Ramli & Tan, 2012). Therefore, the unemployment rate will be decrease but the labour cost will increase and thus the price level of the house will be increased as well. Hence, price level is adversely correlated with unemployment rate.

2.2.5 Population Growth

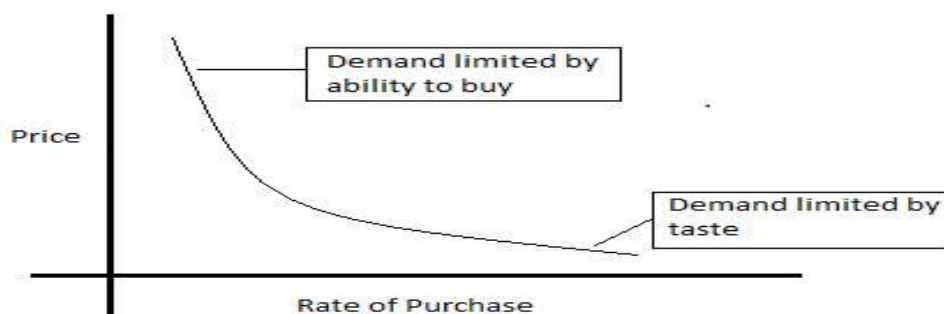
2.2.5.1 Theory of Demand

The theory of demand can be chased forward to the 1600s which demonstrated by Gregory King (1648-1712) (Gordon, Rowe, Moffatt, Woolley, & Matteo, 2015). The law of demand and elasticity was disseminated by Charles Davenant (1656-1714) (Gordon et al., 2015). The theory then left to Adam Smith (1723-1790) concepts of demand and supply with market adjustment (Gordon et al., 2015). Smith believed that a good can have two prices, which are the market price and natural

price (Gordon et al., 2015). John Stuart Mill (1806-1873) then bring demand and supply together with a theory of equilibrium price (Gordon et al., 2015). The theory then continued with Alfred Marshall (1842 – 1924) which provide graphical illustration (Gordon et al., 2015). Gordon et al. (2015) stated that the price is determined by demand and supply in Principles of Economics (1890). Alfred Marshall had restructured the demand and supply explanation, which the utility theory explain demand curve while costs explain the supply curve (Gordon et al., 2015).

Demand is defined as the rate of how much the consumers want to buy a goods (Whelan & Msefer, 1996). It has two factors, which are preference (taste) and the purchasing ability (Whelan & Msefer, 1996). Preference refers to the desire for a good, which determines the willingness of consumer to purchase good at specific price (Whelan & Msefer, 1996). Meanwhile, purchasing ability is related to the wealth, or income of consumers, which an individual must possess sufficient wealth to buy at specific price (Whelan & Msefer, 1996). The Figure 2.3 showed the simple demand curve which imply the price is the only factor that affect demand. However, Whelan and Msefer (1996) argue that this is not the only factor that will affect the demand. They believe that there will still have other factors affect the changes in demand.

Figure 2.3: Simple Demand Curve, Source from: Whelan & Msefer, 1996



There are many studies found that the demand is one of the factors affecting the house price, due to the increasing demand for own dwellings or investment.

Jacobsen and Naug (2005) stated that the house prices are determined by the supply and demand of housing, while the changes in demand will influence the house price to fluctuate in the short term. Myrmo (2012) also concluded that the increase in population growth will lead to increase in demand, hence initiate higher house prices and could bring the bubble formation in the economy. Saiz (2003) stated that the immigration does certainly increases the demand for housing. However, Saiz (2003) mentioned that the increases in house prices was due to the supply of housing market. He said that the supply is fairly inelastic in populated metropolitan areas, which immigrants will tend to live in these area, and caused the house price to grow faster. Cvijanovic (2012) also stated that the population growth leads to house price appreciation. She said that because of the immigration, builders tend to underreact to the demand from immigrants, which drives up the house prices (Cvijanovic, 2012).

2.2.5.2 Theory of Malthus Population

Malthus population theory was developed by Reverend Thomas Robert Malthus in 1809 which emphasizes on human population growth are depends on the concept of carrying capacity (Malthus, 1986). Carrying capacity refers to the number of individuals can be supported by environment.

Food is one of the assumptions in Malthus population theory. Food is necessary for everyone to survive and to be the sole of limiting factor on human population growth (Siedl & Tisdell, 1999). Besides, God gave human an unchanging force of sexual passion and thus Malthus concluded that human population increase geometrically (Siedl & Tisdell, 1999). He emphasized that population growth would be more than resource growth, because population rose drastically whereas food supply rose arithmetically (Siedl & Tisdell, 1999). However, he admitted some existing restraints on population growth which are moral restraints and institutional

effects on these moral restraints. Income equality and common ownership of property would offset any moral restraints (Bowen, 1954).

When population continue to grow human will restricted by carrying capacity (Siedl & Tisdell, 1999). Hence, demand of house will be increased as the shelter for the human. It will directly influence by the price of the house when the population is increasing. The price of the house will be increased as human population increase geometrically.

2.3 Proposed Theoretical / Conceptual Framework

Figure 2.4: Framework for the Determinants of Malaysian Housing Price Index

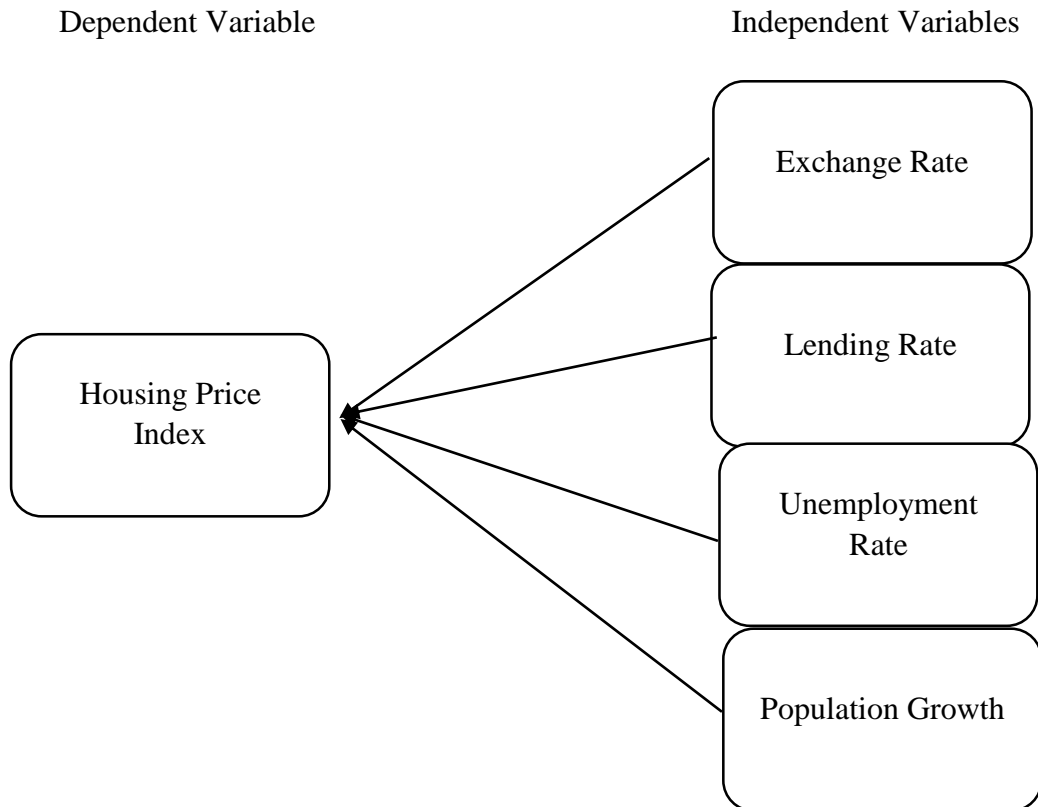


Figure 2.4 indicates that the 4 exogenous variables would have an impacts on the endogenous variable. The 4 independents variables are exchange rate, lending rate, unemployment rate and population growth, which will influence the Malaysian Housing Price Index.

2.4 Conclusion

In nutshell, in Chapter 2, each independent variable is examined by the previous researchers' studies. Each independent variables is also supported by past researchers' findings. This study will focus on Malaysia housing market. In addition, theoretical models and conceptual framework are developed for a clearer picture about the relationship between housing price index with exchange rate, lending rate, unemployment rate, and population growth, in Malaysia.

CHAPTER 3: METHODOLOGY

3.0 Introduction

Research methodology is the means to systematically resolve the research difficulties that arises and the knowledge of how a research should be done (Rajasekar, Philominathan & Chinnathambi, 2006). These methodologies or procedures are used in describing, explaining and illustrating the findings of the whole academic research (Jill & Roger, 1997). As inapt methodology will bring doubtful and questionable results as well as pessimistic impact towards the researcher's professionalism, one must have in-depth knowledge of using either qualitative or quantitative or both once engaging in research (Holden & Lynch, 2004). Collection of data using statistical methods refers to quantitative form of research while qualitative refers to the characteristics or non-numerical data that is aimed to understand its meaning, feeling or even description of a certain situation (Rajasekar, Philominathan & Chinnathambi, 2006).

This chapter will deal with the determination of research design and data sourcing. The whole chapter discusses and deliberates on the effect of using the correct method to enhance the association between endogenous variable and exogenous variables would proceed. In order to accomplish the goal of this study, this chapter comprises of the research design, data collection methods, sampling techniques, data processing and analysis methods to illustrate the results of the research.

3.1 Research Design

Research design focuses on the systematic planning of research question within a research. Greener (2008) mentioned that a research design is basically an outline of a research topic that utilizes data collection methods to determine the validity of the hypothesis made. Research design can be further categorized into quantitative or qualitative in nature. Based on the scope of this study, a quantitatively-based research design is found to be more appropriate to improve the degree of accuracy and provide an exceptional contribution to the study.

3.2 Data Collection Methods

Sekaran (2005) stated that means of gathering data are fundamental part of research design. Thus, selecting the correct independent and dependent variables are crucial and must be addressed with care. Therefore, to study the determinants of housing price in Malaysia, this study investigates the relationship between exchange rate, lending rate, unemployment rate, and population growth with relation to the housing price which is measured by MHPI obtained from NAPIC. Data of independent variables are attained from the Thomson datastream subscribed by Universiti Tunku Abdul Rahman (UTAR). This study uses the quarterly time series data in order to carry out regression model covering from year 2007Q1 until 2014Q4 with 32 observations. As shown in Table 3.1, exemplify and explain sources of each independent and dependent variable.

Table 3.1: Sources and Explanation of Data

VARIABLE	PROXY	UNIT MEASUREMENT	SOURCE	DEFINITION
Exchange Rate	ER	RM / USD	Data Stream (Oxford Economics)	Exchange rate refers to the average of the ringgit against USD for quarterly basis measured in RM/USD.
Lending Rate	LR	In percentage, %	Data Stream (IMF – International Financial Statistics)	The weighted standard rate offered by commercial banks on all loans in national currency. The rate is weighted by loan amounts.
Unemployment Rate	UR	In percentage, %	Data Stream (Oxford Economics)	Unemployed labour force at a given time frame measured in percentage.

Population Growth	PG	In percentage, %	Data Stream (Oxford Economics)	The population growth defined as the growth rate of all residents irrespective of legal status or citizenship excluding refugees which are considered as part of the population of origin country measured in percentage.
Housing Price Index	HPI	In Index	National Property Information Centre (NAPIC)	Annual change in house prices index is the housing index

3.2.1 Secondary Data

Primary data is the process of collecting information through survey, experimentation or even observation based on the variables of interest of the researcher. On the contrary, secondary data refers to the means of gathering facts through published sources like journals, articles, past records, historical data, summary or even conference papers. This study uses secondary data as it saves time and more cost-efficient as well as it is more accurate and effective compared to

tedious collection of primary data as there are six steps of market research process if the collection of data to be done primarily. Furthermore, it is trouble-free to obtain the data as its availability is within a click of a mouse. According to Church (2001), secondary data can also be converted into text, tables and appendices easily to demonstrate the original data in simplified form.

All the independent variables (ER, LR, UR and PG) are obtained directly from the Thomson datastream subscribed by UTAR while the dependent variable (HPI) is obtained from NAPIC and is analysed based on time-series data. The sample size covers 8 years of quarterly data, covering from year 2007Q1 – 2014Q4 for both dependent and independent variables, in total of 32 observations. For this study, time series data is applied, because time-series data is more convenient in forecasting as historical data reliability is exceptionally higher when the data ranges a wide time interval. Besides, time-series take into account for researches that requires identifying seasonal patterns and estimating trend as the data points can be analysed from annually to daily (Cross, n.d)

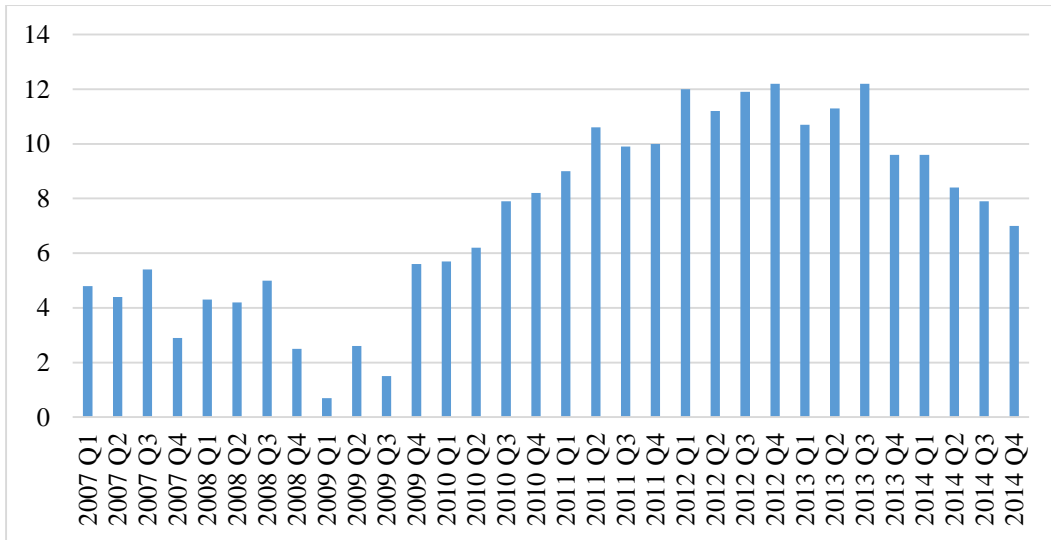
3.3 Sampling Design

3.3.1 Target Population

Respondents that meet the certain criteria set by the researches are known as the target population (Burn & Grove, 1997). This study targets the entire Malaysian citizens who are qualified to purchase a house as well as to examine the housing affordability among Malaysians. Many past researches focused more on housing market of developed and developing countries differences and similarities but not on Malaysian perspective specifically. Hence, this study will be providing an in-

depth knowledge of what drives the housing prices in Malaysian housing market particularly.

Figure 3.1: Percentage Change in 1 year from 2007 Q1 to 2014 Q4, source from NAPIC (2015). (By referring to the Appendix 3.1)



Currently, Malaysia’s residential property market is said to be experiencing a bubble and that bubble has been growing ever since the last Asian Financial Crisis in late 1997 (Ong, 2013). Based on Figure 3.1, it is observable that the percentage change from 2007Q1 to 2014Q4 has been fluctuating and not stable. Due to this instability and unpredictable trend, Malaysians are afraid that their annual income may not be able to cope up with the exorbitant housing prices. Ong and Chang (2013) stated that this increased in housing prices is due to the rapid economic growth of Malaysia. In addition, a local newspaper company, The Star (2015) reported that Malaysians are wondering whether they can even afford to pay for the instalments for a roof to shelter them.

3.3.2 Sampling Technique

In this study, E-views 8 will be used for getting empirical result in order to use the results to analyse the findings as it is most suitable in evaluating time-series data. Therefore, E-views is suitable for this study because it offers the functions of analysing time-series data, cross-sectional data, and panel data. In addition, E-views is easy to learn and understandable within short period.

For this study, E-view 8 will be used to conduct ordinary least square (OLS), multicollinearity tests (Variance Inflating Factor, Tolerance and Correlation Analysis), Autoregressive Conditional Heteroscedasticity (ARCH) test, Breusch-Godfrey LM test, Jarque-Bera test and Ramsey RESET test. Thus, it can be said that E-views would be helpful in identifying significant factors, and ensuring the empirical model is free from econometric problems, such as multicollinearity among independent variables, autocorrelation and heteroscedasticity among error terms, error terms have normal distribution and misspecification in the model. It detects these problem diagnostic checking (Variance Inflating Factor, Tolerance, Correlation Analysis, Autoregressive Conditional Heteroscedasticity (ARCH) test, Breusch-Godfrey LM test, Jarque-Bera test and Ramsey RESET test).

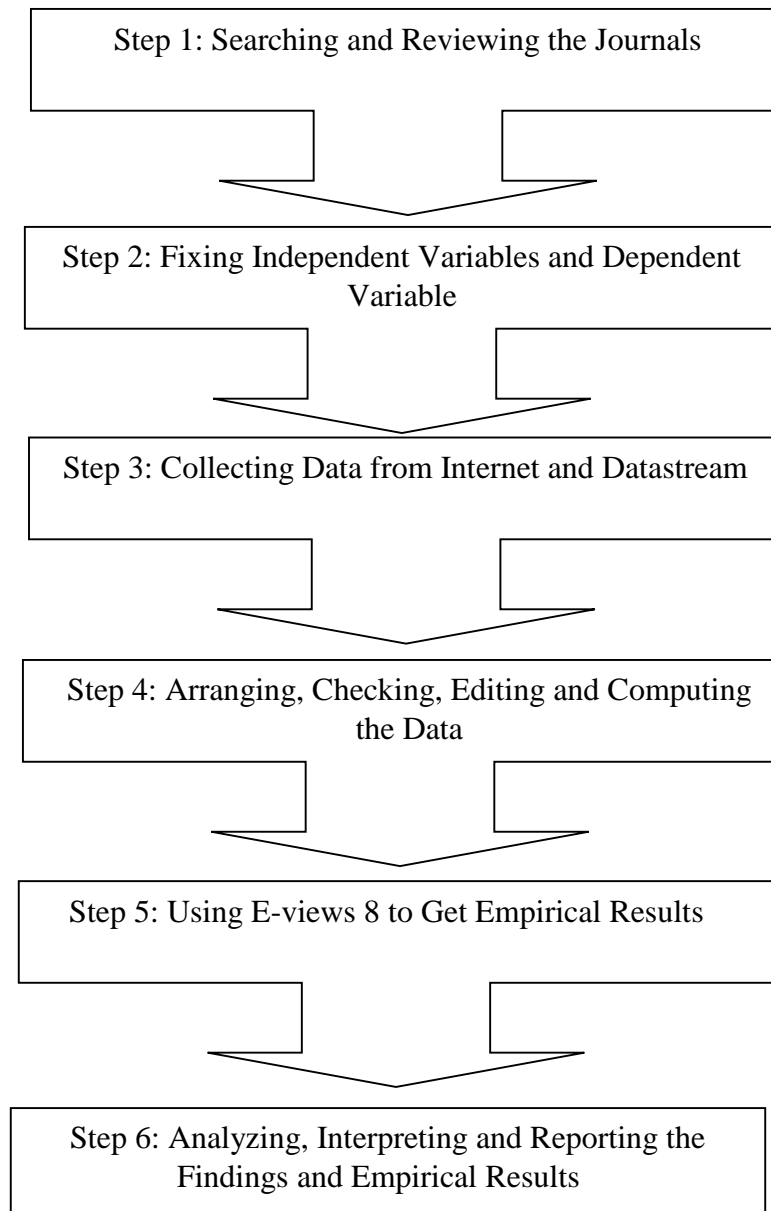
3.4 Data Processing

Data processing is a process of managing data from data preparation to data interpretation. Meaning that transforming the meaningless numerical data into useful information through some software (E-view 8). The most important steps in this process are data checking, data editing and data computing. Besides that, stating the special or unusual treatments of before starting analysing the results may prevent any misleading results from occurring.

In this study, data accuracy and consistency will be confirmed by data checking to avoid any mistakes of human or calculation. If there is any error occurred, then data editing will be applied to correct the errors. At the end, the results will be computed correctly and accurately through data computing (Using E-view 8).

In this section, data processing will describe how this study setting the dependent variable (Malaysian Housing Price Index) and independent variables (exchange rate, lending rate, unemployment rate and population growth) by reviewing the journals done by previous researchers in order to have a better comprehension and information about the determinants of housing price index. Then, describing about collecting the data of Malaysian Housing Price Index, lending rate, unemployment rate, exchange rate and population growth until interpretation of empirical results.

Figure 3.2: The Steps of Data Processing



Step 1: Searching and Reviewing the Journals.

A number of journals with the relation of determinants of housing price have been found on the database of ScienceDirect, Pro-Quest, Emerald Insight, Google Scholars and others. These journals consists of different countries, such as China, Turkey, United States, United Kingdom, Malaysia and so forth. Around 100 journals have been selected and reviewed for summary purpose.

Step 2: Fixing Exogenous Variables and Endogenous Variable

Exogenous variables and dependent variables are fixed by the discussion on the summaries of around 100 journals and data availability. Quarterly data will be used in this study, because of the data availability of dependent variable and sample size problem. In addition, there are several independent variables are selected by reading the summaries, which are money supply, lending rate, consumer price index, population, GDP per capita, income rate, KLCI and real GDP. However, in order to fulfil the requirements of quarterly data and data availability, exchange rate, lending rate, unemployment rate, and population growth are chosen for this study at the end. Malaysian Housing Price Index will be the dependent variable of this study.

Step 3: Collecting Data from Internet and DataStream

The data of independent variables are collected from the DataStream of version 5.1 and the dependent variable is collected from the National Property Information Centre (NAPIC).

Step 4: Arranging, Checking and Editing, Computing the Data

After collecting the data, the data are arranged in an excel file. A thorough checking of whether the data are in correct sequence and in column form was done. Followed by editing the name of dependent variable and independent variables in proxy from as mentioned in Table 3.1. Data editing will also be used when there is an error occurred. Lastly, computing data to detect whether there is any error in the empirical model through diagnostic checking (Multicollinearity test, Jarque-Bera test, Breusch-Godfrey serial correlation LM test, White test, Autoregressive Conditional

Heteroscedasticity (ARCH) test, Ramsey RESET test). If there is econometric problems occurred, then using data editing to correct it or E-views 8 to overcome it.

Step 5: Using E-views 8 to get the Empirical Results

After ensuring the model has no problem, then using E-views 8 to run the OLS to get the empirical results. So that, T-test, F-test can be run and R-squared and Adjusted R-squared can be obtained.

Step 6: Analysing, Interpreting and Reporting the Findings and Empirical Results

Verifying the significance of individual exogenous variables and whole model. Then, making interpretation on the results of significances of the exogenous variables and whole model, R-squared and Adjusted R-squared. In addition, making comparison of these results with past researchers and to check whether the results are consistent with the hypothesis made in chapter 1.

3.5 Multiple Regression Model

Multiple Regression Models is one type of regression analysis that uses to test the relationship among variables (Pindyck & Rubinfeld, 1998). Moreover, there is an error term existed in the model, which used to capture the omitted variables, errors of measurement in dependent variable, randomness of human behaviours and the factors that cannot be explained by independent variables (meaning that to capture unexpected events) (Gujarati & Porter, 2009). Gujarati (2012) also mentioned that

there are few assumptions on error terms, which are errors terms must be normally distributed, homoscedasticity, independent with one another as well as independent variables must be uncorrelated with error term.

For this study, multiple regression model will be formed to examine the association between housing price index with exchange rate, lending rate, unemployment rate, and population growth.

Economic Function:

HPI = f (Exchange Rate, Lending Rate, Unemployment Rate, Population Growth)

Economic Model:

$$\text{Log HPI}_t = \beta_0 + \log \beta_1 \text{ER}_t + \beta_2 \text{LR}_t + \beta_3 \text{UR}_t + \beta_4 \text{PG}_t + \varepsilon_t$$

N = 32 Observations

t = 2007 Q1 – 2014 Q4

Where,

HPI_t = Housing Price Index in Malaysia from 2007 Q1 to 2014 Q4 (Index)

ER_t = Exchange Rate of RM to USD 2007 Q1 to 2014 Q4 (RM/USD)

LR_t = Lending Rate in Malaysia from 2007 Q1 to 2014 Q4 (%)

UR_t = Unemployment Rate in Malaysia from 2007 Q1 to 2014 Q4 (%)

PG_t = Population Growth in Malaysia from 2007 Q1 to 2014 Q4 (%)

This study uses logarithm to standardize the unit measurement of all variables into percentage form and prevent outliers existed in the model. So that, there will not be huge gap in the data.

3.6 Data Analysis

Data analysis can be meant as the process of evaluating the data by running different types of tests in order to ensure the whole model and individual independents variables are significant. Therefore, there are several tests will be conducted to examine the association between HPI and ER, LR, UR and PG to achieve the objectives of this study.

Those tests are Ordinary Least Square (OLS) and diagnostic checking (Multicollinearity Test, Correlation Analysis, Autoregressive Conditional Heteroscedasticity (ARCH), Breusch-Godfrey LM, Ramsey RESET and Jarque-Bera tests).

3.6.1 Ordinary Least Square (OLS)

OLS explores the association between endogenous variable and exogenous variables. Nevertheless, OLS can only be used when all of the assumptions of Classical Normal Linear Regression Model (CNLRM) are fulfilled, as stated below:

1. The regression model is linear in the parameter.
2. The values of X are fixed in repeated sampling.
3. Variability in the values of X and no outlier in X values.
4. No multicollinearity among the independent variables.
5. Zero covariance between independent variables and error terms.
6. Zero mean value of error terms.
7. Homoscedasticity among the error terms.
8. No autocorrelation among the error terms.
9. The number of observations must be larger than the number of parameters to be estimated ($N > K$).
10. The error terms have normal distribution.
11. No specifications bias.

Only the 11 assumptions are fulfilled, then the OLS will be BLUE, otherwise it may lead to misleading results (Gujarati, 2012).

BLUE concept means Best, Linear, Unbiased and Efficient (Gujarati, 2012). The meaning is defined as following:

-Best means that the estimators have minimum variance.

-Linear means that linear in parameters.

-Unbiasedness means that the expected values are approximately or equal to the true values.

-Efficient means that the estimators are correct, accurate and reliable.

Misleading results are typically caused by multicollinearity, heteroscedasticity, autocorrelation and normality assumption has not met. Hence, this study will use E-views 8 to perform diagnostic checking to prevent these econometric problems from stemming.

This study will form a regression model on housing price index with exchange rate, lending rate, unemployment rate, and population growth by using OLS in E-views 8.

3.6.1.1 T-test Statistics

$$H_0: \beta_1 = 0, \beta_2 = 0, \beta_3 = 0, \beta_4 = 0 \quad (\text{insignificant})$$

$$H_1: \beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0, \beta_4 \neq 0 \quad (\text{significant})$$

Where, β_1 = Exchange Rate (ER)

β_2 = Lending Rate (LR)

β_3 = Unemployment Rate (UR)

β_4 = Population Growth (PG)

The t-test assesses the mean of two groups are statistically difference from each other. William Sealy Gosset, who is the founder of Student's t-test, he created and proposed t-test to solve the problem associated with small sample size ($n < 30$). This is because having small sample size may cause the estimated mean and standard deviation to be different from actual mean and standard deviation (Student's t-test,

n.d.). Therefore, the assumption of t-test is the population standard deviation is unknown and normally disturbed.

Typically, t-test is applied to examine the significant association between exogenous variables with endogenous variable. The null hypothesis of t-test represents that the exogenous variable and the endogenous variable have no an important association in between. Meanwhile, the alternative hypothesis represents that exogenous variable is statistically important to endogenous variable. Hence, if t-test statistics exceeds the critical value, it indicated that the means are significantly different at the level of probability. If the t-value is more than $p = 0.05$, then there is 95% chance of the means being significant different which also means that if p is less than the significance level of 5%, then null hypothesis will be rejected. Or else, null hypotheses will not be rejected in this study.

Therefore, this study will test exchange rate, lending rate, unemployment rate, and population growth individually to examine their individual significances on housing price index in Malaysia by using t-test.

3.6.1.2 F-test Statistic

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ (insignificant)

$H_1: \beta_i \neq 0$, at least one of β_i is different from zero (significant to Y), where $i = 1, 2, 3 \text{ \& } 4$

Where, Y = Housing Price Index in Malaysia (HPI)

$\beta_1 = \text{Exchange Rate (ER)}$

$\beta_2 = \text{Lending Rate (LR)}$

$\beta_3 = \text{Unemployment Rate (UR)}$

β_4 = Population Growth (PG)

F-test assess the variances of two population are equal. Snedecor and Cochran are developed the F-test in 1983 (Engineering statistics handbook, n.d.). Analysis of variance (ANOVA) normally is used to control one or more independent variables and observe the effects on the dependent variables to see the response of the independent variables (Engineering statistics handbook, n.d.). The assumption of F-test is the populations are normally disturbed and samples are randomly selected. Besides, the sample size must as large enough and the population must have the same variance.

Therefore, F-test is used to determine the significance of the whole model. Null hypothesis indicated that none of the exogenous variables is significant to endogenous variable, whereas alternative hypothesis represents that at least one of the exogenous variables is significant to endogenous variable. For example, if F-test statistics is larger than critical value, then the null hypothesis will be rejected, which indicated that at least one of the predictors is linearly associated to the response. It can also be said that if p is less than the significance level of 5%. Then, the null hypothesis will be rejected. Or else, null hypotheses will not be rejected in this study.

Thus, this study will test the significance of the whole model on the determinants of housing price index by using F-test.

3.6.2 Diagnostic Checking

3.6.2.1 Multicollinearity

Multicollinearity measure the relationship between 2 or more explanatory variables (Abdi, 2007). If multicollinearity happens, it is hard to express which explanatory variables are influencing the dependent variable. Multicollinearity will lead to high standard errors of estimated coefficients.

Therefore, there are 4 ways to detect multicollinearity in a model. Firstly, if the results of the model show that there is a high R-squared in the model, but few significant independent variables have impacts on dependent variable. Then, the model may have multicollinearity (Gujarati, 2012).

Secondly, the second detection method of multicollinearity is high pair-wise correlation between 2 independent variables. This is because correlation test can be used to measure the degree of correlation among the two or more random variables and range from -1 to +1. The positive correlation between X_1 and X_2 implies that the correlation is between 0 and 1 ($0 < r_{1,2} < 1$), which means that X_1 and X_2 will move in same direction. The negative correlation between X_1 and X_2 implies that the correlation is between -1 and 0 ($-1 < r_{1,2} < 0$), which means that X_1 and X_2 will move in opposite direction. Hence, if the correlation between 2 independent variables is more than 0.8 (ignoring the positive and negative signs), then there may be a potential of serious multicollinearity happened in the model.

The last 2 methods are variance inflation factor (VIF) and tolerance (TOL), which can detect the severity of multicollinearity (Abdi, 2007). Running the least square test, but using one of the exogenous variable as endogenous variable on the remaining regressors in the model to get the R-squared, and then inserting the

coefficient of determination into the formula of VIF or TOL, so that the results of VIF and TOL can be obtained (Repeating the same steps for each independent variable). The larger the value of VIF, the more serious multicollinearity between the regressors existed in the model. If the VIF exceeds 10, which indicated that there is a serious multicollinearity happened in the model (Gujarati, 2012). Otherwise, there is no serious multicollinearity between two or more explanatory variables. If VIF is equal to 1, meaning that there is no multicollinearity between two or more explanatory variables.

$$VIF_{x_1, x_2} = \frac{1}{(1-r^2_{x_1, x_2})}$$

TOL is the inverse method of VIF. When TOL is equal to 1, the regression model is not experiencing any multicollinearity. When TOL is equal to 0, the regression is experiencing severe multicollinearity (Gujarati, 2012).

$$TOL = \frac{1}{VIF}$$

In this study, these 4 methods would be applied to detect whether there is any linear relationship among exchange rate, lending rate, unemployment rate, and population growth.

3.6.2.2 Heteroscedasticity

H₀: Homoscedasticity among the error terms

H₁: Heteroscedasticity among the error terms

One of the important assumptions of OLS estimator to be derived and used is that there should be homoscedasticity. Homoscedasticity presents when the error terms are not correlated with each other as well as have the same variance. Mathematically this assumption can be stated as:

$$\begin{aligned} \text{var}(u_i | X) &= \sigma^2 \quad \text{and} \\ \text{cov}(u_i, u_j | X) &= 0 \quad \text{for } i \neq j \end{aligned}$$

Thus, if error terms have different variances, then heteroscedasticity exists. Heteroscedasticity is usually caused by several reasons which includes multiple independent variables (IVs) used which increases the errors or caused by measurement error and model mis-specification. About the consequences of heteroscedasticity are the OLS estimates will no longer BLUE although it is unbiased in parameter estimates. This is because OLS does not give the estimate with the smallest variance. It may lead to either too low or too high significance tests as the standard errors are biased if they are heteroscedastic. Then, the model will get biased test statistics and confidence intervals which can cause the data analysis to be inaccurate and inefficient. Therefore, there are various detection method to detect the heteroscedasticity, such as Park test, Glejser test, White test, Goldfeld-Quandt test, Breusch-Pagan-Godfrey test and Autoregressive Conditional Heteroscedasticity (ARCH) test.

To prevent the problem of heteroscedasticity existed in the model, this study will carry out the ARCH test to detect whether there is heteroscedasticity problem exists

in the model, because ARCH test is only applicable for time series data. Null hypothesis means homoscedasticity, whereas alternative hypothesis is heteroscedasticity. Therefore, if test statistics is greater than critical value or p-value is less than the significance level of 5%, then the null hypothesis will be rejected. Or else, the null hypothesis will not be rejected. If heteroscedasticity is detected in the model, then White's Heteroscedasticity-Corrected Variances and Standard Error method will be used to solve this problem.

Autoregressive Conditional Heteroscedasticity (ARCH) test

The impact of Autoregressive Conditional Heteroscedasticity (ARCH) is related with an association within the heteroscedasticity. Since the application of ARCH models was started by Engle (1982), it has been given much attention and commonly employed by researchers in modelling financial time series that shows time varying volatility clustering.

In short, ARCH effect explained that the variance of the current error term is related to the size of the previous periods' error terms. Thus, ARCH test is suitable to detect heteroscedasticity in this study which consists of quarterly time series data of eight years.

Given the following ARCH model:

$$Y_t = \beta_0 + \beta_1 X_t + u_t$$
$$u_t \sim N(0, \alpha_0 + \alpha_1 u_{t-1}^2)$$

It implies that the error term, u_t is normally distributed with zero mean and conditional variance depending on the squared error term lagged one time period.

The conditional variance is the variance given the values of the error term lagged once, twice etc:

$$\sigma_t^2 = \text{var}(u_t \mid u_{t-1}, u_{t-2}, \dots) = E(u_t^2 \mid u_{t-1}, u_{t-2})$$

where σ_t^2 is the conditional variance of the error term.

The ARCH effect is then modelled by:

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2$$

This is an ARCH (1) model as it contains only a single lag on the squared error term, however it is possible to extend this to any number of lags, if there are q lags it is termed an ARCH(q) model.

Steps for ARCH test:

1. Run the regression of the model using Ordinary Least Squares (OLS) and collect the residuals. Square the residuals.
2. Run the following secondary regression:

$$u_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \alpha_2 u_{t-2}^2 + \dots + \alpha_p u_{t-p}^2 + v_t$$

Where u is the residual from the initial regression and p lags are included in this secondary regression. The appropriate number of lags can either be determined by the span of the data (i.e. 4 for quarterly data) or by an information criteria. Collect the statistic from this regression.

3. Compute the statistic T^* , where T is the number of observations. It follows a chi-squared distribution with p degrees of freedom. The null hypothesis is that there is no ARCH effect present.

3.6.2.3 Autocorrelation

H_0 : No autocorrelation among the error terms

H_1 : Autocorrelation among the error terms

Autocorrelation can be defined as the correlation of a time series with the past and future values. Autocorrelation can be called “lagged correlation” or “serial correlation” which refers to the disturbance term for any observations is related to the disturbance term of other observations. If autocorrelation happened, it violates the assumption of CLRM. Consider the regression of output on labour and capital inputs in year 2011. If the production of output decrease because of the flood happened in 2011. Since labour and capital were not affected by the flood, the shock in 2011 will affect the output of 2011. The disruption of output in 2011 is not explained by labour and capital and thus it captured by the disturbance term. If there is autocorrelation, the output disruption (shock) will be carried to 2012 and future. The positive autocorrelation will tend to have the same sign from one period to the next. For example, the probability of tomorrow being hotter is greater if today is dry than today is rainy. Negative autocorrelation indicates that the error term has a tendency to switch signs from negative to positive and back again in consecutive observation.

Spatial autocorrelation is measured by the degree of the data value attributable to their relatively close locational position (Basu & Thibodeau, 1998). House price may experience spatial autocorrelation such as the neighbourhoods tend to develop

at the same time and similar design and the neighbourhood residential properties share location amenities (Basu & Thibodeau, 1998).

In addition, autocorrelation normally will occur in time series data the model omits relevant independent variables, applied incorrect functional form, and data manipulation or data problem. Therefore, when the model omitted relevant independent variables and incorrect functional form, then leading to the estimated parameters become biased, inefficient and inconsistent. However, when there are data manipulation or data problem the estimated parameters will remain unbiased, inefficient and consistent. Thus, autocorrelation problem can be detected by Durbin-Watson Test, Durbin's h Test and Breusch-Godfrey LM Test.

Since Durbin-Watson Test has some limitations, such as providing inconclusive results and only applicable for first order of series correlation and Durbin's h test has lagged dependent variable problem. Thus, this study will use Breusch-Godfrey LM test to detect whether there is autocorrelation among the error terms.

Null hypothesis indicated that there is autocorrelation among the error terms, whereas the alternative hypothesis means that there is autocorrelation existed among the error terms. Therefore, if the test statistics is greater than critical value or p-value is less than the significance level of 5%, then the null hypothesis will be rejected. Or else, the null hypothesis will not be rejected. If autocorrelation problem is detected, then Newey-West Method will be used to overcome this problem.

3.6.2.4 Normality Test

H₀: Error terms are normally distributed

H₁: Error terms are not normally distributed

As this study is dealing with large samples, the normality of the residuals is less important as long as this study meet the assumptions to the mean and variance-covariance structure of the residuals. However, this study will still carry out the following test to make sure to meet the normality assumption.

Jarque–Bera test

Jarque-Bera test can be carried out simply using the E-views software. Jarque-Bera test can test whether the sample skewness and sample kurtosis matches the skewness and kurtosis of a normal distribution.

The Jarque-Bera test statistic is defined as:

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

Where N denotes the sample size, S denotes the sample skewness, and K denotes the sample kurtosis. The p-value is calculated using a table of distribution quantiles.

In this study, normality test will be done by E-views 8. Null hypothesis indicated that error terms have a normal distribution, whereas the alternative hypothesis means that error terms do not have a normal distribution. Therefore, , if the test statistics is greater than critical value or p-value is less than the significance level of 5%, then the null hypothesis will be rejected. Or else, the null hypothesis will not be rejected. If the error terms are not normally distributed.

3.6.2.5 Model Specification

H₀: Model is precisely specified

H₁: Model is not precisely specified

Model specification is one of the most important diagnostic checking of data analysis. Model specification error might be caused by omission of relevant variables, inclusion of unnecessary variables, adopting the wrong functional form and errors of measurement (Gujarati, 2012). Serious model specification can lead to biased estimators and other problems such as multicollinearity, heteroscedasticity and autocorrelation. Model specification can be detected through Ramsey Regression Equation Specification Error Test (RESET) test. Ramsey (1969) proposed a general functional form misspecification test, Regression Specification Error Test (RESET), which has proven to be useful. The test can be carried out using the E-views software.

In this study, Ramsey RESET test will be done by E-views 8. Null hypothesis indicated that model is precisely specified, whereas the alternative hypothesis means that model is not accurately specified. Therefore, , if the F-test statistics is greater than critical value or p-value is less than the significance level of 5%, then the null hypothesis will be rejected. Or else, the null hypothesis will not be rejected.

3.7 Conclusion

In conclusion, there will be some tests for the relationships between exchange rate, lending rate, unemployment rate, and population growth with housing price index in Malaysia. The data type of this study is secondary data, which applies time series data, investigation period is from 2007Q1 to 2014Q4 and the frequency is quarterly. In total of 32 observations are taken from each independent variables (exchange rate, lending rate, unemployment rate, and population growth) and dependent variable (HPI) for this study. The data of independent variables are collected from DataStream with version 5.1 and the data of dependent variable is collected from NAPIC. Apart that, this study also provide data processing to make the picture on how this study will convert the meaningless data into useful information by using sampling techniques of E-views 8. Furthermore, this study will use OLS, t-test, F-test to explore the association between endogenous variable and exogenous variables, knowing the significance of each individual exogenous variable on endogenous variable and the reliability of the whole model. On the other hand, there will be a series tests of diagnostic checking for the model to avoid econometric problems happen in the model, such as multicollinearity test, Autoregressive Conditional Heteroscedasticity (ARCH) test, Breusch-Godfrey LM test, Ramsey RESET and Jarque-Bera tests. Lastly, the empirical result will be deliberated in Chapter 4.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

As mentioned in the third chapter, Ordinary Least Square (OLS) Regression has been chosen as the main method in this study to examine the housing price market from first quarter of 2007 to last quarter of 2014 in Malaysia. The analysis of this study consists of 32 observations and is following on quarterly performance.

This chapter will discuss about the methodologies of hypothesis testing (T-test and F-test) and diagnostic checking (Multicollinearity, Heteroscedasticity, Autocorrelation, Normality of the error term and Model Specification). Diagnostic checking is used to ensure the estimated parameters are unbiased, efficient and consistent, thus the model would be free of econometric problems. Hypothesis testing is used to test the significances of exchange rate, lending rate, unemployment rate, and population growth on housing price in Malaysia.

Economic Model:

$$\text{HPI}_t = \beta_0 + \beta_1 \text{ER}_t + \beta_2 \text{LR}_t + \beta_3 \text{UR}_t + \beta_4 \text{PG}_t + \varepsilon_t \quad \text{(Model 4.1)}$$

$$\text{Log HPI}_t = \beta_0 + \log \beta_1 \text{ER}_t + \beta_2 \text{LR}_t + \beta_3 \text{UR}_t + \beta_4 \text{PG}_t + \varepsilon_t \quad \text{(Model 4.2)}$$

Estimated Economic Model:

$$\text{Log } \widehat{\text{HPI}}_t = \widehat{\beta}_0 + \log \widehat{\beta}_1 \text{ER}_t + \widehat{\beta}_2 \text{LR}_t + \widehat{\beta}_3 \text{UR}_t + \widehat{\beta}_4 \text{PG}_t + \widehat{\varepsilon}_t \quad \text{(Model 4.3)}$$

N = 32 Observations

t = 2007 Q1 – 2014 Q4

Where,

HPI_t = Housing Price Index in Malaysia from 2007 Q1 to 2014 Q4 (Index)

ER_t = Exchange Rate of RM to USD 2007 Q1 to 2014 Q4 (RM/USD)

LR_t = Lending Rate in Malaysia from 2007 Q1 to 2014 Q4 (%)

UR_t = Unemployment Rate in Malaysia from 2007 Q1 to 2014 Q4 (%)

PG_t = Population Growth in Malaysia from 2007 Q1 to 2014 Q4 (%)

Housing Price represents both the housing price of Malaysia measured in index point (MHPI) and is also the dependent variable (DV) in this regression model. Exchange Rate, Lending Rate, Unemployment Rate and Population Growth are the independent variables (IV) in this regression model where Exchange Rate is measured in currency of Ringgit Malaysia to 1 US Dollar, Lending Rate, Unemployment Rate and Population Growth are measured in percentage.

Diagnostic checking would also be carried out in this chapter to check the estimated regression model. Any econometric problems that exists in the estimated model, would then be solved using the various methods and tests available such as the white test, Newey-West test and many more Hypothesis testing would also be conducted to confirm whether the result is consistent with the previous researches and theories.

4.1 Description of the Empirical Models

Several econometric models will be applied to illustrate and evaluate the relationship between housing price index with exchange rate, lending rate, unemployment rate, and population growth in Malaysia from 2007 Q1 to 2014 Q4.

The empirical model that was used to estimate the relationship earlier is stated as below:

$$\text{Log } \widehat{\text{HPI}}_t = \widehat{\beta}_0 + \log \widehat{\beta}_1 \text{ER}_t + \widehat{\beta}_2 \text{LR}_t + \widehat{\beta}_3 \text{UR}_t + \widehat{\beta}_4 \text{PG}_t + \widehat{\varepsilon}_t \quad (\text{Model 4.3})$$

N = 32 Observations

t = 2007 Q1 – 2014 Q4

Where,

HPI_t = Housing Price Index in Malaysia from 2007 Q1 to 2014 Q4 (Index)

ER_t = Exchange Rate of RM to USD 2007 Q1 to 2014 Q4 (RM/USD)

LR_t = Lending Rate in Malaysia from 2007 Q1 to 2014 Q4 (%)

UR_t = Unemployment Rate in Malaysia from 2007 Q1 to 2014 Q4 (%)

PG_t = Population Growth in Malaysia from 2007 Q1 to 2014 Q4 (%)

Model 4.2 is the fundamental model. Housing price is predicted by using the 4 exogenous variables (ER, LR, UR and PG). Exchange rate is measured by Ringgit Malaysia against US Dollar, whereas the remaining independent variables (LR, UR and PG) are measured in percentage form. An error term denoted by ε_t is inserted into the equation to take into account of the random errors that would stem out upon testing.

4.2 Data and Descriptive Statistics

Table 4.1: Descriptive Statistics (By referring to Appendix 4.1)

	HPI	EXCRATE	LR	PG	UR
Mean	157.7563	3.261445	5.184062	1.718125	3.195938
Median	148.1500	3.230290	4.905000	1.715000	3.105000
Maximum	213.6000	3.625920	6.550000	1.860000	4.020000
Minimum	123.4000	3.018550	4.500000	1.560000	2.730000
Std. Dev.	30.29387	0.176995	0.660136	0.089133	0.282727
Skewness	0.542939	0.424522	0.961718	-0.025012	1.006870
Kurtosis	1.855576	2.044595	2.368946	1.839189	3.717509
Observations	32	32	32	32	32

For this study, 32 observations, comprises of time-series quarterly data, are taken from the housing price index which includes all types of houses in Malaysia from year 2007 to 2014.

Based on the table 4.1, the results found that the average housing price index in Malaysia is 157.7563. Highest reading reached 213.60 while the lowest reading is 123.40. This has led to the large standard deviation of 30.29 as the housing price index, which can be approximated to 8 years. The wide range of sampled data used is the main reason that caused the standard deviation to be huge but this does not raise an issue. The median housing price index is approximately 148.15. In addition, the housing price index is skewed to the left because the skewness is more than zero, which is 0.542939. The data of housing price index in Malaysia is less volatile because the Kurtosis is less than 3, only 1.855576.

Apart from that, the average exchange rate of RM to USD was RM 3.26/USD. The RM to USD peaked to RM 3.63/USD and the currency pair achieved the lowest reading of RM 3.02/USD from 2007 Q1 to 2014 Q4. Hence, the standard deviation was 0.176995. The median of exchange rate of RM/USD is RM 3.23/USD. In addition, the skewness of exchange rate of RM to USD is skewed to the left as the skewness is more than zero, which is 0.424522. The data of exchange rate of RM to USD is less volatile because the Kurtosis is less than 3, only 2.044595.

Moreover, the average lending rate was 5.18%. The highest lending rate from 2007 Q1 to 2014 Q4 was 6.55% while the lowest was 4.5%. Hence, the standard deviation was 0.661036. The median of lending rate was 4.91%. In addition, the skewness of lending rate is left-skewed, because the skewness is more than zero, which is 0.961718. The data of lending rate is less volatile because the Kurtosis is less than 3, only 2.368946.

Furthermore, the average unemployment rate was 3.20%. The highest unemployment rate from 2007 Q1 to 2014 Q4 was 4.02%, but the lowest was 2.73%. Hence, the standard deviation was 0.282727. The median of unemployment rate was 3.11%. As the skewness is more than zero (1.006870), skewness of unemployment rate is left-skewed. The data of unemployment rate is more volatile, because the Kurtosis is more than 3, around 3.717509.

Lastly, the average population growth was 1.72%. The highest population growth from 2007 Q1 to 2014 Q4 was 1.86%, but the lowest was 1.56%. Hence, the standard deviation was 0.089133. The median of population growth was 1.72%. In addition, the skewness of population growth is right-skewed, because the skewness is less than zero, which is -0.025012. The data of population growth is less volatile, because the Kurtosis is less than 3, only 1.83918.

4.3 Model Estimation and Interpretation

Model 4.2 will now be tested using the OLS regression method in order to test the model with EViews 8.0 for further hypotheses testing and diagnostic checking using the data that collected previously.

Table 4.2 (refer to Appendix 4.2.) demonstrates the initial regression output conducted using EViews 8.0 which can be used to define the economic *Model 4.3*, stated as the following:

$$\text{Log HPI}_t = \widehat{\beta}_0 + \log \widehat{\beta}_1 \text{ER}_t + \widehat{\beta}_2 \text{LR}_t + \widehat{\beta}_3 \text{UR}_t + \widehat{\beta}_4 \text{PG}_t + \widehat{\varepsilon}_t \quad (\text{Model 4.3})$$

Table 4.2 Initial Regression Output (By referring to Appendix 4.2.)

Variables	Coefficient	Standard Error	t-statistics	P-value
$\widehat{\beta}_0$	9.168901	(0.171882)***	53.34411	0.0000
log ER_t	0.038106	(0.111165)	0.343792	0.7344
LR_t	0.103051	(0.018257)***	5.644464	0.0000
UR_t	0.011222	(0.026458)	0.424144	0.6748
PG_t	-2.758874	(0.156099)***	-17.67384	0.0000

Notes: *** For significance level at 1%

** For significance level at 5%

* For significance level at 10%

$$R^2 = 0.983750 \quad \bar{R}^2 = 0.981342$$

4.3.1 Interpretation of Beta

$$\widehat{\beta}_0 = 9.1689$$

By assuming all the exogenous variables are equal to zero, on average, the Malaysian housing price index will rise by 9.1689%.

$$\widehat{\beta}_1 = 0.03811$$

If exchange rate of RM against USD increases by 1 percent, on average, the housing price index will rise by 0.03811%, by holding other variables constant. (MYR depreciates, USD appreciates)

$$\widehat{\beta}_2 = 0.1031$$

If lending rate increases by 1 percentage point, on average, housing price index will rise by 10.31%, by holding other variables constant.

$$\widehat{\beta}_3 = 0.01122$$

If unemployment rate increases by 1 percentage point, on average, housing price index will rise by 1.122%, by holding other variables constant.

$$\widehat{\beta}_4 = -2.7589$$

If population growth increases by 1 percentage point, on average, the housing price index will drop by 275.89%, by holding other variables constant.

4.3.2 Interpretation of R-squared, and Adjusted R-squared and Standard Error

$$\text{Standard Error} = 0.025454$$

The sample size for this study is at 32 with a standard error of 0.025454 as shown in Table 4.1. Borg and Gall (1979) stated that sample size larger than thirty is considered large enough to illustrate the significance of the model. To support this statement, this study conducts the standard error-to-mean ratio which is 0.50 % (0.025454 / 5.043892). In addition, it is known for a fact that the lower the standard error-to-mean ratio, the better the model.

$$R^2 (\text{Goodness of Fit}) = 0.98375$$

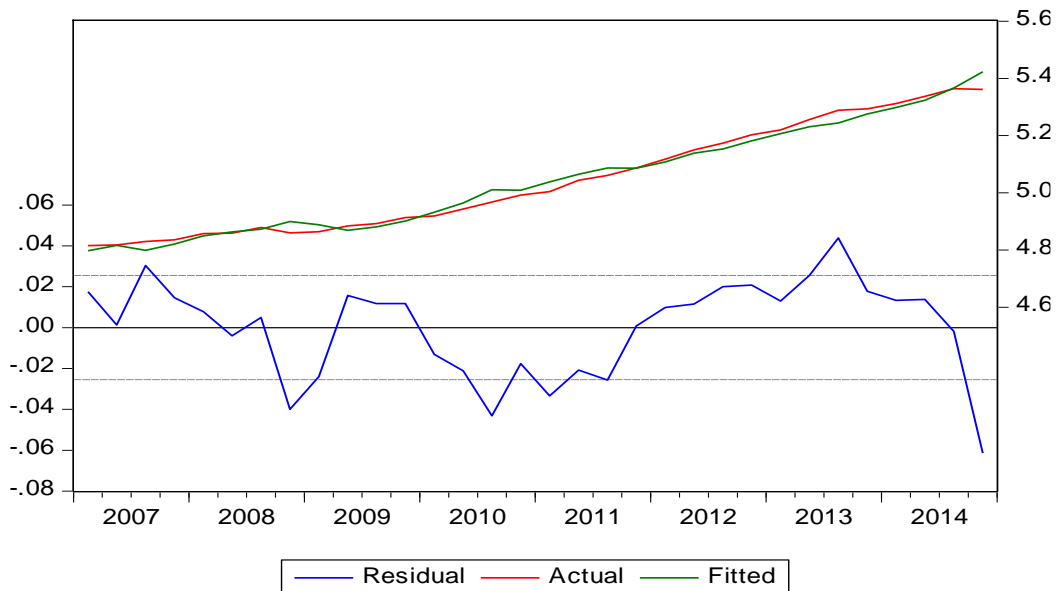
R^2 is found to be 0.983750. This indicates that 98.375 % of the variation in Malaysian housing price index may be described by the variation in exchange rate, lending rate, unemployment rate, and population growth.

$$\bar{R}^2 = 0.981342$$

Adjusted R^2 is found to be 0.981342. This indicates that 98.13 % of the variation in Malaysian housing price index may be described by the variation in exchange rate, lending rate, unemployment rate, and population growth, after the number of exogenous variables and degree of freedom are counted into account. Therefore, it can be said that this model is reliable and fit into this study, as the R-squared and adjusted R-squared are greater than 0.80.

4.3.2.1 Reason of Carrying High R-squared

Figure 4.1: Plot of Residual, Actual and Fitted Lines, from 2007Q1 to 2015Q4
(By referring to Appendix 4.3)



As stated by Frost (2013), residual is equal to the differences between actual values and fitted values. The smaller the values between actual and fitted values, the better the model fits the data fits. Meaning that the model is reliable and unbiased based on the figure 4.1.

From the figure 4.1, it showed that the residual values are fallen in the range between 0.04 to -0.08. The values are relatively small, which means there is no much deviation and proved that the model is reliable and unbiased. This is because the pattern of residual shown was random and fluctuating (Frost, 2013). Therefore, the R-squared of this model is high, about 98.38%

As said by Frost (2016), there are few reasons that a model will have high R-squared. Firstly, combining different models to reach at the final model. This could be, because before running the regression analysis, this study has included many

possible variables and tried the different combinations of variables by reviewing past researches to know the relationships, coefficient signs and effect magnitude of housing price with exchange rate, lending rate, unemployment rate, and population growth to come out the final model.

Secondly, there may be correlation existed among the variables, but this reason is invalid, because it has been proven in session 4.5.1, there is no serious multicollinearity happened among the variables (Frost, 2016).

Thirdly, using time series data will help to produce high R-squared, if the endogenous variable and exogenous variables both have significant trend over time (Frost, 2016). This is already proven by t-test in session 4.4.1. Lending rate and population growth both have significant impacts on housing price in Malaysia over time. For example, lending rate will affect the availability of credit to household in Malaysia, because if the lending rate is high will cause the demand of housing to drop, because household will not choose to borrow and invest, they will choose to deposit instead, consequently lead the housing price to drop (Ong, 2013). In addition, Ong (2013) said that population growth is significant to the housing price in Malaysia. This is because nowadays the population in Malaysia keeps increasing, but the housing production is slow, due to many laws and regulations and procedures to house suppliers. Therefore, people will move to the areas where houses are built. Limited supply of house leads to housing price to increase. Since the house price nowadays is too expensive, therefore a lot of Malaysians choose to rent a house (Ong, 2013). Therefore, the model of this study carrying a high R-squared is possible and reliable.

4.4 Hypotheses Testing

In order to ensure the estimated regression model is free from econometric problems, hypotheses testing would be conducted and results are interpreted accordingly. Furthermore, several diagnostic checking tests would be carried out such as multicollinearity, autocorrelation, heteroscedasticity, model specification and normality of error term to ensure that model is significant with the study. For every econometric problem that exists, solution(s) will then needed to be developed to solve them either by reducing or even removing the problem(s) completely.

4.4.1 T-test

This particular test would identify the significance of each explanatory variable with the housing price index by comparing the p-value of t-test at the significance level of 5%.

4. 4. 1. 1 Exchange Rate (ER)

Hypothesis:

H₀: Housing price index and exchange rate of RM against USD have no important association in Malaysia.

H₁: Housing price index and exchange rate of RM against USD have an important association in Malaysia.

Decision Rule:

Reject H₀, if p-value of test statistics is less than the significance level of 5%. Or else, do not reject H₀.

Decision-Making:

Do not reject H₀, because p-value of test statistic is 0.7344, which is larger than the significance level of 5%.

Conclusion:

Based on the above result, housing price index and exchange rate of RM against USD have no important association in Malaysia at the significance level of 5% with sufficient evidence. Meaning that exchange rate of RM against USD is not statistically important in describing housing price index in Malaysia. This is because exchange rate is not the factor that affects Malaysian to decide to buy a house. Malaysian would consider lending rate rather than exchange rate. Hence, Le (2015) interest rate and exchange rate do not granger caused housing price in Malaysia.

4.4.1.2 Lending Rate (LR)

Hypothesis:

H₀: Housing price index and lending rate have no important association in Malaysia.

H₁: Housing price index and lending rate have an important association in Malaysia.

Decision Rule:

Reject H₀, if p-value of test statistics is less than the significance level of 5%. Or else, do not reject H₀.

Decision-Making:

Reject H₀, because p-value of test statistics is 0.0000, which is lesser than the significance level of 5%.

Conclusion:

Based on the above result, housing price index and lending rate have an important association in Malaysia at the significance level of 5% with sufficient evidence. Meaning that lending rate is statistically important in describing housing price index in Malaysia. The lending rate is positively correlated with housing price, because the higher the lending rate, the higher the financing costs and lesser capital to be used in the projects of house building (Guo & Wu, 2013). As a result, the supply of housing decreases, then the housing price increases (Haron & Liew, 2013).

4.4.1.3 Unemployment Rate

Hypothesis:

H₀: Housing price index and unemployment rate have no important association in Malaysia.

H₁: Housing price index and unemployment rate have an important association in Malaysia.

Decision Rule:

Reject H₀, if p-value of test statistics is less than the significance level of 5%. Or else, do not reject H₀.

Decision-Making:

Do not reject H₀, because p-value of test statistics is 0.6748, which is larger than the significance level of 5%.

Conclusion:

Based on the above result, housing price index and unemployment rate have no important association in Malaysia at the significance level of 5% with sufficient evidence. Meaning that unemployment rate is not statistically important in describing Malaysian housing price index, because people would buy a house when they could afford the mortgage loan. If people have job, but with low income, they also would not buy a house, they would rent a house (Lau & Li, 2006). Inversely, if people have high income, they would also not buy a house until finding a preferable house (Mulder, 2006).

4.4.1.4 Population Growth (PG)

Hypothesis:

H₀: Housing price index and population growth have no important association in Malaysia.

H₁: Housing price index and population growth have an important association in Malaysia.

Decision Rule:

Reject H₀, if p-value of test statistics is less than the significance level of 5%. Or else, do not reject H₀.

Decision-Making:

Reject H₀, because p-value of test statistics is 0.0000, which is lesser than the significance level of 5%.

Conclusion:

Based on the above result, housing price index and population growth have an important association in Malaysia at the significance level of 5% with sufficient evidence. Meaning that population growth is statistically significant in describing housing price index in Malaysia. This is because population growth included immigrants. Immigrants normally would rent a house, because they are just for short term living (Mulder, 2006).

4.4.2 F-test

Unlike the t-test, F-test examines the overall significance of the model as a whole by including all the independent variables which are exchange rate, lending rate, unemployment rate, and population growth. The result for the test is as the following:

Hypothesis:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ (The model is insignificant)

H_1 : At least one of the β_i is different from zero, where $i = 1,2,3,4$ (At least one exogenous variable is important to the model)

Decision Rule:

Reject H_0 , if p-value of F-test statistics is less than the significance level of 5%. Or else, do not reject H_0 .

Decision-Making:

Reject H_0 , because p-value of F- test statistics is 0.000000, which is less than the significance level of 5%.

Conclusion:

Based on the above result, at least one of β_i is dissimilar from zero at the significance level of 5% with sufficient evidence. Meaning that at least one exogenous variable (ER, LR, UR and PG) that is significantly describing housing price index in Malaysia.

4.5 Diagnostic Checking

As mentioned in the introduction of this chapter, diagnostic checking tests will be carried out in order to detect whether this model is facing the problem of multicollinearity, heteroscedasticity, autocorrelation, normality of the error term and model specification. The purpose of conducting these five tests is to be certain that the model fits the requirements of Best Linear Unbiased Estimators (BLUE).

4.5.1 Multicollinearity Test

The Multicollinearity test is used to test whether between or among the exogenous variables have linear or non-linear relationship.

i) High pair-wise correlation coefficients

Hypothesis:

H_0 : No Multicollinearity existed among independent variables

H_1 : Multicollinearity existed among independent variables

Table 4.3: Correlation Analysis (refer to Appendix 4.4)

	LOGEXCRATE	LR	PG	UR
LOGEXCRATE	1.000000	0.482893	0.540032	0.565968
LR	0.482893	1.000000	0.888982	0.358625
PG	0.540032	0.888982	1.000000	0.615269
UR	0.565968	0.358625	0.615269	1.000000

* $r > 0$, implying that the two variables have a positive correlation.

* $r < 0$, implying that the two variables have a negative correlation.

* $r = 0$, implying that the two variables have no correlation.

Correlation means a measurement that used to quantify the relative strength and direction of the linear association between two variables on scatter plot. The correlation coefficient (r) ranges between -1 and +1. A positive correlation coefficient implies a direct association between the variables. It indicates that a growth in the preceding variable will then lead to a rise in the subsequent variable. A negative correlation indicates an adverse association where one variable rises, the other declines. The closer the r coefficient approaches to 1, the stronger the existing association in the two variables, regardless of the direction. This indicates a more linear association between the two variables, without concern on the direction. As said by Gujarati (2012), if the correlation between two variables exceeds 80%, then there is a potential of high possibility that suffers from serious multicollinearity.

As shown in the correlation analysis (refer to Appendix 4.3), the highest pair-wise correlation between independent variable of population growth and lending rate is 0.888982. Hence, this study will carry out the regression analysis for the high pair-wise correlation between those independent variables in order to get R^2 to conduct VIF and TOL.

ii) **Variance Inflation factor (VIF) and Tolerance (TOL)**

Regression Analysis, LOGEXCRATE and LR, (refer to Appendix 4.5)

$$\text{VIF} = \frac{1}{(1-R^2)} = \frac{1}{(1-0.233186)} = 1.3041$$

$$\text{TOL} = \frac{1}{\text{VIF}} = \frac{1}{1.3041} = 0.7668$$

Regression Analysis, LOGEXCRATE and PG, (refer to Appendix 4.6)

$$\text{VIF} = \frac{1}{(1-R^2)} = \frac{1}{(1-0.291634)} = 1.4117$$

$$\text{TOL} = \frac{1}{\text{VIF}} = \frac{1}{1.4117} = 0.7084$$

Regression Analysis, LOGEXCRATE and UR, (refer to Appendix 4.7)

$$\text{VIF} = \frac{1}{(1-R^2)} = \frac{1}{(1-0.320319)} = 1.4713$$

$$\text{TOL} = \frac{1}{\text{VIF}} = \frac{1}{1.4713} = 0.6797$$

Regression Analysis, LR and PG, (refer to Appendix 4.8)

$$\text{VIF} = \frac{1}{(1-R^2)} = \frac{1}{(1-0.790290)} = 4.7685$$

$$\text{TOL} = \frac{1}{\text{VIF}} = \frac{1}{4.7685} = 0.2097$$

Regression Analysis, LR and UR, (refer to Appendix 4.9)

$$VIF = \frac{1}{(1-R^2)} = \frac{1}{(1-0.128612)} = 1.1476$$

$$TOL = \frac{1}{VIF} = \frac{1}{1.1476} = 0.8714$$

Regression Analysis, PG and UR, (refer to Appendix 4.10)

$$VIF = \frac{1}{(1-R^2)} = \frac{1}{(1-0.378556)} = 1.6092$$

$$TOL = \frac{1}{VIF} = \frac{1}{1.6092} = 0.6214$$

Table 4.4: Result of VIF, (refer to Appendix 4.11)

	LOGEXCRATE	LR	PG	UR
LOGEXCRATE	1.0000	1.3041	1.4117	1.4713
LR	1.3041	1.0000	4.7685	1.1476
PG	1.4117	4.7685	1.0000	1.6092
UR	1.4713	1.1476	1.6092	1.0000

Based on the result showed in Table 4.4 (refer to Appendix 4.11), this model has no serious multicollinearity problem existed in the model. Therefore, the problem can be ignored, since the degree of VIF of five pairs of independent variables is fall between 1 and 10 (no serious multicollinearity). Hence, the estimated parameters are unbiased, efficient and consistent.

Table 4.5: Result of TOL, (refer to Appendix 4.12)

	LOGEXCRATE	LR	PG	UR
LOGEXCRATE	1.0000	0.7668	0.7084	0.6797
LR	0.7668	1.0000	0.2097	0.8714
PG	0.7084	0.2097	1.0000	0.6214
UR	0.6797	0.8714	0.6214	1.0000

Based on the result shown in Table 4.5 (refer to Appendix 4.12), this model does not experience serious multicollinearity problem since the degree of TOL of five pairs independent variables is more than zero. Hence, the estimated parameters are unbiased, efficient and consistent.

4.5.2 Heteroscedasticity Test

The heteroscedasticity test examines whether the variance of error term are not constant between one to the other observation in the regression model. The heteroscedasticity problem will happen when the disturbance term have unequal variance. Typically, it happens in cross-sectional data and in time series data. The OLS estimators will no longer be BLUE thus the ARCH test is used to test whether the model has fulfil the assumption of homoscedasticity. Therefore, if heteroscedasticity is detected in the model, then White’s Heteroscedasticity-Corrected Variances and Standard Error method will be applied to solve this problem.

Hypothesis:

H_0 : Homoscedasticity among the error terms

H_1 : Heteroscedasticity among the error terms

Decision Rule:

Reject H_0 , if p-value of Chi-square is less than the significance level of 5%. Or else, do not reject H_0 .

Table 4.6: Autoregressive Conditional Heteroscedasticity (ARCH), (refer to Appendix 4.13)

F-statistic	0.287675	Prob. F(1,29)	0.5958
Obs*R-squared	0.304494	Prob. Chi-Square (1)	0.5811

Decision-Making:

Do not reject H_0 , because the p-value of Chi-square is 0.5811, which is larger than 5%.

Conclusion:

Hence, the model has met the homoscedasticity assumption of error term at 5% level of significance with sufficient evidence.

4.5.3 Autocorrelation

The autocorrelation problem exists when there is relationship or correlation between the error terms of the model. This study will use Breusch-Godfrey LM test to detect whether there is autocorrelation among the error terms.

Hypothesis:

H_0 : No autocorrelation existed among the error terms

H_1 : Autocorrelation existed among the error terms

Decision rule:

Reject H_0 , if p-value of Chi-square is less than the significance level of 5%. Or else, do not reject H_0 .

Table 4.7: Breusch Godfrey Serial Correlation LM Test, (refer to Appendix 4.14)

F-statistic	15.76301	Prob. F(1,26)	0.0005
Obs*R-squared	12.07806	Prob. Chi-Square (1)	0.0005

Decision-Making:

Reject H_0 , because the p-value of Chi-Squared is 0.0005, which is less than the significance level of 5%.

Conclusion:

Thus, autocorrelation is existed in the model at the significance level of 5%.

Since there is an autocorrelation problem in the model, then Newey-West HAC Standard Errors and Covariance Test will be used to overcome the problem.

4.5.3.1 Newey-West HAC Standard Errors and Covariance Test

Hypothesis:

H_0 : No autocorrelation among the error terms

H_1 : Autocorrelation among the error terms

Decision rule:

Reject H_0 , if p-value of F-test statistics is less than the significance level of 5%. Or else, do not reject H_0 .

Table 4.8: Newey-West HAC Standard Errors and Covariance Test, (refer to Appendix 4.15)

F-statistic	408.6293	Durbin-Watson stat	0.778554
Prob (F-statistic)	0.000000	Wald F-statistic	261.18945

Decision-Making:

Reject H_0 , because the p-value of F-test statistics is 0.00000, which is less than the significance level of 5%.

Conclusion:

Thus, autocorrelation problem may be still existed in the model at the significance level of 5%. This is because, in theory, the autocorrelation could be solve by the Newey-West HAC Standard Errors and Covariance Test (Gujarati, 2012). However, the result showed is different with the theory said. Hence, this study will conduct Autoregressive Distributed Lag Model (ARDL) to ensure that the autocorrelation problems is solved. The Autoregressive Distributed Lag Model (ARDL) will be conducted in next section.

4.5.3.2 Autoregressive Distributed Lag Model (ARDL)

An econometric problem which is autocorrelation was discovered from the findings. In order to resolve this issue, this study uses the Autoregressive Distributed Lag Model (ARDL) to solve the autocorrelation problem.

An ARDL is a model that provides a general distributed lag structure without clearly assigning a dynamic optimization. Belloumi (2014) used ARDL model as there were several advantages compared to previous and old cointegration method. Firstly, not all variables studied need to be integrated in the same order and it can be applied when underlying variables are integrated (Belloumi, 2014). Secondly, ARDL model is more productive in the case of small and finite sample sizes (Belloumi, 2014). Last of all, unbiased estimates of long-run model can be obtained via ARDL model (Belloumi, 2014).

The use of ARDL model has several disadvantages that are to be noted in the model. When the number of exogenous variables in the model increases, it will cause the degree of freedom to drop. This might affect the significance of the predicted parameter and the model would auto-regress the error term of its own, which brings the existence of technical problem.

The ARDL model is chosen to reform a better model in order to remove the econometric problems. The improved regressive model is shown as below:

$$\begin{aligned} \text{Log HPI}_t = & \beta_0 + \log \beta_1 \text{ER}_t + \beta_2 \text{LR}_t + \beta_3 \text{UR}_t + \beta_4 \text{PG}_t + \log \beta_1 \text{ER}_{t-1} + \beta_2 \text{LR}_{t-1} + \beta_3 \\ & \text{UR}_{t-1} + \beta_4 \text{PG}_{t-1} + \log \beta_1 \text{ER}_{t-2} + \beta_2 \text{LR}_{t-2} + \beta_3 \text{UR}_{t-2} + \beta_4 \text{PG}_{t-2} + \log \beta_1 \text{ER}_{t-3} \\ & + \beta_2 \text{LR}_{t-3} + \beta_3 \text{UR}_{t-3} + \beta_4 \text{PG}_{t-3} + \log \beta_1 \text{ER}_{t-4} + \beta_2 \text{LR}_{t-4} + \beta_3 \text{UR}_{t-4} + \beta_4 \text{PG}_{t-} \\ & 4 + \log \beta_1 \text{ER}_{t-5} + \beta_2 \text{LR}_{t-5} + \beta_3 \text{UR}_{t-5} + \beta_4 \text{PG}_{t-5} + \log \beta_1 \text{ER}_{t-6} + \beta_2 \text{LR}_{t-6} + \beta_3 \\ & \text{UR}_{t-6} + \beta_4 \text{PG}_{t-6} + \log \beta_1 \text{ER}_{t-7} + \beta_2 \text{LR}_{t-7} + \beta_3 \text{UR}_{t-7} + \beta_4 \text{PG}_{t-7} + \log \beta_1 \text{ER}_{t-8} \\ & + \beta_2 \text{LR}_{t-8} + \beta_3 \text{UR}_{t-8} + \beta_4 \text{PG}_{t-8} + \log \beta_1 \text{ER}_{t-9} + \beta_2 \text{LR}_{t-9} + \beta_3 \text{UR}_{t-9} + \beta_4 \text{PG}_{t-} \\ & 9 + \log \beta_1 \text{ER}_{t-10} + \beta_2 \text{LR}_{t-10} + \beta_3 \text{UR}_{t-10} + \beta_4 \text{PG}_{t-10} + \log \beta_1 \text{ER}_{t-11} + \beta_2 \text{LR}_{t-} \\ & 11 + \beta_3 \text{UR}_{t-11} + \beta_4 \text{PG}_{t-11} + \log \beta_1 \text{ER}_{t-12} + \beta_2 \text{LR}_{t-12} + \beta_3 \text{UR}_{t-12} + \beta_4 \text{PG}_{t-12} + \\ & \log \beta_1 \text{ER}_{t-13} + \beta_2 \text{LR}_{t-13} + \beta_3 \text{UR}_{t-13} + \beta_4 \text{PG}_{t-13} + \log \beta_1 \text{ER}_{t-14} + \beta_2 \text{LR}_{t-14} + \\ & \beta_3 \text{UR}_{t-14} + \beta_4 \text{PG}_{t-14} + \log \beta_1 \text{ER}_{t-15} + \beta_2 \text{LR}_{t-15} + \beta_3 \text{UR}_{t-15} + \beta_4 \text{PG}_{t-15} + \log \\ & \beta_1 \text{ER}_{t-16} + \beta_2 \text{LR}_{t-16} + \beta_3 \text{UR}_{t-16} + \beta_4 \text{PG}_{t-16} + \log \beta_1 \text{ER}_{t-17} + \beta_2 \text{LR}_{t-17} + \beta_3 \\ & \text{UR}_{t-17} + \beta_4 \text{PG}_{t-17} + \log \beta_1 \text{ER}_{t-18} + \beta_2 \text{LR}_{t-18} + \beta_3 \text{UR}_{t-18} + \beta_4 \text{PG}_{t-18} + \log \beta_1 \\ & \text{ER}_{t-19} + \beta_2 \text{LR}_{t-19} + \beta_3 \text{UR}_{t-19} + \beta_4 \text{PG}_{t-19} + \log \beta_1 \text{ER}_{t-20} + \beta_2 \text{LR}_{t-20} + \beta_3 \\ & \text{UR}_{t-20} + \beta_4 \text{PG}_{t-20} + \varepsilon_t \end{aligned}$$

This model has added a lag term of 20 periods. LM test is applied to this model to detect whether there is still autocorrelation problem or not.

Below is the hypothesis testing of ARDL:

Hypothesis:

H_0 : No autocorrelation among the error terms

H_1 : Autocorrelation among the error terms

Decision rule:

Reject H_0 , if p-value of Chi-square is less than the significance level of 5%. Or else, do not reject H_0 .

Table 4.9: Breusch Godfrey Serial Correlation LM Test, (refer to Appendix 4.16)

F-statistic	12.84431	Prob. F(20,7)	0.0010
Obs*R-squared	31.15115	Prob. Chi-Square (20)	0.0532

Decision-Making:

Do not reject H_0 , because p-value of Chi-Squared is 0.0532, which is larger than the significance level of 5%.

Conclusion:

Therefore, no autocorrelation problem among the error terms in the model at the significance level of 5% is proven with sufficient evidence. Therefore it can be concluded that the model has fulfilled the assumption of no autocorrelation problem in this improved model. Therefore, this model is free of econometrics problems.

4.5.4 Normality Test

The normality test will be carried out to ensure for the compliance of normality assumption. This study will use Jarque-Bera test to check the normality distribution of error terms based on the estimated model. If the error terms are normally distributed, β and independent variables will also be normally distributed, which could also indicate that the model is accurately specified.

Hypothesis:

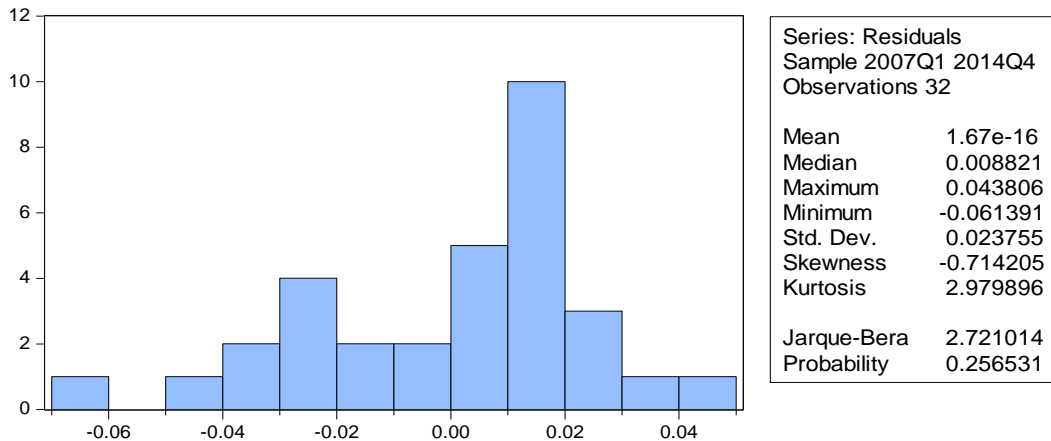
H_0 : Error terms are normally distributed

H_1 : Error terms are not normally distributed

Decision rule:

Reject H_0 , if p-value of JB test is less than the significance level of 5%. Or else, do not reject H_0 .

Table 4.10 Jarque-Bera Test, (refer to Appendix 4.17)



Decision-Making:

Do not reject H_0 , because the p-value of JB test is 0.256531, which is larger than the significance level of 5%.

Conclusion:

Thus, the model has met the normality assumption of error term at 5% level of significance with sufficient evidence.

4.5.5 Model Specification Test

The model specification test will be used to check whether this model is a “reliable or unreliable” model using the Ramsey RESET test.

Hypothesis:

H_0 : Model is precisely specified

H_1 : Model is not precisely specified

Decision rule:

Reject H_0 , if p-value of F-test statistics is less than the significance level of 5%. Or else, do not reject H_0 .

Table 4.11: Ramsey RESET test, (refer to Appendix 4.18)

	Value	df	Probability
t-statistic	0.407344	26	0.6871
F-statistic	0.165929	(1,26)	0.6871
Likelihood ratio	0.203572	1	0.6519

Decision-Making:

Do not reject H_0 , because p-value of F-test statistics is 0.6871, which is larger than the significance level of 5%.

Conclusion:

Hence, the model has met the model specification assumption at the 5% level of significance.

4.6 Conclusion

The aim of this chapter is to test whether the model is BLUE by using the data collected from the Data Stream Navigator and NAPIC. This study finds that two independent variables (LR & PG) have important association with the endogenous variable (HPI) as their p-values are less than the level of significance, α (0.05). UR and ER does not have any significant relationship with HPI as their p-values are larger than the level of significance, α (0.05)

Besides that, this chapter has conducted diagnostic checking to detect whether the econometric problems of multicollinearity, autocorrelation, heteroscedasticity, normality of error term, and model specification existed in the model by using E-view 8. The results of these tests presents that the model specification is correct, error terms are normally distributed; there is no serious multicollinearity problem, and homoscedasticity. However, there is autocorrelation existed in the model; the problem is already overcome by auto-distributed lag model.

In addition, the following chapter will discuss about the statistical results, major findings, policy implications and limitations of this study. The recommendations for future studies will also be discussed.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

This chapter will provide an overall outline from chapter 1 to chapter 4. Moreover, this chapter will also provide the summary of statistical analysis and major findings in chapter 4. The results in chapter 4 will be used to compare with the objectives stated in chapter 1 to know about whether there is a relationship between housing price index with the independent variables (ER, LR, UR and PG) in Malaysia. In addition, the implications or policies will be suggested in this study, followed by limitations of this study. Lastly, recommendations for future researchers will be given too.

5.1 Summary of Statistical Analysis

The aim of this study is to discover the significant association between Malaysian housing price with exchange rate, lending rate, unemployment rate, and population growth. The data are collected from data stream and website of NAPIC. The time range is from 2007 to 2014, in quarterly. Hence, total observations for this study is 32.

From chapter 4, this study showed that housing price index is not related with exchange rate and unemployment rate in Malaysia at 5% of significance level. However, lending rate and population growth are significantly related with housing price in Malaysia at 5% of significance level. Lending rate is positively related with housing price in Malaysia, but population growth is negatively related with housing price. This will be discussed in 5.2 in a detailed way.

Table 5.1: Summary of Diagnostic Checking

Econometrics Problems	Results
Multicollinearity	Multicollinearity existed, but not serious
Heteroscedasticity	Homoscedasticity among the error terms
Autocorrelation	Autocorrelation among the error terms, but overcome by Newey-West test and Auto-regressive Distributed Model
Normality	Error terms are normally distributed
Model Specification	Model is precisely specified

According to the concept of CNLRM and OLS, to ensure the results are trustable and reliable, diagnostic checking is required to ensure that BLUE concept is achieved, which best, linear, unbiased, and efficient.

Based on the table 5.1, the results indicated that the estimated model of this study has no serious multicollinearity existed in the model, homoscedasticity among the error terms, error terms are normally distributed and model is precisely specified. The only problem is autocorrelation was existed in the model, but have been overcome by Newey-West test and Auto-regressive distributed lag model. In brief, the estimated model now is free from econometric problems and fulfilled the concept of CNLRM and BLUE.

5.2 Discussions of Major Findings

Table 5.2: Summary of the Results and Theories

Dependent Variable	Independent Variables	Significance Level	Expected Sign (Theoretical)	Result
Housing Price Index	Exchange Rate	5%	Negative, <i>Supported by Mahalik and Mallick (2011); (Lo, 2011).</i>	Positive, but not significant
Housing Price Index	Lending Rate	5%	Negative, <i>Supported by Pashardes and Savva (2009); Rahman, Khanam and Xu (2012)</i>	Positive and significant

Housing Price Index	Unemployment Rate	5%	Negative, <i>Supported by Lee (2009); Rosli (2011); Shi, Jou and Tripe (2014)</i>	Positive, but not significant
Housing Price Index	Population Growth	5%	Positive, <i>Supported by Burda (2013); Lee (2009); Miles (2012)</i>	Negative and significant

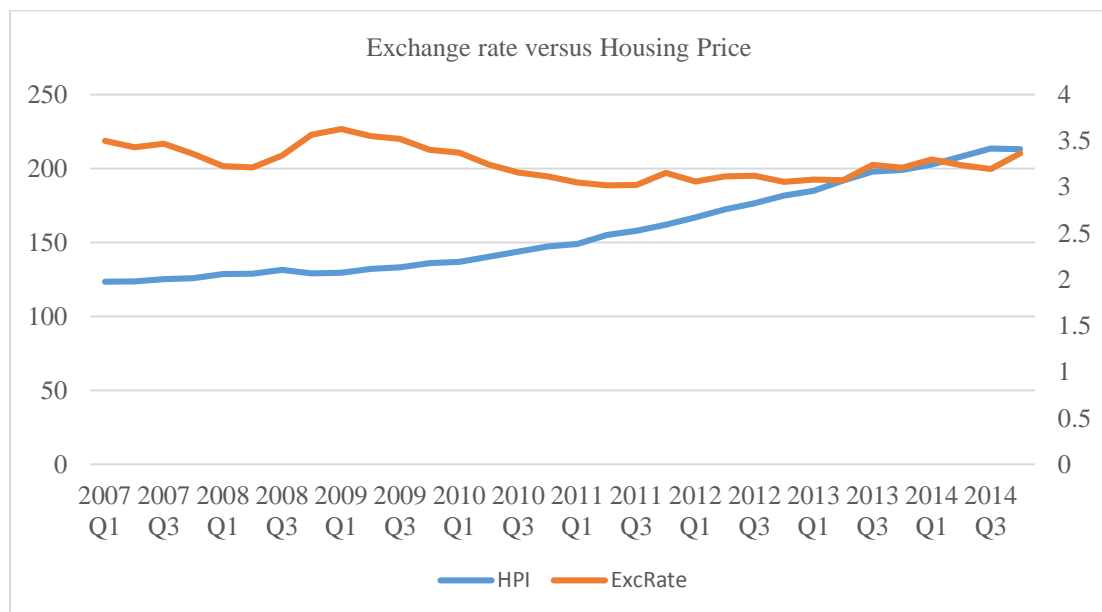
According to the table 5.2, it showed that the outcomes obtained in chapter 4 are not consistent with what did this study expect in chapter 1. From the table, the result showed that lending rate and population growth are significant to housing price index in Malaysia, whereas unemployment rate and exchange rate have statistically no effect on housing price in Malaysia. In addition, the expected sign of all independent variables are also different with the results obtained.

In theory, this study expected exchange rate, lending rate and unemployment rate are negatively related with housing price index. This is because lower exchange rate will increase foreign investors to buy house in domestic market, then demand of housing will increase and this consequently lead to housing price rises (Mahalik & Mallick, 2011). The other reason is that lower exchange rate will increase the cost of building, because of import (Wheeler, 2013). For lending rate, the higher the lending rate, the lower the demand of housing, because of lower affordability, consequently the house price drops (Ong, 2013). For unemployment rate, the lower the unemployment rate, the higher the demand of housing as public can afford to purchase houses in which consequently increases the housing prices (Taltavull de La Paz, 2013). Meanwhile, population growth is estimated to have a positive

association with housing price index in Malaysia. This is because if the population growth increases, then the demand of housing would also increase, subsequently lead to house price increases, vice versa (Mulder, 2006).

However, the results showed that there are deviation on the expectation results. Exchange rate, lending rate and unemployment rate are positively related with the Malaysian housing price, while population growth is negatively related with Malaysian housing price. What are the reasons behind?

Figure 5.1: The Trend of Exchange rate and Housing Price, from 2007Q1 to 2014Q4, Source from: NAPIC



Regarding to the effects of exchange rate on housing price index in Malaysia, the result showed that exchange rate has no statistical effect on housing price, which is not consistent with the hypotheses made, because while people are buying house, they will consider lending rate rather than exchange rate (Le, 2015). The other reason is that based on the figure, from 2007 to 2014, the exchange rate in Malaysia was stable, but the housing price keep going up, hence no so much effect on housing

price (NAPIC, 2015). Therefore, exchange rate is insignificant to housing price in Malaysia (Le, 2015).

About the variable of lending rate towards housing price in Malaysia, the result showed that lending rate is statistically and positively related with housing price. The expected sign is different with the result, because when the lending rate is higher, then developers will borrow at higher cost or borrow less from bank (Guo & Wu, 2013.) This will decrease the supply of house in the market, because of limited capital (Haron & Liew, 2013). As a result, the house price increases. Therefore, this study draws a conclusion by indicating that lending rate has a positive association with Malaysian housing price.

Unemployment rate supposedly having an inverse relationship with housing price, but the result indicated that unemployment rate is insignificant to housing price in Malaysia. This is because if the job has provided low income for workers, they also could not afford to buy a house, even though they have job (Lau & Li, 2006). Besides that, even if the job has provided higher income, people will also not buy a house until finding a suitable and good quality house (Mulder, 2006). Hence, this study concludes that unemployment rate is insignificant to housing price in Malaysia.

This study expects that population growth and housing price in Malaysia is positively related. However, based on the results obtained, population growth is negatively related with housing price in Malaysia. This is because population growth has counted the new baby born and immigrants of Malaysia. There are a few reasons to explain the negative relationship between population growth and housing price. Firstly, normally immigrants who want to move for job, they will not migrate with a family, so they do not need to find a suitable house. This is because they only need a shelter over their head for short-term. Therefore, they would rent a house rather than buying a house (Mulder, 2006). Therefore, demand for house

would drop and subsequently the price of houses follows the trend of demand. Thus, this study concludes that population growth has a negative association with Malaysian housing price index.

5.3 Implications of the Study

5.3.1 Managerial Implications

The implication of this study can be describe as what the research signifies or implies. Future research possibilities are also discussed accordingly.

Throughout this study, there were quite a handful of macroeconomic determinants that could affect the housing prices in Malaysia. This study is to explore the association or significance of these four variables, which are exchange rate, population growth, lending rate and unemployment rate towards the housing prices in Malaysia. This study benefits various groups of the community such as policy makers, investors, home buyers, construction companies as well as the future researchers who are keen in studying about Malaysia's housing prices (Ong, 2013).

The causal relationship and dynamic interactions between macroeconomic determinants and housing prices is indeed crucial in the formulation of macroeconomic policies. Floating interest rates affect the investment decisions made by investors as higher interest rate would increase the borrowing costs and the latter is also true. This would reduce the demand and housing prices thus hurting their turnover and return on investment. Therefore, policy makers should be very cautious in implementing the right monetary policy to ensure it is consistent with

the stability and prospects of the Malaysian economy to provide long-term sustainability of the housing industry (Ong, 2013).

The national housing policies should be reviewed and studied in detail to align them with the monetary policy. In 2007, Malaysia introduced the “Build then Sell” (BTS) system as the previous “Sell then Build” (STB) resulted in high fraudulent cases and most projects was abandoned before completion. The housing delivery system was revised to BTS to provide a decent and affordable housing for home buyers. However, even with BTS, most developers find it difficult to comply with the policy as the system was not comprehensive and incentives given were not attractive (Yusof et al., 2010). As a matter of fact, policy makers should communicate with developers before reviewing the housing policies to mitigate the negative impact of the delivery system towards the domestic housing industry.

This study also impact home buyers in making their purchasing decisions. They can only rely on the authorities to implement stringent rules and legislations to protect them from their dreamt homeownership. Without strict enforcement, housing developers are able to take advantage and levy unaffordable prices for low quality products which would reduce the probability of homeownership by the society. As such, local enforcers should monitor and revise the existing property and housing laws in order to curb the risk of abandoned housing projects as well as ensuring the houses are reasonably priced. Furthermore, this study provides a great opportunity to the developers to access and understand that affordable housing accompanied with quality is the only way they would be able to coexist and sustain in the industry.

Based on the 10th Malaysia Plan from 2011-2015, the government launched several scheme such as Perumahan Rakyat 1Malaysia (PR1MA), Youth Housing Scheme (YHS) and First Home Deposit Scheme in order to provide more affordable housing in Malaysia (“*Providing Adequate and Quality Affordable House*”, 2015). In addition, another scheme was launched by government under Budget 2016 which

is the First Home Deposit Scheme with RM 200 million allocations to assist home buyers' deposit (The Malay Mail, 2016).

PR1MA was launched in 2011 in order to supply more affordable homes to middle-class household with monthly income of RM 2,500 – RM 10,000 which is placed under the jurisdiction of Prime Minister Department. Sufian (2012) added that this initiative is very much welcome provided that adequate legal provisions and administrative frameworks are needed to materialize the objective of providing more affordable homes. Under Budget 2016, Datuk Seri Najib Razak, Prime Minister of Malaysia announced that in order to fulfill the demand for PR1MA homes, there will be another additional 175,000 homes built (The Malay Mail, 2016).

In conjunction with Budget 2015, YHS was announced by Datuk Seri Najib Abdul Razak to encourage house ownership among the youths in Malaysia in collaboration with CAGAMAS, BSN and EPF (Berita Semasa, 2015). Furthermore, government would also assist in the monthly installment to those who are eligible for the first two years and a 50% stamp duty exemption on the sale and purchase agreement as well as facility legal documents to reduce the younger households (The Sun Daily, 2015).

Despite the various schemes launched by the government of Malaysia, citizens of Malaysia still faced with housing affordability issues. Therefore, these measures should be planned out accordingly again in order to tackle the issue to its root.

5.4 Limitations of the Study

During the process of this study, there are some limitations and difficulties. The main limitation of this paper is data discrepancies. This study has to employ the data that covered a shorter period which is from year 2007 to year 2014, because the empirical test conducted using the longer period of data (year 2000 to year 2014) showed an invalid result with plenty of econometric problems. Hence, this study decided to use the shorter period of data, from year 2007 to year 2014, to avoid the econometric problems.

Besides, this study generally covered the housing market of whole Malaysia as it used the data of Malaysia as a whole. However, it might not be accurate if individual investors or traders try to use the result to determine the housing price in a particular geographical area. For example, the overall housing prices in Malaysia might be increasing, but some states such as Terengganu and Pahang may be experiencing a drop in prices. This is because housing price in different geographical areas might have a huge difference due to the different wealth and living standard of the people. Thus, this study may be sufficient to determine the overall performance of housing prices in Malaysia but not accurate enough estimating in one particular geographical area.

Moreover, this study uses four independent variables such as lending rate, unemployment rate, population growth and currency exchange rate to test their relationship with the housing prices. However, there are limitations to include the qualitative variables such as the changes of rules and regulations. For example, the recent implications of goods and services tax (GST). The changes of these rules and regulations might have indirect effects towards the behavior of buyers and sellers of houses (The Malay Mail, 2016). This study might be more reliable if it is able to obtain the outcome from the changes of rules and regulations and other qualitative variables.

Last but not least, this study employs the ordinary least squares (OLS) method to analyze the data only. The study does not use the other tests which might give a different result, such as Hedonic Model and Unit Root Test.

5.5 Recommendations for Future Research

In the future, researchers could try more sources such as World Bank database, Yahoo Finance, and other reliable database for data collection. They are also encouraged to look for the consistency of data for a better result. Besides time series data, future researchers may try other data categories such as panel data or cross-sectional data for more different possible results.

Besides, future researchers can conduct researches on the housing prices based on specific geographical areas only because the changes of housing market are highly geographical. For example, they can narrow down the scope of study to particular urban or rural areas to find out the difference in the performance of housing prices in those particular areas compared to the overall housing prices changes in Malaysia. The result of their study may be more accurate to make specific implications or estimation of the performance of housing market in the particular geographical areas.

Future researchers should also try to investigate the implications of changes of rules and regulations in the countries. This might require the researchers to collect the qualitative data such as the changes of behaviors among buyers and sellers when there are any changes in the rules and regulations. This can be done through primary data collection such as surveys, case studies and interviews. In additions, the

researchers can try to use different methods such as unit root test and hedonic model to analyze the data other than the OLS method.

Future researchers are recommended to apply different data frequency such as annually, weekly and daily because the changes of each data would be different in different data frequency. For example, this study included the currency exchange rate which is more sensitive and fluctuates more frequently than other variables. Extra considerations should be given when choosing the data frequency when there are several different types of variables in order to maintain the reliability of the tests.

Lastly, there are some macroeconomic variables that can be included in future study such as real gross domestic products, money supply and geographical factors. Real gross domestic products may reflect the performance of the country's economy. Thus, it might affect the buyers and sellers to when they would buy or sell their property. Money supply might also have significant effect on the changes of housing prices. For example, money supply increases when government tries to apply easy monetary policy, then the purchasing power of people as well as the government investment increases. This may directly increase the demand and price of houses.

5.6 Conclusion

In this chapter, an overall conclusion is given. Besides that, discussions on major findings about the results carried out in chapter 4 are done too. This study found that exchange rate and unemployment rate are not significantly related to housing price index in Malaysia. This study also showed the housing price index is positively correlated with lending rate in Malaysia. However, housing price index is negatively correlated with population growth in Malaysia. Moreover, the model of this study is free of econometrics problems by using diagnostic checking. Therefore, the results of this study are reliable and can be trusted.

On the other hand, several policies and implications are provided in this study. Furthermore, limitations and recommendations are discussed for researchers who will be doing the relevant topic in future.

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Appendices

Chapter 2: Literature Review

Appendix 2.1: Malaysian Housing Price Index, Quarterly, source from NAPIC, from 2007 to 2014

Year	HPI	Year	HPI
2007 Q1	123.4	2011 Q1	149.1
2007 Q2	123.7	2011 Q2	155.1
2007 Q3	125.2	2011 Q3	157.8
2007 Q4	125.9	2011 Q4	161.9
2008 Q1	128.7	2012 Q1	167
2008 Q2	128.9	2012 Q2	172.4
2008 Q3	131.4	2012 Q3	176.5
2008 Q4	129	2012 Q4	181.7
2009 Q1	129.6	2013 Q1	184.9
2009 Q2	132.2	2013 Q2	191.8
2009 Q3	133.3	2013 Q3	198
2009 Q4	136.1	2013 Q4	199.1
2010 Q1	136.9	2014 Q1	202.7
2010 Q2	140.3	2014 Q2	208
2010 Q3	143.7	2014 Q3	213.6
2010 Q4	147.2	2014 Q4	213.1

Chapter 3: Methodology

Appendix 3.1: Percentage Change in 1 year from 2007 Q1 to 2014 Q4 (Source: NAPIC)

Year (Quarterly)	1 Year Change (%)	Year (Quarterly)	1 Year Change (%)
2007 Q1	4.80	2011 Q1	9.00
2007 Q2	4.40	2011 Q2	10.60
2007 Q3	5.40	2011 Q3	9.90
2007 Q4	2.90	2011 Q4	10.00
2008 Q1	4.30	2012 Q1	12.00
2008 Q2	4.20	2012 Q2	11.20
2008 Q3	5.00	2012 Q3	11.90
2008 Q4	2.50	2012 Q4	12.20
2009 Q1	0.70	2013 Q1	10.70
2009 Q2	2.60	2013 Q2	11.30
2009 Q3	1.50	2013 Q3	12.20
2009 Q4	5.60	2013 Q4	9.60
2010 Q1	5.70	2014 Q1	9.60
2010 Q2	6.20	2014 Q2	8.40
2010 Q3	7.90	2014 Q3	7.90
2010 Q4	8.20	2014 Q4	7.00

Chapter 4: Data Analysis

Appendix 4.1: Descriptive Statistics

	HPI	EXCRATE	LR	PG	UR
Mean	157.7563	3.261445	5.184062	1.718125	3.195938
Median	148.1500	3.230290	4.905000	1.715000	3.105000
Maximum	213.6000	3.625920	6.550000	1.860000	4.020000
Minimum	123.4000	3.018550	4.500000	1.560000	2.730000
Std. Dev.	30.29387	0.176995	0.660136	0.089133	0.282727
Skewness	0.542939	0.424522	0.961718	-0.025012	1.006870
Kurtosis	1.855576	2.044595	2.368946	1.839189	3.717509
Observations	32	32	32	32	32

Appendix 4.2 Initial Regression Output (Source: Developed for research via EViews 8.0)

Dependent Variable: LOGHPI

Method: Least Squares

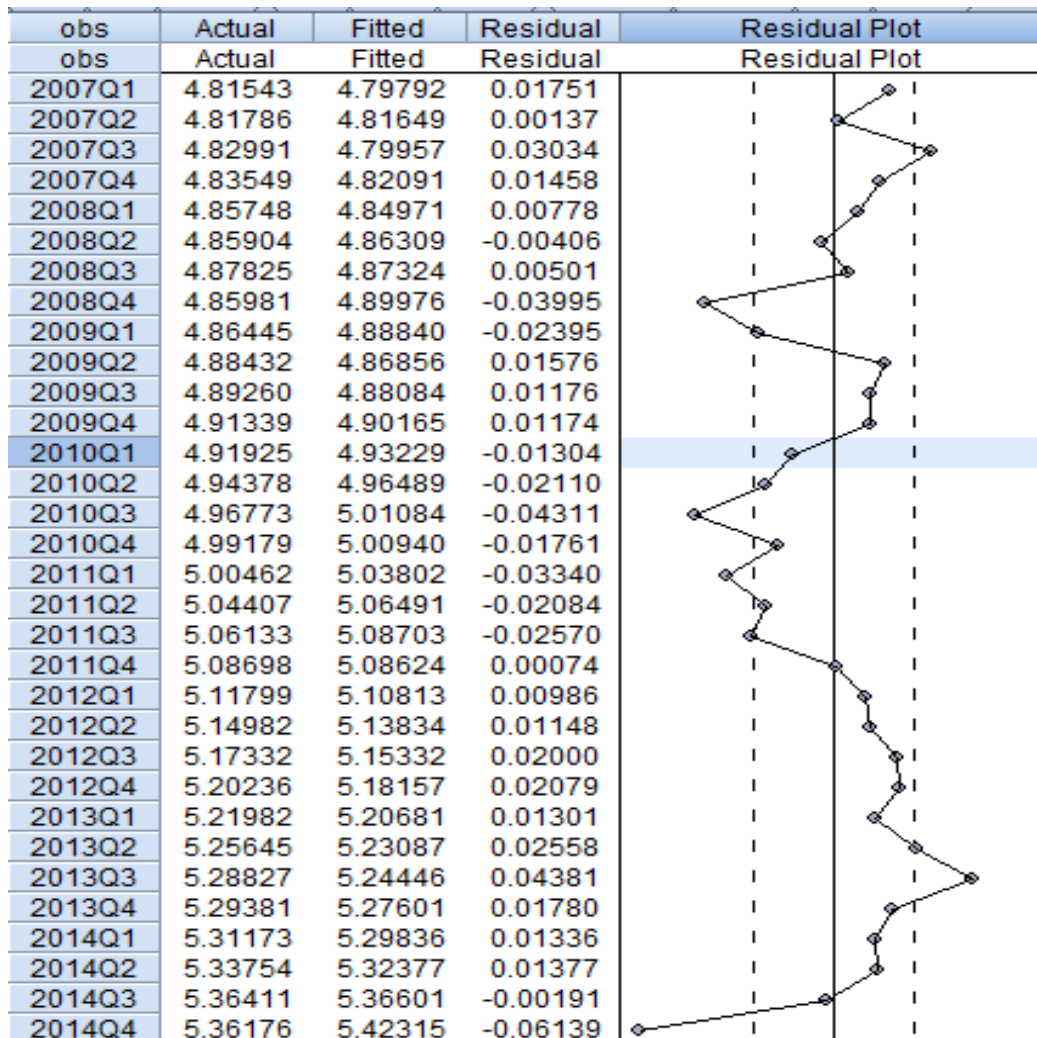
Date: 01/22/16 Time: 13:45

Sample: 2007Q1 2014Q4

Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGGER	0.038106	0.111165	0.342792	0.7344
LR	0.103051	0.018257	5.644464	0.0000
PG	-2.758874	0.156099	-17.67384	0.0000
UR	0.011222	0.026458	0.424144	0.6748
C	9.168901	0.171882	53.34411	0.0000
R-squared	0.983750	Mean dependent var		5.043892
Adjusted R-squared	0.981342	S.D. dependent var		0.186351
S.E. of regression	0.025454	Akaike info criterion		-4.361266
Sum squared resid	0.017494	Schwarz criterion		-4.132245
Log likelihood	74.78026	Hannan-Quinn criter.		-4.285352
F-statistic	408.6293	Durbin-Watson stat		0.778554
Prob(F-statistic)	0.000000			

Appendix 4.3: Plot of Residual, Actual and Fitted Lines, from 2007 to 2014 (Source: Developed for research via EViews 8.0)



Appendix 4.4: Correlation Analysis (Source: Developed for research via EViews 8.0)

	LOGEXCRATE	LR	PG	UR
LOGEXCRATE	1.000000	0.482893	0.540032	0.565968
LR	0.482893	1.000000	0.888982	0.358625
PG	0.540032	0.888982	1.000000	0.615269
UR	0.565968	0.358625	0.615269	1.000000

Appendix 4.5: Regression Analysis (LOGEXCRATE & LR) (Source: Developed for research via EViews 8.0)

Dependent Variable: LOGEXCRATE

Method: Least Squares

Date: 01/21/16 Time: 14:47

Sample: 2007Q1 2014Q4

Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LR	0.039334	0.013023	3.020414	0.0051
C	0.976851	0.068039	14.35721	0.0000
R-squared	0.233186	Mean dependent var		1.180761
Adjusted R-squared	0.207625	S.D. dependent var		0.053772
S.E. of regression	0.047865	Akaike info criterion		-3.180405
Sum squared resid	0.068732	Schwarz criterion		-3.088797
Log likelihood	52.88648	Hannan-Quinn criter.		-3.150040
F-statistic	9.122898	Durbin-Watson stat		0.395616
Prob(F-statistic)	0.005120			

Appendix 4.6: Regression Analysis (LOGEXCRATE & PG) (Source: Developed for research via EViews 8.0)

Dependent Variable: LOGEXCRATE

Method: Least Squares

Date: 01/21/16 Time: 14:49

Sample: 2007Q1 2014Q4

Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PG	0.325785	0.092700	3.514400	0.0014
C	0.621022	0.159478	3.894096	0.0005
R-squared	0.291634	Mean dependent var		1.180761
Adjusted R-squared	0.268022	S.D. dependent var		0.053772
S.E. of regression	0.046005	Akaike info criterion		-3.259689
Sum squared resid	0.063493	Schwarz criterion		-3.168081
Log likelihood	54.15503	Hannan-Quinn criter.		-3.229324
F-statistic	12.35101	Durbin-Watson stat		0.386492
Prob(F-statistic)	0.001421			

Appendix 4.7: Regression Analysis (LOGEXCRATE & UR) (Source: Developed for research via EViews 8.0)

Dependent Variable: LOGEXCRATE

Method: Least Squares

Date: 01/21/16 Time: 14:51

Sample: 2007Q1 2014Q4

Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UR	0.107641	0.028627	3.760102	0.0007
C	0.836749	0.091836	9.111289	0.0000
R-squared	0.320319	Mean dependent var	1.180761	
Adjusted R-squared	0.297663	S.D. dependent var	0.053772	
S.E. of regression	0.045064	Akaike info criterion	-3.301027	
Sum squared resid	0.060922	Schwarz criterion	-3.209418	
Log likelihood	54.81643	Hannan-Quinn criter.	-3.270661	
F-statistic	14.13837	Durbin-Watson stat	0.710293	
Prob(F-statistic)	0.000735			

Appendix 4.8: Regression Analysis (LR & PG) (Source: Developed for research via EViews 8.0)

Dependent Variable: LR

Method: Least Squares

Date: 01/21/16 Time: 14:52

Sample: 2007Q1 2014Q4

Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PG	6.583947	0.619217	10.63270	0.0000
C	-6.127981	1.065278	-5.752474	0.0000
R-squared	0.790290	Mean dependent var	5.184062	
Adjusted R-squared	0.783299	S.D. dependent var	0.660136	
S.E. of regression	0.307301	Akaike info criterion	0.538482	
Sum squared resid	2.833014	Schwarz criterion	0.630091	
Log likelihood	-6.615720	Hannan-Quinn criter.	0.568848	
F-statistic	113.0544	Durbin-Watson stat	0.212527	
Prob(F-statistic)	0.000000			

Appendix 4.9: Regression Analysis (LR & UR) (Source: Developed for research via EViews 8.0)

Dependent Variable: LR

Method: Least Squares

Date: 01/21/16 Time: 14:53

Sample: 2007Q1 2014Q4

Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UR	0.837349	0.397934	2.104240	0.0438
C	2.507946	1.276585	1.964575	0.0588
R-squared	0.128612	Mean dependent var		5.184062
Adjusted R-squared	0.099566	S.D. dependent var		0.660136
S.E. of regression	0.626411	Akaike info criterion		1.962842
Sum squared resid	11.77173	Schwarz criterion		2.054451
Log likelihood	-29.40548	Hannan-Quinn criter.		1.993208
F-statistic	4.427827	Durbin-Watson stat		0.212746
Prob(F-statistic)	0.043844			

Appendix 4.10: Regression Analysis (PG & UR) (Source: Developed for research via EViews 8.0)

Dependent Variable: PG

Method: Least Squares

Date: 01/21/16 Time: 14:53

Sample: 2007Q1 2014Q4

Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UR	0.193972	0.045375	4.274890	0.0002
C	1.098204	0.145563	7.544515	0.0000
R-squared	0.378556	Mean dependent var		1.718125
Adjusted R-squared	0.357841	S.D. dependent var		0.089133
S.E. of regression	0.071427	Akaike info criterion		-2.379824
Sum squared resid	0.153054	Schwarz criterion		-2.288216
Log likelihood	40.07719	Hannan-Quinn criter.		-2.349459
F-statistic	18.27468	Durbin-Watson stat		0.499431
Prob(F-statistic)	0.000179			

Appendix 4.11: Result of VIF

	LOGEXCRATE	LR	PG	UR
LOGEXCRATE	1.0000	1.3041	1.4117	1.4713
LR	1.3041	1.0000	4.7685	1.1476
PG	1.4117	4.7685	1.0000	1.6092
UR	1.4713	1.1476	1.6092	1.0000

Appendix 4.12: Result of TOL

	LOGEXCRATE	LR	PG	UR
LOGEXCRATE	1.0000	0.7668	0.7084	0.6797
LR	0.7668	1.0000	0.2097	0.8714
PG	0.7084	0.2097	1.0000	0.6214
UR	0.6797	0.8714	0.6214	1.0000

Appendix 4.13: Autoregressive Conditional Heteroscedasticity (ARCH) Test
(Source: Developed for research via EViews 8.0)

Heteroskedasticity Test: ARCH

F-statistic	0.287675	Prob. F(1,29)	0.5958
Obs*R-squared	0.304494	Prob. Chi-Square(1)	0.5811

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 01/21/16 Time: 13:58

Sample (adjusted): 2007Q2 2014Q4

Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000621	0.000190	3.265164	0.0028
RESID^2(-1)	-0.150207	0.280052	-0.536354	0.5958
R-squared	0.009822	Mean dependent var		0.000554
Adjusted R-squared	-0.024322	S.D. dependent var		0.000793
S.E. of regression	0.000803	Akaike info criterion		-11.35460
Sum squared resid	1.87E-05	Schwarz criterion		-11.26208
Log likelihood	177.9963	Hannan-Quinn criter.		-11.32444
F-statistic	0.287675	Durbin-Watson stat		1.487798
Prob(F-statistic)	0.595805			

Appendix 4.14: Breusch-Godfrey Serial Correlation LM Test (Source: Developed for research via EViews 8.0)

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	15.76301	Prob. F(1,26)	0.0005
Obs*R-squared	12.07806	Prob. Chi-Square(1)	0.0005

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 01/21/16 Time: 14:58

Sample: 2007Q1 2014Q4

Included observations: 32

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGEXCRATE	-0.051044	0.090303	-0.565251	0.5767
LR	-0.018694	0.015416	-1.212588	0.2362
PG	0.180028	0.133452	1.349005	0.1890
UR	-0.003905	0.021296	-0.183370	0.8559
C	-0.141115	0.142700	-0.988895	0.3318
RESID(-1)	0.763682	0.192350	3.970266	0.0005
R-squared	0.377439	Mean dependent var		1.67E-16
Adjusted R-squared	0.257716	S.D. dependent var		0.023755
S.E. of regression	0.020467	Akaike info criterion		-4.772681
Sum squared resid	0.010891	Schwarz criterion		-4.497855
Log likelihood	82.36289	Hannan-Quinn criter.		-4.681584
F-statistic	3.152602	Durbin-Watson stat		1.838302
Prob(F-statistic)	0.023477			

Appendix 4.15: Newey-West HAC Standard Errors and Covariance Test (Source: Developed for research via EViews 8.0)

Dependent Variable: LOGHPI

Method: Least Squares

Date: 01/22/16 Time: 21:23

Sample: 2007Q1 2014Q4

Included observations: 32

HAC standard errors & covariance (Bartlett kernel, Integer Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGEXCRATE	0.038106	0.148100	0.257302	0.7989
LR	0.103051	0.019029	5.415591	0.0000
PG	-2.758874	0.214646	-12.85315	0.0000
UR	0.011222	0.019311	0.581134	0.5660
C	9.168901	0.181516	50.51295	0.0000
R-squared	0.983750	Mean dependent var	5.043892	
Adjusted R-squared	0.981342	S.D. dependent var	0.186351	
S.E. of regression	0.025454	Akaike info criterion	-4.361266	
Sum squared resid	0.017494	Schwarz criterion	-4.132245	
Log likelihood	74.78026	Hannan-Quinn criter.	-4.285352	
F-statistic	408.6293	Durbin-Watson stat	0.778554	
Prob(F-statistic)	0.000000	Wald F-statistic	261.8945	
Prob(Wald F-statistic)	0.000000			

Appendix 4.16: Breusch-Godfrey Serial Correlation LM Test (ARDL) (Source: Developed for research via Eviews 8.0)

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	12.84431	Prob. F(20,7)	0.0010
Obs*R-squared	31.15115	Prob. Chi-Square(20)	0.0532

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 01/22/16 Time: 22:11

Sample: 2007Q1 2014Q4

Included observations: 32

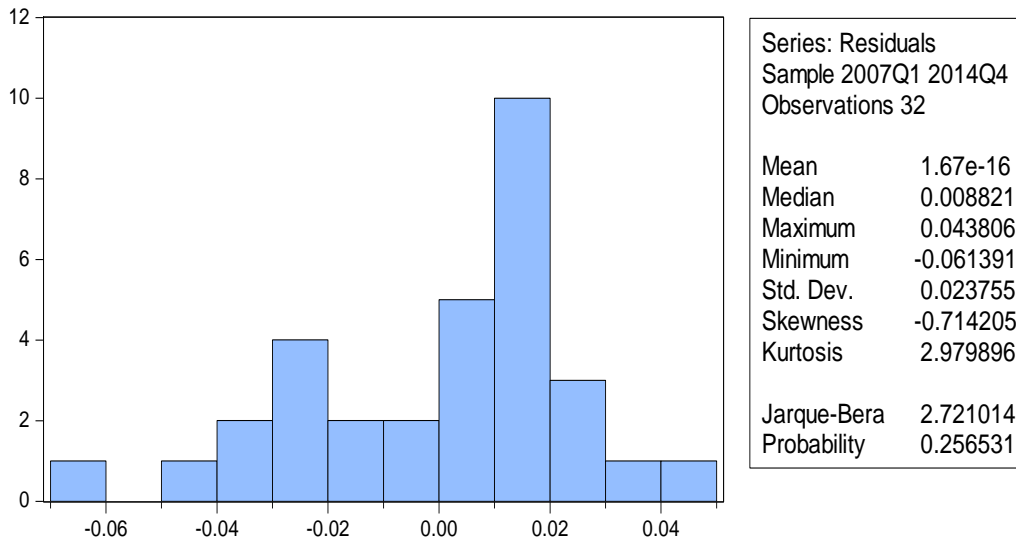
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGEXCRATE	-0.351416	0.085932	-4.089449	0.0046
LR	-0.095684	0.015032	-6.365220	0.0004
PG	1.343319	0.196415	6.839189	0.0002
UR	-0.039597	0.012824	-3.087666	0.0176
C	-1.291672	0.169348	-7.627344	0.0001
RESID(-1)	-0.370457	0.225207	-1.644964	0.1440
RESID(-2)	-0.010084	0.192318	-0.052436	0.9596
RESID(-3)	-0.257103	0.155667	-1.651622	0.1426
RESID(-4)	-0.141626	0.192101	-0.737250	0.4849
RESID(-5)	-0.277806	0.187397	-1.482445	0.1818
RESID(-6)	-0.061294	0.186045	-0.329458	0.7514
RESID(-7)	-0.306487	0.190134	-1.611949	0.1510
RESID(-8)	-0.380517	0.207979	-1.829596	0.1100
RESID(-9)	-0.342159	0.263969	-1.296210	0.2360
RESID(-10)	-0.485883	0.240184	-2.022962	0.0828
RESID(-11)	-0.775421	0.274303	-2.826878	0.0255
RESID(-12)	-0.989945	0.229366	-4.316001	0.0035

RESID(-13)	-1.107056	0.221887	-4.989278	0.0016
RESID(-14)	-1.303194	0.345433	-3.772637	0.0070
RESID(-15)	-1.229492	0.254157	-4.837538	0.0019
RESID(-16)	-1.153141	0.280904	-4.105111	0.0045
RESID(-17)	-0.729690	0.271373	-2.688877	0.0311
RESID(-18)	-0.852682	0.240251	-3.549134	0.0094
RESID(-19)	-0.892149	0.356883	-2.499834	0.0410
RESID(-20)	-0.331114	0.279482	-1.184741	0.2748

R-squared	0.973473	Mean dependent var	-1.67E-16
Adjusted R-squared	0.882525	S.D. dependent var	0.023755
S.E. of regression	0.008142	Akaike info criterion	-6.740874
Sum squared resid	0.000464	Schwarz criterion	-5.595768
Log likelihood	132.8540	Hannan-Quinn criter.	-6.361304
F-statistic	10.70359	Durbin-Watson stat	1.497401
Prob(F-statistic)	0.001745		

Appendix 4.17 Jarque-Bera Test (Source: Developed for research via EViews 8.0)



Appendix 4.18: Ramsey RESET test (Source: Developed for research via Eviews 8.0)

Ramsey RESET Test

Equation: UNTITLED

Specification: LOGHPI LOGEXCRATE LR PG UR C

Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.407344	26	0.6871
F-statistic	0.165929	(1, 26)	0.6871
Likelihood ratio	0.203572	1	0.6519

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.000111	1	0.000111
Restricted SSR	0.017494	27	0.000648
Unrestricted SSR	0.017383	26	0.000669
Unrestricted SSR	0.017383	26	0.000669

LR test summary:

	Value	df
Restricted LogL	74.78026	27
Unrestricted LogL	74.88205	26

Unrestricted Test Equation:

Dependent Variable: LOGHPI

Method: Least Squares

Date: 01/21/16 Time: 15:02

Sample: 2007Q1 2014Q4

Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
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LOGEXCRATE	-0.068033	0.283981	-0.239568	0.8125
LR	-0.044453	0.362587	-0.122601	0.9034
PG	1.038750	9.324236	0.111403	0.9122
UR	-0.003870	0.045771	-0.084543	0.9333
C	0.189486	22.04450	0.008596	0.9932
FITTED^2	0.133189	0.326970	0.407344	0.6871
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R-squared	0.983853	Mean dependent var	5.043892	
Adjusted R-squared	0.980748	S.D. dependent var	0.186351	
S.E. of regression	0.025857	Akaike info criterion	-4.305128	
Sum squared resid	0.017383	Schwarz criterion	-4.030302	
Log likelihood	74.88205	Hannan-Quinn criter.	-4.214031	
F-statistic	316.8381	Durbin-Watson stat	0.732656	
Prob(F-statistic)	0.000000			
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