MACROECONOMIC AND FINANCIAL DETERMINANTS OF MALAYSIAN RESIDENTIAL PROPERTY MARKET

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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 research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

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

(4) The word count of this research report is <u>24,607</u> words.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller Test
AR	Autoregressive
ARDL	Autoregressive-Distributed Lag
BLR	Base Lending Rate
CPI	Consumer Price Index
DV	Dependent Variable
ECT	Error Correction Term
EMPT	Employment
EXG	Exchange Rate
GDP	Gross Domestic Product
HI	Household Income
HPI	House Price Index
IV	Independent Variable
LN	natural logarithm
OLS	Ordinary Least Square
PP	Phillips-Perron Test
VAR	Vector Autoregressive Model
VECM	Vector Error Correction Model

PREFACE

The global house prices have been going up tremendously since year 2000. Most of the real estate investors invest in Asia Pacific countries, especially after the subprime mortgage crisis in year 2008. As Malaysian residential housing market represents one of the most important industries which significant affected the economics of Malaysia, it is important to pay an attention on it.

The Malaysian housing price has gradually kept increasing from 1990 until 2014. It is important to take note that the Malaysian housing price has experienced a rapid increased since year 2008 compared to year before. Economists believed that the rapid increased of housing price will lead to housing bubble which were consequently have destructive effect toward the Malaysia economics. Hence, the trend of house price must be concerned and the factors that lead to the increased of residential house price must be determined.

This research will investigate the relationship between the fluctuation of house price index in Malaysia with the macroeconomic determinants such as inflation (CPI), employment (EMPT), exchange rate (EXG) and gross domestic product (GDP) and the financial determinants such as interest rate (BLR) and household income (HI). This research will provide a clearly picture and empirical results for readers, such as policy makers, investors, homebuyers and homeowners about the connection between these macroeconomic and financial variables towards the house price index in Malaysia.

ABSTRACT

This study examines the relationship between macroeconomic determinants and financial determinants with residential housing price in Malaysia from period year 1996 first quarter to year 2014 fourth quarter, which consist of quarterly data of 76 observations. This study used the Time Series Econometrics to capture the effect of macroeconomic and financial variables on the Malaysian residential housing price. Besides investigate the relationship, this study also examined the long run, short run, causality direction, dynamic stability and shocks of the empirical model of this study.

Macroeconomic determinants such as inflation (CPI), employment (EMPT), exchange rate (EXG) and gross domestic product (GDP) and the financial determinants such as interest rate (BLR) and household income (HI) are used in this study. This study concludes that the employment (EMPT), exchange rate (EXG) and interest rate (BLR) are significant toward the Malaysian residential housing price, however inflation rate (CPI) is not significant toward the residential housing price of Malaysia. Besides, inflation rate (CPI), employment (EMPT) and interest rate (BLR) showed positive relationships with the house price index, whereas exchange rate (EXG) showed a negative relationship with the house price index.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

This study aims to determine the relationship of macroeconomic and financial factors towards the fluctuations of residential house price in Malaysia from year 1996 until 2014. There are a total of four macroeconomic variables which include inflation rate (CPI), employment (EMPT), gross domestic product (GDP) and exchange rate (EXG), and a total of two financial variables such as interest rate (BLR) and household income (HI) were taken into this study together with Malaysia house price index.

Firstly, the research background of this study will be discussed, which includes the general ideas, Malaysian residential property market, Malaysian house price index, macroeconomic factors affect house price index and financial factors affect house price index. Next, a few problems regarding to residential property market in Malaysia have brought into discussion. After problem statements, the general and specific objectives of this study are determined. Besides, this chapter also listed out the questions and hypothess regarding to this study. In the last part of this chapter, a short conclusion will be reviewed.

1.1 Research Background

Housing happens to be the fundamental and essential needs for every human being because these assets not only provide living space for the human accommodation, but also act as shelter for human being protection. Therefore, house is important for every people and the change in residential house price is a concerning issue. The movement of house price in a nation will affect the spending and borrowing behaviors of households because it influences the household's perceived lifetime

wealth. Besides providing protection and shelter, house also act as an investment vehicle. According to Paciorek (2013) the price of a house I n s influenced by the construction cost and the raise in housing price will raise the value of a house. When the housing price increases above the construction costs, the new construction of house is profit, therefore residential investment is consider as positively related to the increment of housing price.

Figure 1.1: Global House Price Index
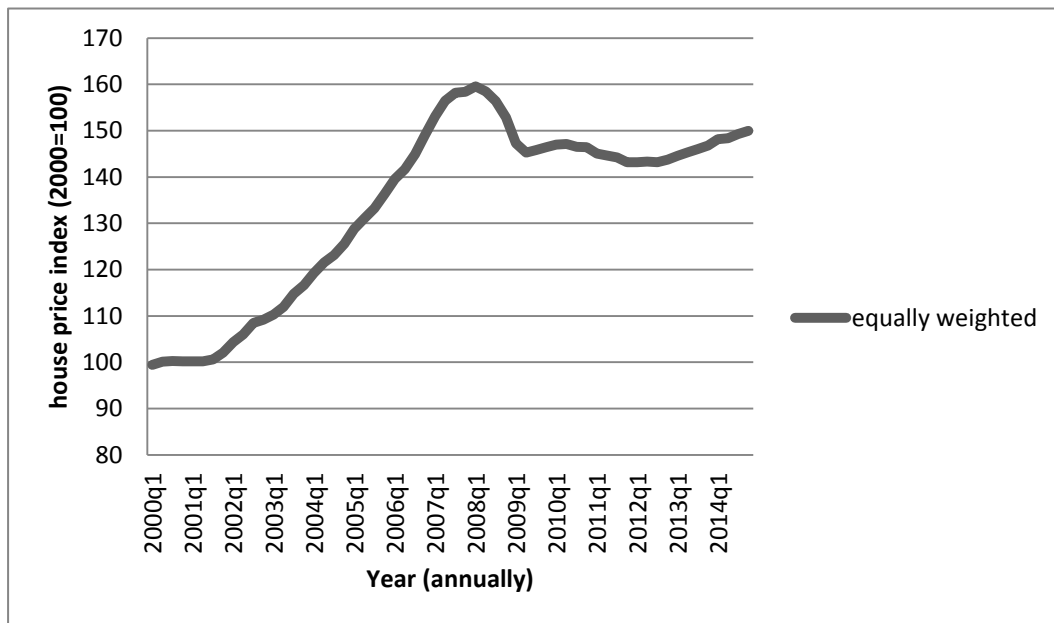
source: International Monetary Fund, 2015; author's compilation

In recent years, house prices from all over the world have been going up tremendously (Glindro, Subhanij, Szeto & Zhu, 2011). The authors believe that real property is a special form of asset that possesses a binary role as an investment and consumption tools. In order to figure out whether there is a global improvement of residential house price, this study take the global house price index calculated by International Monetary Fund from year 2000 quarter 1 until year 2014 quarter 4 and compile in figure 1.1 as above. The global house price index initially experience a steadily growth until a peak of 160 points in year 2008 third quarter, later dramatically collapse about 15 points until a bottom of 145 points in year 2009 second quarter. The global HPI fluctuated in between 140 and 150 points after year 2009 onwards. The drastic decline of global house price

index is due to the United Stated subprime mortgage crisis and global financial crisis in year 2008. Crotty (2009) stated that the collapse of financial markets in year 2008 is the most severe case since the Great Depression and subsequently lead to housing bubble and global economic recession.

After the subprime mortgage crisis in 2008, most of the Asia Pacific countries such as China, Japan, Australia, South Korea, Singapore, Hong Kong, India, Taiwan and Malaysia implemented the macro-prudential policies and focus on the development of real property sectors in order to recover from global financial crisis (PwC & Urban Land institute, 2015). Figure 1.2 below shows the investor's regional allocation percentages in the real estate sectors from year 2010 until year 2015.

Figure 1.2: Investors' Regional Allocation Percentages
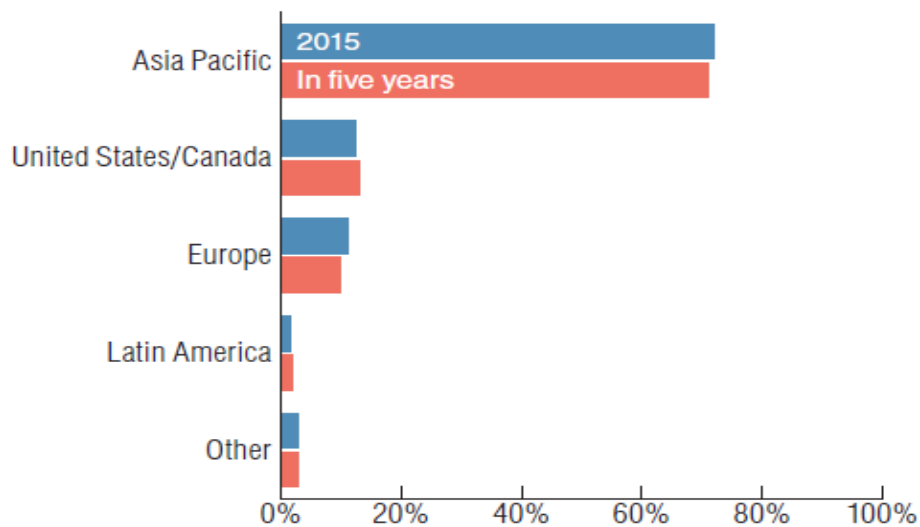
source: PwC, 2015

By analyzing the statistics above, the percentage of real estate investment in Asia Pacific is the highest among the regions in the world. This survey proves that the success of the macro-prudential policies that introduce by the countries in Asia Pacific and investors from worldwide tend to invest in Asia Pacific countries after the subprime mortgage crisis in year 2008. Figure 1.3 below shows the house price index of emerging Asia countries.

Figure 1.3: Emerging Asia House Price Index
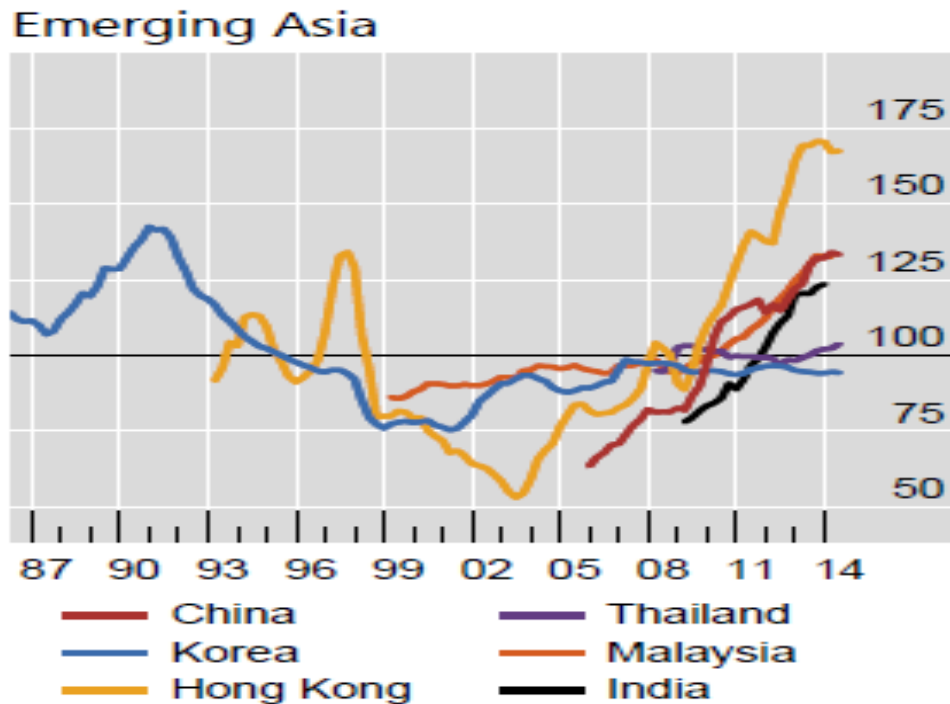
source: BIS quarterly review, 2014

The top three highest rates of HPI in emerging Asia are Hong Kong, China and Malaysia. Apart of Korea, most of the countries HPI show an upward trend. Malaysia has a continuous blooming house price waves since 1999 until 2014, hence it raise the importance for this study to analyze and identify the significant determinants of residential house price in Malaysia.

1.1.1 Malaysian Residential Property Market

In Malaysia, there are different sub-sectors on real estate, including residential property, agricultural, commercial, industrial, and development land. Among these sub-sectors, in year 2013 residential property is the largest sub-sectors which accounts for 64.6% of the total share, the second is the agriculture which is 18.5% of total share, the third is commercial which holds 9.0% of total share, followed by the development land and industrial which are 5.6% and 2.2% respectively (Rehda, 2014). Hence, the residential property can be considered as the major

player of real property markets. The figure 1.4 below shows the total share of sub-
sectors on the real property of Malaysia in year 2013.

Figure 1.4: Total Share of Malaysian Property Markets in year 2013
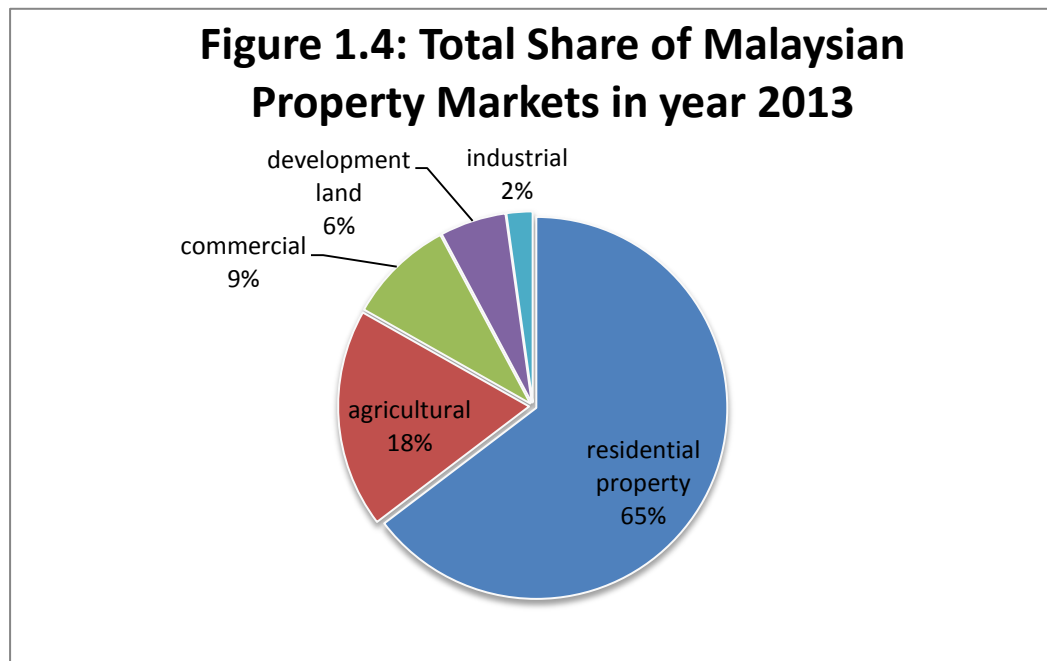
source: Rehda, 2014; author's compilation

The PwC and Urban Land Institution (2014) reported that Malaysia residential
market has an advantage over Singapore residential market due to the fact that
Malaysia residential markets are all domestic players and less of international
players hence the speculation from foreign investor is lesser. The Iskandar Special
Economic Zone of Malaysia had successfully attracted the Asian investors,
especially investors from China. The China developers are active these few years
in Malaysia real property markets, particularly on the Iskandar Special Economic
Zone, which is located in Johor Bharu and near Singapore (PwC & Urban Land
Institution, 2014). This is due to the idea that the developers saw the potential of
real property in Johor Bharu as the satellite of Singapore, which in the same way
of Shenzhen, China that provide services for Hong Kong, SAR.

According to PwC and Urban Land Institute (2015), the continuous boost up of
residential property markets since year 2010 in Malaysia has led the government
to adopt market cooling measures policy similar with thise Asia Pacific countries
in 2014. Government imposed a 30 percent of real property gains tax for the first 3

years, 20 percent (fourth year) and 15 percent (fifth year) in year 2014, which is the charges from disposal of a new house. As comparison with year 2010, whereby the real property gain tax is 5 percent for the first five years, it is clearly showed that government has increased the tax values in order to prevent speculation activity and control the housing to become too pricey. Real property gain tax is created for both foreign and domestic purchasers and it is the tax on net gains after selling the properties within 5 years on new houses.

The markets activities and housing launches are expected to become slower in year 2015 onwards due to the uncertainty of the markets, the political stability, stringent lending rules and weak Malaysian currency (VPC Asia Pacific, 2015). The slowdown of residential property market starting from 2015 onwards may be due to the cooling measures policies and also the citizens cautions the potential impact of Goods and Services Tax (GST) that newly implemented in Malaysia on the property prices.

1.1.2 Malaysian House Price Index

The Malaysian residential property prices are of significant interest to policy makers, market analyst, and also researchers. The accommodation prices played a remarkable role in Malaysia economy, specifically on the transmission of monetary policy and the determination on the wealth of household. In Malaysia, Valuation and Property Services Department (JPPH) contributes to the information on the specific facet of any selling or transferring of land, building and any interest therein either on an ad-hoc basis (single request), on a subscription basis (continuing service), or a special request. Under JPPH, the National Property Information Centre (NAPIC) is responsible for providing comprehensive, precise and timely information in relation to the demand and supply of real property in Malaysia to government agencies, real property developers as well as all parties in this particular industry. Furthermore, NAPIC is in charge to assemble data related to demand and supply, maintain and develop a

national property stock warehouse, and distribute them to the relevant property industry.

House price index (HPI) refers to the measurement of the housing price at which houses are traded over time while holding other economic variables constant. Indices can be surrounded by many different areas, such as a city, state, or country. Growth rates of house price indices can be utilize to calculate house price appreciation. The residential property prices indexes are used by policy makers for targeting monetary policy and inflation, as a macroeconomic indicator to measure the inflation of residential property prices and as an input into a homebuyer's decision making. The HPI is based on transactions involving conventional and conforming mortgages in term of single-family properties.

Figure 1.5 Malaysian House Price Index
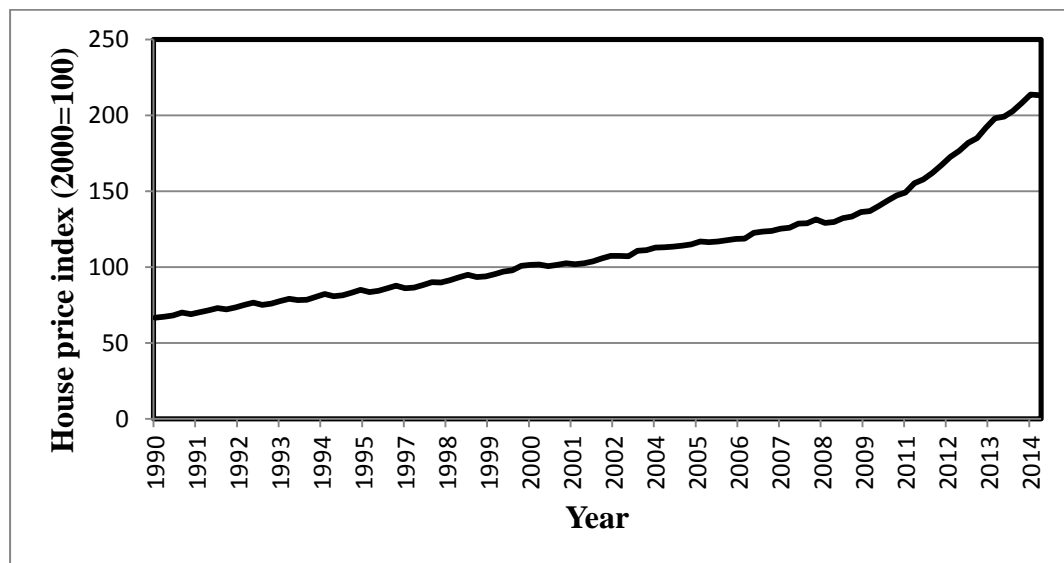
source: oxford economics; author's compilation

Figure 1.5 above shows the housing price index in Malaysia from year 1990 until year 2014. It shows an increment trend from year 1990 until year 2014, especially at the year 2010, the house price index experience an exponential growth until year 2014. From 2001 to the year 2009, the growth of house price in Malaysia is relatively steady. In order to reduce the unsustainable developments in housing property sectors, in year 2010, Bank Negara Malaysia decided to implement the macro-prudential policies (Bank Negara Malaysia, 2012).

In this research, a vast measure on the movement of single-family house prices is the Malaysian house price index (HPI), which is extracted as the selected dependent variable. Malaysia HPI is the only one type of house price index that is designated to act as an indicator for overall Malaysia's housing market in Malaysia. It is a useful and vital tool to provide a big picture on the variation of prices over time and allows monitoring the situation of house market easily. HPI can be determined as a vital indicator for individual to consider whether to buy or sell houses. Moreover, financial institutions and government also used HPI to govern the house price stability and the sustainability of the house market.

1.1.3 Macroeconomic factors that are related to HPI

Macroeconomic is the movement and trend of a country's economy conditions. Residential housing price is dissimilar with others goods and services, hence a stable and well regulated macroeconomic policy and environment will cause the property price to increase. According to Ong (2013), the house price in Malaysia is affected by overall economy growth and macroeconomic factors. Sivitanides (2015) concluded that most of the studies of macroeconomic factors and determinant residential housing price is mainly focusing on the demand and supply factors of housing. The demand factors include GDP, income per capita, interest rate, mortgage rate, population, inflation and others. For the supply factors include construction cost, labor cost, material cost, investment, money supply and others.

1.1.4 Financial factors that are related to HPI

The development of residential housing markets will have significant impact on a country's economic activity and financial stability. The fluctuation of housing price will affect the credit demand of households and debt service capacity in both direct and indirect ways. According to the Lecat and Mesonnier (2005), the house

price dynamic may affect both monetary stability and financial stability. For monetary stability, at least three types of the economic activity will be affected by the house price fluctuations. Firstly, the increase of housing price will cause the rental price to increase at the same time; consequently the consumer will be spending more and lead to consumer price inflation. Secondly, the increment trend of house price will attract local and foreign investors to invest in residential property market, hence the economy will be boost up due to the increase of foreign direct investment. Last but not least, as the value of house price increase, the wealth of the home owners will also increase. Lecat and Mesonnier (2005) also mention from the view point of financial stability, the household balance sheet will be worsen if the home price drops, consequently affecting the banking system because most people are taking mortgage loan from bank when purchase houses.

1.2   Problem Statement

Nowadays, people not only purchase a house for living, but also treat it as a long term investment vehicle. Citizens and investors regardless of domestic or foreign will gather information before purchasing a house in order to avoid paying too much. However, it cannot be deny that the housing price today is much different from the price in the last few decades. Global house price index had shown increments over past few decades and it can be said that as the year goes by, housing price also will increase (figure 1.1). By comparing the trend of real estate with different region worldwide (figure 1.2), it shows that investors tend to invest in Asia countries after the United States Subprime Mortgage Crisis in 2008. This has directly influenced the housing price in Asia countries blooming up in recent years.

Igan and Loungani (2012) stated that few of economic condition in Asia-Pacific region have experienced a rebound in residential property price since 2009. The studies also mentioned the economies in certain countries (China, Singapore & Hong Kong SAR), price-to-income and price-to-rent ratios are still above their

historical values and estimation of econometric still shows a deviation of house prices from the fundamental values. Glindro et al. (2011) stated that few Asia countries, such as Hong Kong SAR, China and South Korea have witnessed a strong inflation of house price in past few years. Asian governments, especially for those emerging countries have stepped up efforts to improve and enhance the structure of housing finance system after the 1997 Asian financial crisis happened (Zhu, 2006). Majority of studies have been focusing on OECD countries (Caldera & Johansson, 2013; Demary 2009; Egert & Mihaljek 2007; Englund & Ioannides, 1997; Madsen, 2012; Orsal 2014). However, there was less research focusing on Asia countries. Generally, the continuous bloom of house price waves intruding the Asia region have raise the importance and attention for this study to analyze and identify the significant determinants of the house price in the emerging country of Asia.

The Malaysian housing prices have undergone a series of upward trend since 1990 until 2014, especially from year 2008 onwards, Malaysia has experienced a rapid increase in housing price. Economists believe that the rapid increase in housing price will form the housing bubble (Zainuddin, 2010). Lecat and Mesonnier (2005) also stated that the recent strong growth of housing prices have raised the concern of housing bubble to be inflated, consequently leading to detrimental impact towards economic activities and financial stabilities. Under this circumstance, this increment trend has raised the attention of investors and home buyers whether the Malaysia housing price will fall through the housing bubble. Policy makers and government are also concerned on the impact of house price towards the economy. Therefore, the trend of house price must be concerned and the factors that led to the increases of residential house price must be determined.

Overall, the residential house price performance is significant to a country. The housing price are not only affecting the residents, but also affect the economy of that country (Guirguis, Giannikos & Anderson, 2005). By highlighting how important and essential housing is, it has led government and developers to propose policies to maintain the stability of the country's economy condition while also ensure citizens in the country obtain an appropriate place to stay. Thus,

this study aims to look into the changes in residential housing price in Malaysia with the macroeconomic and financial variables such as inflation, employment, exchange rate, interest rate, gross domestic product and household income.

1.3 Research Objectives

1.3.1 General objective

This study examines the determinant of residential housing price in Malaysia based on four macroeconomic factors and two financial factors. The macroeconomic factors are inflation (CPI), employment (EMPT), exchange rate (EXG) and gross domestic product (GDP), whereas the financial factors are interest rate (BLR) and household income (HI).

1.3.2 Specific Objectives

i. To identify the long run relationship and short run relationship between residential housing prices and its determinants.

ii. To investigate the causality relationship among the six factors and the residential housing price in Malaysia.

iii. To measure the dynamic interaction among residential housing price and its determinants.

1.4 Research Questions

i. Whether all of the determinants have long run and short run relationship towards the residential housing price?

ii. How is the causality pattern among all of the variables?

iii. How is the dynamic interaction between residential housing price and its determinants?

1.5 Hypotheses of the Study

In this study, there are six hypotheses to determine the relationship between the macroeconomic factors and financial factors towards the residential housing price in Malaysia.

1.5.1 Inflation Rate

H_0: There is no relationship between inflation rate and house price index

H_1: There is a relationship between inflation rate and house price index

The inflation rate has a strong relationship with housing price (Tsatsaronis & Zhu, 2004). A simple explanation would be that when inflation rate increase, eventually price of things will increase such as raw material for house construction. It will affect the housing price naturally. Hence, the housing price will increase as inflation rate increase.

1.5.2 Employment

H_0: There is no relationship between employment and house price index

H_1: There is a relationship between employment and house price index

Employment is referred to people having their occupation and getting paid for living purpose. In other words, employment is providing service to the society. Rupert and Wasmer (2012) and Valletta (2013) stated that variation of employment is important to the residential property market. On the other hand, Abraham and Hendershott (1996), Egert and Mihaljek (2007), and Wang et al.

(2011) found that employment is correlated with housing price. Therefore, this hypothesis is established to examine the connection between employment and housing price in Malaysia.

1.5.3 Exchange Rate

H_0: There is no relationship between exchange rate and house price index
H_1: There is a relationship between exchange rate and house price index

Abelson, Joyeux, Milunovich & Chung (2005) stated housing price and exchange rate having a significant and negative relationship. As the currency of one country depreciates, foreign investors who hold a higher currency tend to invest in that country's property. The higher demand of residential houses in the lower currency country will lead to the increment of house price.

1.5.4 Interest Rate

H_0: There is no relationship between interest rate and house price index
H_1: There is a relationship between interest rate and house price index

It is no doubt that interest rate is seen as an important macroeconomic variable to widely influence the economics and financial sectors of countries (Blankenaua, Kose & Yi, 2001). Mayer and Hubbard (2008) stated the variation of interest rate is a main indicator toward the housing market. Otrok and Terrones (2005) also found that interest rate is an important variable that can affect the housing price significantly. Hence, this paper included interest rate as an independent variable to test its impact on house prices.

1.5.5 Gross Domestic Product

H_0: There is no relationship between gross domestic product and house price index

H_1: There is a relationship between gross domestic product and house price index

The relationship between GDP and housing price has been an interesting issue for the past few decades. High growth rate on GDP represent reliability and consistency of economic condition, and the major aim for government will focus more on international transaction that happen effectively. Consequently, it will affect the levels of cumulative demand for investment to raise, no matter domestically or foreign investment (Zhang, Hua & Zhao, 2012). Author like Zhu (2006) have explained that GDP is correlated with housing price when Zhu conducted the study in Korea and Singapore. Hence, this study had included GDP as one of the factors to test the impact toward housing price.

1.5.6 Household Income

H_0: There is no relationship between household income and house price index
H_1: There is a relationship between household income and house price index

Household income is commonly used as an economic indicator to reflect economic status and standard of living, as well as an essential risk measure used by lenders for underwriting loans. In accordance with economic status, household income may either increasing or decreasing, hence it will vary household borrowing capacity and affordability to buy a house. It is able to demonstrate household income significantly affect the demand side of the housing market (Bujang, Zarin & Jumadi, 2010; Hasim, 2010; Määttänen & Terviö, 2014). This study is intended to examine the relationship between household income and housing prices.

1.6   Significance of the Study

The continuous increment trend of housing price in Malaysia has raised the attention of home buyers, investors, policy makers and economists. The factors that affected the housing markets have been widely discussed recently. The advent of research prepared by Ong (2013) on the macroeconomic determinants of Malaysian housing price has stated the importance of macroeconomics affect the housing price and called for future studies in this area. The research of Lecat and Mesonnier (2005) also mentioned that financial factors play an important role on the dynamic of housing price. Consequently, this study will reveal the relationship of macroeconomic factors and financial factors which are CPI, EMPT, EXG, GDP, BLR and HI with respect to the Malaysian residential housing prices.

Identifying the main factors that affect housing price in Malaysia is an important step for policy makers and government before making any decisions. They need to handle it carefully because a significant fluctuation in housing price will affect the wealth of investors and home buyers, as well as the whole nation. Campbell and Cocco (2007) suggested that government should investigate consumer's consumption behaviors before implementing any policy related to housing price. Nakajima (2011) also stated that it is important for policy makers and government who want to make sound financial decisions to understand why and how the residential house price fluctuates. Hence, this study will explore the most significant relationship between these macroeconomic and financial factors that currently affected the rise of Malaysian housing prices.

For home buyers and investors, both users' interest may be different. For potential home buyers, they will prefer house price drop in the future so they can purchase a house with cheaper price. For investors, the decrease of housing price is unfavorable for them because it affected the house values and decreased their wealth. Besides, housing is also an important component for home owners, which act as their non-pension wealth. The drop of housing price will affect home owner to receive less money when they selling their house in the future. The decision to buy a house or investment in real property is a major decision because it involved

a huge cost and potential of a substantial loss. Nakajima (2011) stated that young households will benefit from lower house price while this situation will hurt home owners. Besides, the author also stated the approach to determine the valuation of housing price is important.

In a nutshell, this study will provide great recommendations for policy makers and government execution policies related to house price and therefore can fulfill the needs of Malaysian citizens who need a house for living. For the property investors, this research will act as a medium for them to assess the timing for purchasing houses in Malaysia as a part of their own investment planning. For potential home buyers, this study will help them to determine the timing to purchase a house. Towards the end, this research will provide the causality and dynamic interaction among the house price index and the macroeconomic and financial factors to give a clear information for readers.

1.7   Chapter Layout

Chapter 1 presents an overview of residential house price in Malaysia, including the importance of a house, the increment trend of housing price and consequences of housing price increment over the years in Malaysia. Besides, the background of Malaysia and the linkage of residential housing price with macroeconomic and financial factors are discussed in this chapter. The research problems, general objective, specific objectives and research questions are also included in this chapter. Lastly, the contribution and significant of this studies have been discussed in this chapter.

Chapter 2 presents an overview of the past relevant studies and existing literature. In this particular chapter, the relationship between residential housing price and each of the determinants have been discussed, including the definition, significance and sign. In addition, the conceptual frameworks and theoretical models of residential house price are discussed and reviewed in this chapter.

Chapter 3 will display the methodology and research method. The model of this research will be explained in this chapter. The proxy, definition, and expected sign for each variable is also been stated. Next, the data collection ways and sources as well as the scale of measurement for each variable are summarized and presented in table form. Lastly, the methods and tests that will be utilized in this entire research for the purpose of analyzing the data are discussed as well.

Chapter 4 would be the empirical result and interpretation. Initially, the trends of each variable will be discussed and the data series patterns will be tested through unit root tests. A few tests to study the significant, long run relationship, short run relationship and causality relationship between residential house price and its determinants will be carried out afterwards. This research will also discuss the dynamic stability of the empirical model. Furthermore, variance decomposition and impulse response function tests will be carried out in the final part.

Chapter 5 is the conclusion and policy implication chapter. It is to summarize whatever findings from chapter 4 and interpret the results consistent with the objective of this study. Besides, some recommendations which may be useful for policy makers or investors will be explained in this chapter. Lastly, the limitation and future study of this research will be discussed.

1.8   Conclusion

The global residential house prices are in continuous increment trend. Nowadays, housing prices are more expensive than previous centuries. After the Subprime Mortgage Crisis of United Stated in 2008, the real estate investors from worldwide invested in Asia Pacific region. This marked the success of implementing macro-prudential policies in Asian countries. The top three highest residential housing prices in Asian countries are Hong Kong (SAR), China and Malaysia. The Malaysian housing price never decline since 1996 and continue to rise until today, hence it is subject to numerous discussions about the housing bubble in Malaysian residential markets. The factors that led to the continuous

blooming of house price in Malaysia are considered to be the most widely discussed topic in this few years. In order to better understanding of the role of macroeconomic and financial factors towards the residential house price, six factors which are inflation, employment, exchange rate, gross domestic product, interest rate and household income are employed in this research to study the relationship of these factors with the Malaysia house price index. After introducing the main ideas and elaborated the problems of this study, the literature review is followed next.

CHAPTER 2: LITERATURE REVIEW

2.0   Introduction

There are various view points on the relationship between macroeconomic and financial variables towards the housing prices in Malaysia. Therefore, in this chapter the literature review regarding the relationship between respond variable (HPI) and explanatory variables (CPI, EMPT, EXG, GDP, BLR and HI) will be discussed in detail. Initially, this chapter will review past researcher's literature and explain the relationship between respond variable and explanatory variables. After that, this chapter will discussed the relevant theoretical framework of house price index with the macroeconomic and financial factors. The last part of this chapter will be the proposal of the theoretical model of this study and the brief summary of this chapter.

2.1   Review of the Literature

Court (1939) is the first author to determine the relationship between quality and price characteristics by using hedonic method. A further detail of quality change as compared to the hedonic method was explained by Price Statistics Review Committee of United States in 1961. Triplett and McDonald (1977) studied the hedonic quality changes with refrigerator price index, and Diewert (2001) had further applied consumer theory into hedonic regression model. Sutton (2002) studied the relationship of house price, real interest rates, national incomes and stock prices with using simple empirical model. Sutton studied the response of changes of housing price when there are small changes in the key determinants. This study will focus on the response of house price index with the macroeconomic and financial variables such as inflation rate (CPI), employment

(EMPT), exchange rate (EXG), gross domestic product (GDP), interest rate (BLR) and household income (HI).

2.1.1 The relationship between inflation and house price index

Inflation rate is use to measure the level of economic stability of a host country. It represents a continuous rise or continuous fall in the general price of goods and services in the host country (Labonte, 2011). In another way, inflation rate can indicate the purchasing power of consumers on goods and services in that country's economy. The level of inflation rate is one of the main concerns of government and central back to maintain the country growth. High inflation rate brought a sign of macroeconomic imbalances and will lead to dawdling of economic growth. Alternatively, low inflation rate will not assure a high growth in the economy.

In short, there is a negative relationship between inflation rate and housing price. Rogers (2001) found out that there was a negative relationship between inflation rate and housing price in Euro in year 1999. They commended that the expected inflation may be detected in certain low housing price country if housing prices are different in the beginning across the euro countries. The inflation rate of countries may give a potential explanation for housing prices cross-country. Besides, Brunnermeier and Julliard (2007) have supported the negative relationship hypothesis. They explained the negative relationship in two paths; first, the economy may become riskier when high inflation happens. Housing agents will face more uncertainty risk. In order to attract buyers, housing agents tend to increase risk premium as to lower the housing price. The second way of explanation is high inflation rate may give a signal of economic downturn that will push away buyers and hence housing price will decrease.

In contrast, some researchers argued that there might be a positive and strong relationship between inflation rate and housing price. Frappa & Mesonnier (2010) has revealed the positive relationship in between and argue that when inflation

rate increase, the same shall happen to the real payments on long-term fixed-rate mortgage. Housing supply will decrease and indirectly leading to the increase of house price. His statement was supported by Tsatsaronis and Zhu (2004). They enhanced the theory behind it which is common for households to hedge risk by investing in residential real estate other than bond and equities. Such high inflation will also bring a high level of uncertainty attracted investors and will lead to increase in house price.

On the other hand, some researchers believed that the inflation rate is not a significant determinant of house price. Tan (2010) found that inflation rate has a lagged effect to house price in Malaysia from 1988 to 1997. He applied the hedonic pricing model which was derived from the multi regression analysis present the negative r-value of inflation rate. Similarly with the result above, Ong (2013) examined the macroeconomic determinants of houses in Malaysia during the period of 2000 until mid of 2012, it was found that inflation rate is not a significant determinant of the house price.

In a nutshell, inflation rate may have both significant or insignificant and negative or positive affect toward house price. Perhaps there are a lot of discovered and undiscovered determinants, one thing that is undeniable is inflation rate is one of the significant factors for house price.

2.1.2 The relationship between employment and house price index

Carlson, Haveman, Kaplan and Wolfe (2012) defined employment as the state of having a job that is working for others or providing services to the community. Besides, employment is a situation in labor force market where the demand of worker is higher than the supply of worker (Katz, 1988). In other hand, researcher Kitov, Kitov and Dolinskaya (2008) stated employment rises in the labor market was due to the condition of the market provides the wages that able to fulfill the minimum requirement for most of the job seekers. Employment is important from

the country perspective because it is an indicator to detect the health of an economy. There were few researchers conducted the study on the phenomenon of employment and came out a review of studies concluding that employment is positively affecting the housing price (Bump, Levkov & Garriga, 2014; Dohmen, 2005; Khan, Shamshad & Hassan, 2012; Valletta, 2013).

Next, demographic structures changes are one of the major determinants of housing price. By referring to the 2015 Census by the Department of Statistics Malaysia, the number of citizens being employed had increased steadily to 13,532 thousand people in year 2015 from 12,284 thousand people in year 2011. As the number of youngsters in Malaysia emerging into local job field increased rapidly, they are more likely to acquire their first property at an early age. Consequently, the demand of residential house will rise as well and it makes the housing price to increase to a certain level (Altman, 2006).

In the research conducted by Aminuddin (2009), he stated that sexual harassment was not recognized and not alert on the consequences until late 1990s. The first studied on sexual harassment at working place in Malaysia was conducted by Sabitha Marican in year 1999 and no further research after that until 2007 when Ismail, Lee and Chan (2007) published their results of research and concluded that sexual harassment problem arises in Malaysian workplaces. Ali, Mohammad, Sabri and Jislan (n.d.); Ismail, Lee and Chan (2007); Laxman, Som, Saat and Low (n.d.) came to the same conclusion as prior researchers, whereby they found that sexual harassment will cause low employment rate towards the country if sexual harassment arises. Thus, this will lead to a major problem to the number of citizens being employed regardless of gender. Hence, employment will refract the economic condition in a country; therefore employment is the key indicator that will affect the housing market in a country.

In addition, few researchers found that employment is positively and significantly influencing housing price (Chinn, Ferrara & Mignoon, 2014; Mcquinn & o'Reilly, 2005; Otrok & Terrones, 2005; Xue, Gao & Guo, 2014; Zabel, 2012). According to economic theory, high employment implies higher purchasing power parity.

Consequently, with more potential buyer in the housing market, the house agent will mark-up the price for houses in order to suit market condition.

2.1.3 The relationship between exchange rate and house price index

In finance perspective, exchange rate refers to the rate of one currency that will be exchanged for another. In other words, exchange rate represents the strength of a currency. Besides, exchange rate reflects on the consequence of inflation in economic perspective.

Studies showed that exchange rate and house price have negative relationship in between. According to Abelson et al. (2005), the increase in the demand of purchasing house holds a low exchange rate by foreign investors especially those emerging countries like India. As a country's exchange rate starts to depreciate, foreign investors are capable to convert more currency in that country and the good choice of foreign investment in that country are property market. Furthermore, Abelson et al. (2005) explain this relationship is in long-run relationship. In addition, Mallick and Mahalik (2015) have supported the negative relationship between exchange rate and house price and giving an insight that not only the exchange rate will affect house price, house price will cause causality effect on exchange rate too.

In contrast, some other researchers argued that exchange rate and house price were correlated. Meidani, Zabihi and Ashena (2011) revealed that demand of house price will increase when exchange rate appreciate. They explained that this is because house owners wish to preserve their asset value. Besides, Meidani, Zabihi and Ashena (2011) found that there is no causality relationship exist in between exchange rate and housing price in their research. Besides, their statement had supported by Glindro et al. (2011). Glindro et al. (2011) stated that positive relationships between exchange rate and house price can be found in

those countries which pay attention on foreign direct investment, for example Asia countries.

In a nutshell, the exchange rate may have both positive and negative relationships with house price. However, it was undeniable that exchange rate is one of the important determinants of the house price. As Zhang et al. (2012) had suggested that China government need to adjust their monetary policies in order to control housing bubble in China.

2.1.4 The relationship between interest rate and house price index

Regarding to Tucker (2000), Interest Rate refers to the amount charged in percentage rate on the principal amount or assets from borrowers to lenders. The application of interest rate is used to help lenders to get the compensation or return over time in terms of the usage of the assets from borrowers. In common, interest rate is laid down in contracts between involved parties, the higher risk of loan or assets will be charged at a higher interest rate for higher return and vice versa (Shiller, 2007). However, different kinds of interest rate are connected and affect each other. For instance, the increase of interest rate brings benefit to investor since they can get better profits from bond or bank deposit. In such cases, borrowers will have to make higher repayment in term of the rises of interest rate (Piana, 2002).

In accordance with the objectives of this paper, we concentrate on studying how interest rate influences our dependent variable which is housing prices. McQuinn and O'Reilly (2008) argued that interest rate played a major role as the main determinant of house price movements is essentially incontestable. There is an important remark that the extent of variation in housing prices will eventually rely on anything that will lead to the estimation of income and interest rates. Based on the previous researchers, Tse, Rodgers and Niklewski (2014) also emphasize that interest rate is a significant variable to determine housing prices and it cannot be neglected.

According to Craig and Hua (2011), interest rate significantly influence the housing prices in a negative way. There is a lot of evidences to indicate the decline of interest rate will lead to the appreciation of housing prices, as well as housing boom (Glindro et al., 2011). Furthermore, a rise in interest rate will cause a decline in demand side of housing market, as a result of interest rate and house prices are negatively correlated (Cho, 2006; Shiller, 2007). Furthermore, Mayer and Hubbard (2008) also stated the variation of interest rate is a main indicator toward the housing market.

According to Tumbarello and Wang (2010), they found that interest rate has a significant effect on housing price. Besides that, Hott (2009) stated that the willingness of banks to provide mortgage loan can have a significant effect on the demand for houses, thus affecting the residential housing prices. Lower interest rate will lead to a considerably increase in money supply, as well as slackening in specific mortgage credit policy will boost the enlargement of house price. As well, Xu and Chen (2012) expected that house price and bank loan rate are negative correlated. Moreover, Muellbauer and Murphy (1997) agreed that the development of bank lending can lead to house price development.

If the availability of credit of banks increased, those banks are able to offer lower bank lending rates, as a result of encouraging more people to participate in current and future housing market. Zainuddin (2010) also stated if the lending rate decreased, housing demand in Malaysia will increase due to the lower cost of mortgage financing. The higher lending rates imply higher credit costs, whereby it should depress the demand for housing (Ong & Chang, 2013).

In this paper, base lending rate (BLR) is taken as a proxy for interest rate. Based on a variety of researches, they tend to use BLR as an appropriate proxy for interest rate and found that it is negatively correlated with housing prices in the long term period (Adams & Füss, 2010; Tan, 2010).

2.1.5 The relationship between gross domestic product and house price index

Gross domestic product (GDP) is a measurement of nation's business cycle over an economic year. Most of the researchers have used GDP as one of the independent variable to measure the independent variable which is housing price. Due to increase of the sample size that was used for GDP, most of the researchers prefer to use quarterly data (Hott, 2009). However, GDP data is also commonly available yearly.

Otrok and Terrones (2005), Sutton (2002), Tsatsaronis and Zhu (2004) have studied global macroeconomic effects on real estate prices and specified that real estate market is highly correlated with GDP and other macroeconomic variable. However, fundamentals like GDP makes the real estate markets become international correlated. For example, residential housing price drop in year 2008 and affected nearly all countries around the world (Adam & Fuss, 2010). According to Sutton (2002), the strength of GDP to residential housing price depends on the openness of the country and GDP correlations were found at range on average 0.33 to 0.44.

There are significant results found by GE (2009) and Otrok and Terrones (2005). Both of these authors have identical conclusion stated that there is significantly positive effect between GDP and housing price. Besides, few researchers also stated GDP as one of the macroeconomic variables which positively and significantly influence the residential housing price in a country (Bekhet & Othman, 2011). In addition, Adams and Fuss (2010) and GE (2009) found similar result and it was supported by theoretical equilibrium models. Furthermore, the result showed that as the GDP increases, the housing price will increase as well. Many researchers has shown studies to examine the positive relationship between GDP and housing price, either in short run, long run, or both (Bekhet & Othman, 2011). But, the result from other researcher shows that GDP is negatively related to housing price (Pour, Khani, Zamanian & Barghandan (2013). This shows that

different country have dissimilar trend of relationship between GDP and housing price.

When a country is an export dominant country such as Malaysia, the depreciation of a country's currencies might be good news for the country because when then currency of the country becomes weaker than other countries, these other countries will be attracted by cheaper goods in Malaysia. Thus, the exporting country will get higher amount of Balance of Payment (BoP) than previous year due to the increased numbers of exports to other countries. In a nutshell, positive balance of payment will stimulate the country's economic condition since exports are more than imports, which will highly influence the GDP of a country. In general, the GDP of a country consists of consumption, government expenditure, income, and net exports. When exports had been increased, it will directly affect the GDP of a nation holding imports constant.

Moreover, most empirical finding stated that GDP positively affects the residential housing price in the long run (Capozza, Hendershott, Mack & Mayer, 2002). This phenomenon is due to the increment in income level in a country. High income lead to high consumption, therefore, demand and supply of residential house is not equilibrium in property market. In other ways, investing on residential property is the alternative way for investors and it directly affects the housing price in the market (GE, 2009). Although the results obtained from past researchers are not consistent, but all this proof are significant to housing price. Hence, GDP is an important indicator that used to determine housing price in a country.

2.1.6 The relationship between household income and house price index

Household income can defined as a measure of the aggregated earning incomes from the members sharing a specific household of residence. HI comprises any modus of income and the level of income is an essential risk measure used by

lenders for underwriting loans criteria, as well as an indicator of consumption capability of a household. Hence, household income level is able to represent household borrowing capacity and affordability to buy a house for housing demand (Gallin, 2006; Fox & Finlay, 2012).

According to Fox and Finlay (2012) and Hashim (2010), the researchers adopted household income as one of the most appropriate variable to gauge housing prices. The increment in the level of household income is able to alter the demand circumstances in the housing market. Campbell and Cocco (2007) also found that household consumption responds to predictable changes in house prices. It means that the growth in household income encourage households to expand their consumption and expenditures in normal and luxury goods, as well as to enhance their living standard. As well, housing can represent one of the goods, it means that the increased HI will boost the demand side of the housing market. Hence, an increment of household incomes will positively affect house prices. However, an increase in income inequality might possibly decrease housing prices as well, depending on the details of both demand and supply sides of the housing market (Määttänen & Terviö, 2014).

According to previous studies, a lot of researchers (Abraham & Hendershott, 1996; Capozza et al., 2002; Malpezzi, 1999) considered housing price is connected to income in terms of its long-run relationship. Besides, the rise in household income will lead to the decline in the cost of the home loan as a proportion of total income, as well as increasing the affordability of households. Therefore, house prices and household income are positively correlated. Furthermore, Gaines (2015) also examined the linkage between household income levels and housing prices, as well as the variation in each relative that affected on the other. In regard to economic growth strongly, household incomes increment along with the high level of housing affordability and the intention to buy houses. Thus, it induces housing demand side and subsequently lead to the increment of house prices. (Hasim, 2010; Määttänen & Terviö, 2014).

In addition, the proportion of the property price to annual household income is commonly used as a benchmark to assess the affordability of house prices. Other than that, Chen and Patel (1998) also decided to use household income as one of the determinants of house price in their research and found that household income granger cause house prices. It has been proposed there is a long-run equilibrium relationship between house price and household income (Abraham & Hendershott, 1996; Capozza et al. 2002).

2.2   Review of Relevant Theoretical Framework

For households, most of them purchased housing as a shelter or for investment purposes. Similar to companies and investors, they purchase property based on the comparison of return between an asset with other asset. In order to fulfill this two economic functions and roles, Lecat and Mesonnier (2005) applied two theoretical approaches in their study. The first approach is asset pricing models, which primarily focus on investment and provide the arbitrage opportunities and the second approach is structural model, which focus on the demand and supply factors in determinants of the property. The researcher used the first approach to make comparison between stock market investment and residential property investment. Lecat and Mesonnier (2005) stated that although this approach is simple and easy to apply, however there are certain limitations such as lumpiness of housing, limited arbitrage opportunities and imperfect in separate between renting and owning a property. The second approach, structural model is used to determine the house price by using either demand side factors or supply side factors. The housing demand side equations are mostly used for empirical estimation and represented the long run equilibrium. However, the housing supply side factors are mostly described by land prices, building costs, construction cost and others.

Fisher effect theory was first introduced by Irving Fisher. Fisher effect theory is an economic theory that determines the relationship between inflation rate, real interest rate and nominal interest rate. According to Alvarez et al. (2008), inflation

rate is playing an important role in manipulating nominal interest rate and it is affecting by the money supply demand. Moreover, inflation rate represents one of an important indicator in affecting house price (Frappa & Mesonnier, 2010). Thus, investors were sensitive to the government movement because government will conducts monetary policies when inflation rate of nation happens. Low cost of borrowing will increase the demand of money in economy, authorities implemented lower interst rate of policy in order to increase the inflation rate of nation. Indirectly, changes in inflation rate adjusted by authorities will affect the house price level in nation.

Monetarist model derived from the monetary approach which focus more on balance of payments (Bain, n.d.). This model categorized exchange rate as a relative asset price. Moreover, currency is defined as discounted value of future money indicating the output level of nation.Monetarist model link closely with Purchasing Power Parity which define as the respective prices of goods and services after converted into common currency is the only basis when choosing local and foreign goods under the assumption of same price level. According to Purchasing Power Parity, a decrease in local inflation rate will increase its home currency. However, the assumption of same price level of two countries will never achieve in reality because transportation cost could not be avoided (Eita, 2012). Hence, the movement of export and import cost will affect the exchange rate as the capital investment flow fluctuates. Thus, local house price will be affected by fluctuation of exchange rate as exchange rate is consider as one of the important determinants affecting residential house price (Abelson et al., 2005).

Sivitanides (2015) formulated the model of explaining impact of macroeconomic variables on house price in Cyrus followed by the classical demand and supply theoretical framework. The researcher suggested that household income, total employment, interest rate, mortgage rate, GDP, inflation and others demand side factors for houses can be used when carrying out the test. Besides, the construction cost, land supply, material cost, labor cost, housing stock, residential building permits are the supply side factors which can be employed when carrying out the test. Furthermore, this researcher applied partial adjustment modeling

approach which involved the logarithmic of the empirical model in order to solve the non-linearity problems of the explanatory variables.

According to Ong and Chang (2013), the house price in Malaysia is affected by overall economy growth and macroeconomic factors. The authors study the relationship of macroeconomic factors such as population, gross domestic product, labor force, interest rate, inflation rate and real property gain tax with the residential housing markets in Malaysia. The result showed that only gross domestic product, real property gains tax and population are significant affect the housing price in Malaysia. Valadez (2010) study the impact of macroeconomic factors towards the housing prices from year 2005 until 2009. This researcher found that there is a relationship between real gross domestic product and house price index. Besides, this researcher also mentioned that there would be a challenge to study the scientific causal effect macroeconomic variables and house price index.

Lastly, Bilozor and Wisniewski (2012) used rough set theory to identify the impact of different macroeconomic factors that affect the residential housing price in Italy and Poland. The result showed that most significant variables affect residential housing price in both Poland and Italy countries are gross domestic product, consumer price index, population growth, net national income and household final consumption expenditure. In conclusion, after reviewing the theories and methodologies from other research papers, this research applied and studied the relationship of gross domestic product, consumer price index, employment, base lending rate, household income and exchange rate toward house price index in Malaysia.

2.3   Proposed Theoretical Framework

Table 2.1 shows the relationship between the six selected variables with house price index in Malaysia.

Table 2.1: Relationship between house price and its determinants

Dependent Variable	Independent Variables
Residential House Price	Inflation Rate
	Employment
	Exchange Rate
	Interest Rate
	Household Income
	Gross Domestic Product
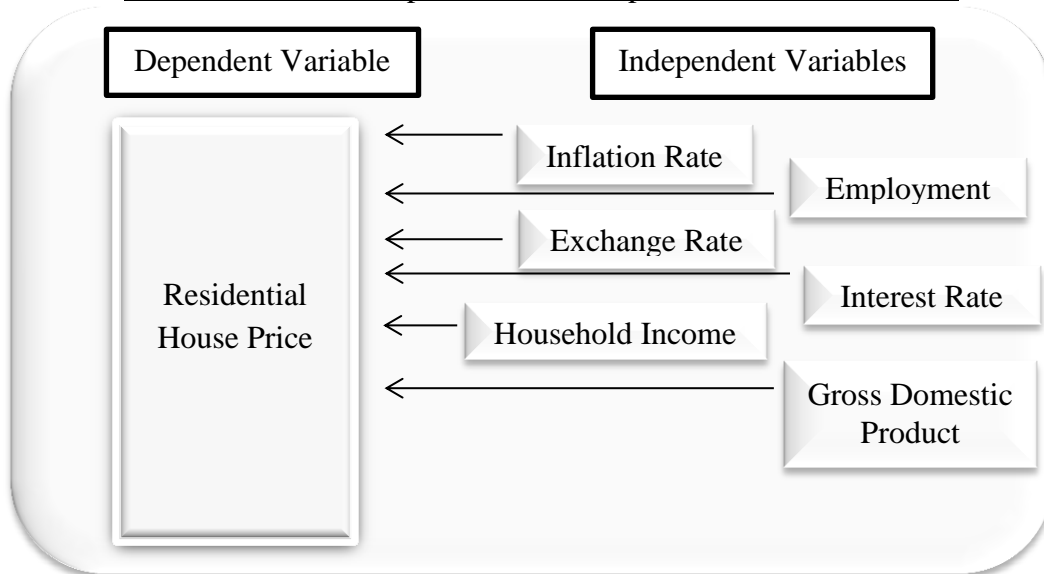
source: prepared by author

Frappa and Mesonnier (2010) had revealed the positive relationship in between and argued that when inflation rate increase, the same will happen to the real payments on long-term fixed-rate mortgage. Housing supply will decrease and indirectly increase the house price.

According to Abelson et al. (2005), the increase in the demand of purchasing house holds a low exchange rate by foreign investors especially those emerging countries like India. As a country's exchange rate starts to depreciate, foreign investors are capable to convert more currency in that country and the good choice of foreign investment in that country are property market.

Otrok and Terrones (2005) found that employment has a positive and significant influence on the residential housing price. As the employment in the country increased compared to previous year, the housing price will rises as well.

Based on Tan (2010) and Ong (2013), interest rate decreased, housing demand in Malaysia increased due to the lower cost of mortgage financing. The higher lending rates imply higher credit costs, whereby it should depress the demand for housing and negatively affect housing prices.

Sutton (2002), Tsatsaronis and Zhu (2004), and Otrok and Terrones (2005) have conducted their studies on global macroeconomic effects on property prices and specified that GDP is one of the independent variable that positive and significant relationship toward residential housing price. As the GDP in a nation increase significantly, and housing price is expected to arises indirectly.

Household income level can represent households' borrowing capacity and affordability to buy house for housing demand. In such cases, a rise in household income will lead to a decline in the cost of the home loan as a proportion of total income, as well as increase affordability of households, hence it enables positive influence on house prices. (Gallin, 2006; Fox & Finlay, 2012).

Table 2.2 Determinants of the house price index

Researchers	Interest rate	Income level	Job growth	CPI	EXG	GDP
Beltratti and Morana (2010)	✓				✓	✓
Paciorek (2013)	✓					
Aura and Davidoff (2008)	✓					
Tsatsaronis and Zhu (2004)	✓	✓		✓		✓
Aherne et al. (2005)	✓			✓		✓
Brunnermeier and Julliard (2007)	✓			✓		✓
Zhu (2006)	✓			✓	✓	✓
Abraham and Hendershott (1996)	✓	✓	✓	✓		
Egert and Mihaljek (2007)	✓		✓			✓
Breitenfellner et al. (2015)	✓			✓		✓

Madsen (2012)	✓			✓		✓
Agnello and Schuknecht (2009)	✓		✓			✓
Sutton (2002)	✓	✓				
Orsal (2014)	✓			✓		✓
Maclennan et al. (2000)	✓			✓		
Hofmann (2003)	✓					✓
McQuinn and O'Reilly (2005)	✓	✓				
Glindro et al. (2011)					✓	✓
Bardhan et al. (2003)						✓
Zhang et al. (2012)		✓		✓		✓
Wang et al. (2011)			✓			✓
Cho (2006)	✓			✓		✓
Chang et al. (2012)				✓	✓	✓
Wu and Zheng (n.d.)	✓			✓		
Yiu (2007)				✓		✓
Huma (2012)		✓				✓
Craig and Hua (2011)	✓					✓
Vanichvatana (2007)	✓	✓	✓		✓	✓
Mahalik and Mallick (n.d.)	✓	✓			✓	
Ong (2013)	✓			✓		✓
Ong and Chang (2013)		✓		✓		✓
Zainuddin (2010)	✓			✓		✓
Shi et al. (2013)	✓		✓	✓		
GE (2009)			✓	✓		
Motu (2006)	✓	✓				✓
Lee (2009)		✓		✓		

Tumbarella and Wang (2010)		✓			
Abelson et al. (2005)			✓	✓	✓	
Chien et al. (2014)	✓		✓			✓
Plakandaras (2015)	✓		✓	✓		✓
Gartini and Ganoulis (2012)	✓			✓		✓
Iacoviello (2002)	✓			✓		✓
Goodhart and Hofmann (2008)	✓			✓		✓
Bracke (2011)				✓		✓
Ozkan (2012)	✓		✓	✓		✓
Kang and liu (2014)	✓	✓	✓	✓		✓
Caldera and Johansson (2013)	✓	✓				
Ott (2014)	✓	✓		✓		
Total	35	15	12	29	7	33

source: Prepared by author

2.4 Conclusion

In brief, this chapter has explained the relationship of the house price index and macroeconomic and financial factors based on the literature from previous researchers. Throughout the discussion above, those studies have stated that there are strong correlation between the CPI, EMPT, EXG, BLR, GDP and HI and the HPI. This chapter also reviewed the theoretical framework between house price index and its determinants. For the next chapter, this research will discuss the methodology and technique used for the estimation of the relationship of HPI and other variables in Malaysia.

CHAPTER 3: METHODOLOGY

3.0   Introduction

This study examined the effect of macroeconomic and financial factors towards the residential housing price in Malaysia. The methodology and tests used in order to meet with the objective of this study will be discussed and explained in this chapter. More specifically, this chapter will present the data source and data collection method, the proxy for the variables, the unit measurement for each variable, research model, research techniques and instruments, and flows of the methodology.

Initially, this study was to testify the determinants of residential housing price with six independent variables includes consumer price index, employment, base lending rate, exchange rate, gross domestic product and household income. The frequency of the data in this paper is quarterly data for 19 years from 1996Q1 to 2014Q4, a total of 74 observations. This study applied time series econometric models for interpreting, analyzing and testing hypothesis concerning with the data used in this research. Besides, Eviews 8 software is used to read and analyze the results output.

In brief, section 3.1 will discuss the proposed empirical model of this study. Section 3.2 is the description of the variables and section 3.3 is the data source and data collection method of this study. Section 3.4 will elaborate the data processing of this research. The ideas, theories and functions of each methodology will be discussed in the section 3.5. The last section is the conclusion of this chapter.

3.1   Proposed Empirical Model

This study investigated the effect of consumer price index, employment, exchange rate, base lending rate, gross domestic product and household income towards the house price index in Malaysia. The empirical model of this study can be specified as below:

$$lnHPI_t = \beta_0 + \beta_1 lnCPI_t + \beta_2 lnEMPT_t + \beta_3 lnEXG_t + \beta_4 BLR_t + \beta_5 lnGDP_t + \beta_6 lnHI_t + u_t$$

Where,

HPI   = House price index in Malaysia (index, 2000=100)

CPI   = Consumer price index in Malaysia (index, 2010=100)

EMPT = Employment in Malaysia (thousands of citizen)

EXG   = Exchange rate index in Malaysia (index, 2010=100)

BLR   = Base lending rate in Malaysia (percentage)

GDP   = Gross domestic product by expenditure in Malaysia (index, 2010=100)

HI   = Household income in Malaysia (Millions of ringgit Malaysia)

ln representing the natural logarithm form, u_t represents uncorrelated white-noise error terms. β_0 is the intercept of the regression model and $\beta_{(1,2,3,4,5,6)}$ represent the slope of coefficient.

There are several reasons for this study to apply natural logarithm form to the variables. Firstly, log the variables will turn the data series into linear trend. Many of the economic variables are underlying rate of growth, which the data may or may not be constant. The mean will continue to increase and the data are not integrated because no amount of differencing can make the data stationary (Asteriou & Hall, 2007). The second reason is it can narrow down the scale of data if the scale of the sample data is too big. Specifically, unit measurement of household income is millions in Ringgit Malaysia which data figure is very large compared to the consumer price index which data figure is small. Lastly, the coefficients on the natural logarithm scale can be directly interpreted as approximately proportionally different (Gujarati & Porter, 2009). For example, a

small percentage changes in dependent variable (Y) correspond to an approximate small percentage changes in independent variable (X).

3.2   Variable Descriptions

3.2.1 House Price Index

In reality, housing price is the main concern by the citizens in the country. Besides, it shows the overall condition of economy in a country. Thus, to study the determination of housing price, HPI is used as a proxy to measure the price of housing in the country. According to researcher Tse, Ho and Gansesan (1999), they stated that unstable housing price has significant influence towards the economic state regarding GDP and demographic changes. Recently, demand of housing is increasing over the years. Therefore, when there are more home buyers than sellers in housing market, the housing price is expected to increase due to the imbalance between home buyers and sellers.

In Malaysia, HPI is a broad measure of fluctuation of single-family house price and it is measuring the weighted average price change in repeat sales (Department of Statistics of Malaysia, 2015). According to McQuinn and O'Reilly (2005), they conducted the study about theoretical of model in house price determination by using HPI as their proxy. In addition, past researcher took HPI to capture the relationship between macroeconomic activity and housing prices (Hott, 2009). The researchers came out with similar conclusion, they claimed that independent variables such as GDP, exchange rates, employment rate, personal income and inflation have positive and significant relationship against HPI, however, interest rate shows negative relationship towards HPI. In this study, GDP, exchange rate, employment rate, household income and inflation are expected to have positive relationship with HPI and base lending rate to have negative relationship against HPI.

3.2.2 Consumer Price Index

Normally, inflation rate is measured by CPI (consumer price index). CPI can be defined as the measurement of price of change of services and goods that household consumed in index form. However, CPI only refers to the average measurement of goods because not all of them are changed at the same velocity. It is closely linked to real purchasing power. This is because real purchasing power links the strength of a currency with the price of services and goods. As we know, an increase in CPI will decrease the intensity of consumers' real purchasing power. Department of Statistics Malaysia had applied the internationally accepted statistical methodologies for computation of inflation rate from the International Monetary Fund. The formula of CPI for multiple items provided below:

$$CPI = \sum_{i=1}^{n} CPI_i * weight_i$$

The expected sign of inflation rate in this research is positive sign.

3.2.3 Employment

Employment is referred to people having their occupation and getting paid for living purpose. In other words, employment is a job that needs to have so that they could get their wages, but, from country view, it shows a sign for great economic in a country. From a country perspective, when the country need expertise in different industry, it will automatically create job opportunities for local citizen, thus the total number of citizens getting employed in the country will be getting higher compared to previous year (Antipova, 2015).

In order to define housing price index, employment should be used as our proxy in this study. Besides, this research used independent variable such as employment and the unit used is in thousands of employees. High employment could lead to a favorable economic condition due to high productivity in a country. Hence, employment is a key indicator to determine previous or current housing price no

matter directly or indirectly (Longhi & Taylor 2013). The method used to calculate employment in Malaysia is total number of labor force in labor market. According to Antipova (2015) and Hartley, Medlock, Temzelides and Zhang (2015), they used employment as their proxy to determine relationship between housing prices and job performance in their finding. They came to the same results and claimed that employment is positively and significantly affecting housing price. Hence, the expected sign in this research would be positive and significant relationship toward housing price. This shows that employment can represent demographic and it is a reliable proxy in our study.

3.2.4 Exchange Rate

According to Klau and Fung (2006), real exchange rate performs better than nominal exchange rate in the sense of inflation included. Therefore, real exchange rate index included in our research as real exchange rate index is capable to detect the consequence of purchasing power. Real exchange rate index is derived from deflating nominal effective exchange rate with consumer price index. Department of Statistics Malaysia had applied the internationally accepted statistical methodologies for computation of exchange rate from the International Monetary Fund. The formula of real exchange rate index provided below:

$$ RELKI_t = NELKI_t \times \prod_{i=1}^{n} \left(\frac{P_{Liet.t}}{P_{it}} \right)^{w_i}, $$

The expected sign of exchange rate in this research is negative sign.

3.2.5 Base Lending Rate

In this research, base lending rate (BLR) in Malaysia is used as the proxy for interest rate. In Malaysia, BLR is the lowest interest rate that is computed by financial institutions in terms of a designated formula. The institutions cost of funds and other administrative costs will be counted in the fixed formula in order

to construct BLR. However, throughout Monetary Policy Meeting, the BLR is practically determined by Bank Negara Malaysia (BNM). In such cases, after monetary policy was adjusted, the availability of credit of banks is increased, those banks are able to offer lower bank lending rates, as a result of encouraging more people to participate in current and future housing market (Ong, 2013; Zainuddin, 2010). Therefore, any variation toward BLR will significantly influence the pricing of both existing and latest floating interest rate home borrowings. As well, this research will forecast if there is a negative significant relationship between interest rate and housing prices.

The formula for computing the BLR would be revised as follows:

$$\text{Computed BLR} = \frac{\text{Intervention rate x } 0.8 + 2.25\%}{1 - Statutory\ Reserve\ Requirement(SRR)}$$

3.2.6 Gross Domestic Product

Gross domestic product (GDP) was described as the market value of the entire authoritatively recognized final goods and services which were supplied by a nation in a specified period. In other hand, GDP per expenditure is commonly measured as an indicator of a country's standard of living and a country's GDP will reflect their economic condition. According to Pour et al. (2013), he claimed that economic performance of a country plays an important role to affect the housing market.

When a country is an export dominant country such as Malaysia, the depreciation of a country's currency might be a good news for the country because when then currency of the country becomes weaker as compared with other countries such as United State. Foreign currencies that were not affected by depreciation of its value will be attracted by cheaper price of goods in Malaysia. Thus, the exporting country will get higher amount of Balance of Payment (BoP) than previous year due to the increased number of exports to other countries. In a nutshell, positive balance of payment will stimulate the country' economic condition since exports is more than imports, which is highly influence the GDP of a country. Based on

the result from Adam and Fuss (2010), he found that GDP per expenditure is negative and has significant influence toward residential housing price in their country. Thus, in this study, GDP per expenditure is used as the proxy for GDP and the expected sign for GDP per expenditure would be negatively toward housing price.

3.2.7 Household Income

Household income in millions (RM) in Malaysia will become a proxy of household income in this study. Household income is a measure of the combined incomes of all members sharing a particular household in housing. HI consist of every method of income and stand for a vital risk measurement used by lenders for underwriting mortgage loans. Household income level can represent households' borrowing capacity and affordability to buy house for housing demand (Fox & Finlay, 2012; Gallin, 2006). In a nutshell, this study will forecast if there is a positive significant relationship between housing prices and household income.

3.3 Data Collection Methods

In order to identify the relationship between residential house price and six selected macroeconomic and financial factors in Malaysia, research data and all relevant information were collected. All of the research data used in this paper mainly focused on secondary data. According to Gujarati and Porter (2009), secondary data is defined as data that already existed and is used either to verify new research or justify previous findings.

In this study, seven variables including dependent variable data is collected with timeliness of quarterly data from year 1996 first quarter to year 2014 fourth quarter, consequently a total number of 76 observations. All of the data are retrieved from DataStream, which is available in the library of University Tunku

Abdul Rahman.

House price index is used as the proxy of residential house price in Malaysia. Apart from the residential housing prices, other time series used in this research include CPI (proxy for inflation), employment, exchange rate index (proxy for exchange rate), base lending rate, GDP and household income (proxy for income level), which believed to be the most relevant factors that affect residential housing market and hence the housing price movements. The details the all of the data are summarized as table 3.1 below.

Table 3.1: Data Measurement

Variable	Proxy	Unit	Source
Residential Housing Price	HPI	Index (2000=100)	Oxford Economics
Gross Domestic Product	GDP	Index (2010=100)	IMF-International Financial Statistics
Employment	EMPT	Thousands of citizens	Oxford Economics
Inflation	CPI	Index (2010=100)	Oxford Economics
Exchange Rate	EXG	Index (2010=100)	IMF-International Financial Statistics
Interest Rate	BLR	Percentage	Central Bank of Malaysia
Income	HI	Millions in MYR	Oxford Economics

source: Prepared by author

3.4   Flows of Methodology

Initially, this study tested the stationarity of all the 7 variables through unit root test. Among all of the unit root tests, Augmented Dickey-Fuller test and Phillips-Perron test will be employed to read the stationarity conditions of each variable at both level stage and first difference stage.   If all of the variables stationary at level, hence this research will proceed to ARDL model. If all the variables are not stationary at level and reached stationarity after first difference, this research will proceeded to Johansen & Juselius Cointegration test. If only few independent variables are already stationary at level or still not stationary after first difference, this paper will drop the variable(s) and proceed to Johansen & Juselius Cointegration test by reform the regression model.

Secondly, this research will proceed to optimum lag length selection which is important for Johansen & Juselius Cointegration test. This study will use trial and error method to find out the suitable lag length which has no autocorrelation problem of the error term. The autocorrelation of each of the residual regressions is checked by Ljung-Box Q-statistics. The next step will be proceed to Johansen & Juselius Cointegration test. If there is no cointegration vector, this study will use VAR model. Conversely, if there are one or more than one cointegration vector, this study will use VECM.

The fourth step is interpreting the results which include the sign, significant and long-run relationship between HPI and selected independent variable(s). The short-run relationship and causality direction will be elaborated after went through the Granger Causality test. After that, the stability of the model will be tested. Lastly, this paper will proceed to Variance Decomposition test and Impulse Response Function which are used to determine the shocks and impulse of the variables respectively.

3.5   Methodology

3.5.1 Unit Root Tests

In this research, unit root test is carried out to examine whether the series in the group (or it's first or second difference) are stationary, in order to prevent the results are spurious and invalid.

Three probable cases as below,

1st - $|\emptyset| < 1$ and therefore the series is stationary.

2nd - $|\emptyset| > 1$ where in this case the series explodes.

3rd - $|\emptyset| = 1$ where in this case the series contains a unit root and is non-stationary.

At level,

$$y_t = |\emptyset| y_{t-1} + u_t$$

At 1st difference, having $\phi = 1$ and subtracting y_{t-1} from both side equation,

$$y_t - y_{t-1} = y_{t-1} - y_{t-1} + e_t$$
$$\Delta y_t = e_t$$

Due to e_t is a white noise process, hence Δy_t is a stationary series. After differencing y_t can obtain stationarity.

Hypotheses :

H_0: There is a unit root (Non-stationary)

H_1: There is no unit root (Stationary)

Decision rule: Reject null hypothesis if P-value is less than the significant level, otherwise, do not reject null hypothesis.

Unit root test is generally used to examine the stationary and non-stationary trend of time series data for all variables, as well as to determine an order of each of the

variables integration. Gujarati and Porter (2009) stated stationary trend indicates that the mean, variance, covariance of series are constant across different periods. In contrast, non-stationary trend will have different mean, variance and covariance across different periods. The problem of non-stationary model is that it will lead to inaccurate normal assumptions of the analysis and spurious regression, and the results will be biased and invalid. In such cases, most researchers should carry out unit root test to identify whether a time series is stationary or non-stationary (Hill, Griffiths & Lim, 2007).

In addition, most of the macroeconomic variables are non-stationary and seemed to be varied over time (Asteriou & Hall, 2007). Based on Ray (2012), in order to prevent such econometric problems and invalid results, unit root test must be carried out to make sure there is stationary model and robustness of results. In this paper, Both Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) test which are under the category of unit root test will be conducted to examine whether the time series data is stationary or non-stationary.

3.5.1.1 Augmented Dickey-Fuller test (ADF)

In statistics and econometrics, Augmented Dickey–Fuller test (ADF) is a test for a unit root in a larger and more complicated set of time series models.

Three probable modus of ADF :

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + u_t$$

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + u_t$$

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \alpha_2 t + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + u_t$$

Hypotheses :

H_0: There is a unit root (Non-stationary)

H_1: There is no unit root (Stationary)

Augmented Dickey-Fuller test (ADF) is a parametric test for a unit root in time series data. It can refers to an Augmented version of simple Dickey-Fuller test for larger and complicated set of time series models (Dickey & Fuller, 1979). Regarding to Asteriou and Hall (2007), ADF assumes normal distribution and includes extra lagged terms of the dependent variable to remove the effect of autocorrelation. The lag length on the extra terms can be determined by Akaike Information Criterion (AIC) or Schwartz Bayesian Criterion (SBC). In this study, SBC also called Schwarz Information Criterion (SIC) will bring into the lag length selection in this test due to it is most common and suitable lag length selection in ADF test (Asghar & Abid, 2007; Cheung & Lai, 1997).

The ADF test is divided to two types of model: the model with constant and without trend and the model with constant and with trend. The rule of thumb states that the Augmented Dickey–Fuller (ADF) statistic in the test will always be a negative numerated value. Smaller the negative values, the more likely the null hypothesis being rejected and concluded that unit root do not exist in this paper's estimated model (Asteriou & Hall, 2007; Hill, Griffiths & Lim, 2007).

3.5.1.2 Phillips-Perron test (PP)

PP test is similar to ADF test, but it incorporates an automatic correction to the DF procedure to allow for autocorrelated residuals. Thus, PP test can be useful test for a unit root in time series models, as well as strengthen the evidence of stationarity of the series in this study.

Test regression for PP as below,

$$\Delta y_{t-1} = \alpha_0 + \gamma y_{t-1} + u_t$$

Hypotheses :

H_0: There is a unit root (Non-stationary)

H_1: There is no unit root (Stationary)

Phillips-Perron test (PP) is non-parametric test for a unit root in time series data, but it also similar to Augmented Dickey-Fuller test (ADF). Whereas, the PP does not take into account of lagged difference terms as ADF, but it makes a correction to the t statistic of the coefficient to control serial correlation. The PP statistics are modifications of the ADF's t statistics that take into account the less restrictive nature of error process, as well as investigate any serial correlation and heteroscedasticity error (Gujarati & Porter, 2009). The PP is performed with the inclusion of a constant. a constant and linear trend, or neither in the test regression (Asteriou & Hall, 2007). Besides, this study will follow the most researchers that tend to choose (Newey-West automatic) using Bartlett kernel in Phillips- Perron test (Çağlayan & Saçıldı, 2010; Cheung & Lai, 1997; Dritsaki, C., & Dritsaki, M., 2010).

3.5.2 Johansen & Juselius Cointegration Test

In order to determine the statistically significant of this model, first, optimum lag length needed to determine by Ljung-Box test. According to Box and Pierce (1970) and Ljung and Box (1978), a set of time series is in random or independent is tested by Ljung-Box test. In other word, Ljung-Box test can determine the autocorrelation problem in model. Burns (2002) further emphasized that Ljung-Box test could use to examine the time series model's quality of fit. The Q test statistic formula provided as below:

$$Q^* = T(T+2) \sum_{k=}^{h} (T-k)^{-1} r_k^2$$

From the equation above, the h is the number of lags needs to be tested. Whereas T is the length of time series data.

Based on Magee (2013), he stated that the model will have autocorrelation problem when Q-statistic pointed out the regression error terms are statistically significant. He applied decision rule of $p < 0.05$ (autocorrelation occur) to determine whether the regression error terms are statistically significant or not. The optimum leg length could be obtained when the regression error terms in the model are free from autocorrelation problem.

H_0 = There is no autocorrelation in model

H_1 = There is autocorrelation in model

After the optimum lag length is determined, following by cointegration test. The idea of cointegration refers to the stochastic drift of error terms when more than one individual time series are integrated. Cointegration test is commonly used to test the statistically significant between independent variables and dependent variable. It is important to run cointegration test in regression model in order to determine the significant or equilibrium. Spurious regression problem will occur if variables do not cointegrated.

Typically, cointegration tests consist of 3 methods; Engle-Granger two-step method, Johansen test and Philips-Quliaris cointegration test. Johansen test was implied in this research due to its multivariate tests natural, for example more than two independent variables and also our sample size (Carol, 1999). The reason Engle-Granger two-step method did not imply in this research is because Engle-Granger two-step method is more preferable on single equation model (bivariate). Furthermore, Lee et al. (2005) had emphasized in order to perform Johansen test, Xt and Yt must be in random walk naturally to prevent spurious regression problem. Lastly, cointegration is very closely related to vector error correction model (Asteriou & Hall, 2007).

H_0 = There is no cointegrating vector (r=0)

H_1 = There is cointegrating vector (r>0)

The decision rule rejects the null hypothesis when the test statistic value less than critical value. Number of cointegrating vector can be determined until the last value when come to the situation do not reject null hypothesis. After determining the cointegration test estimate, if there exists any cointegrating vector, proceed to Vector Error Correction Model (VECM) to determine the long-run relationship between residential housing price and independent variables, otherwise proceed to Vector Autoregressive Model (VAR) to determine the short run relationship if cointegraing vector could not be found in cointegration test.

3.5.3 Vector Autoregressive Model

The Vector Autoregressive Model (VAR) is the model that affect by its own and other variables past history. This model is the advance or further extension of Autoregressive (AR) model with including multiple explanatory variables. In order to form the VAR, the series must be covariance stationary and all of the series are treated as endogenous variables for the purpose of capturing dynamic effect. If the model is the presence of cointegration and absent of covariance stationary, the VECM approach should be used for the model. VAR model also can be used to determine the dynamic between the variables in the short run.

Gujarati and Porter (2009) stated that includes too much of lag in the model will consume degree of freedom and includes too less of lag in the model will lead to autocorrelation problem and model misspecification problem. Hence, it can be said that optimum lag length selection is important. According to Asteriou and Hall (2007), there are at least three pros of using VAR models. Firstly, researchers not need to worry about which is exogenous or endogenous variables because VAR treated all variables as the endogenous varibles. Second is the estimation is very simple and each equation can be estimated by using OLS approach separately. Finally is sometimes the forecast result obtained from VAR is better than those complex models.

The VAR model can be written as,

$$y_t = x_1 y_{t-1} + x_2 y_{t-2} + \cdots + x_n y_{t-n} \varepsilon_t$$

Where y_t is vector of endogenous variable at time period (t) and X_i (i=1,2,3,4…) are coefficient vectors. Besides, n is the number of lags of the model and ε_t is the vector of error terms.

3.5.4 Vector Error Correction Model

Johansen (1991) defined Vector Error Correction Model as the estimation on response variable returns to equilibrium after a change in an explanatory variable by using multiple time series model. In simple word, Vector Error Correction Model used to identify whether long run relationship or short run relationship between response variables and explanatory variables after co-integration happened in between (Asari, Baharuddin, Jusoh, Mohamad, & Jusoff, 2011). The inclusion of long-run equilibrium ([Yt-1 − α − βXt-1]) and short-run which represented by difference term have provided VECM the ability to examine the long run and short run relationship.

Applying VECM provide few advantages. Standard OLS estimation is valid when all the error terms in VECM model are stationary. It is a expedient and suitable model when determing the correction term from non-equilibrium comparing to others. When the models are cointegrated, VECM which naturally formulated in first difference capable to solve the spurious regression problem. Lastly, according to Asteriou and Hall (2007), disequilibrium error terms in VECM are stationary variable. This nature capable to prevent errors become bigger and bigger in long-run relationship. Besides, using Vector Error Correction Model can give a clear picture on long term forecasting and any non-stationary series. Theoretical equation provided as below:

$$\Delta y_t = a_0 + b_1 \Delta x_t - \pi \hat{u}_{t-1} + y_t$$

B1= impact multiplier (measures immediate impact when a change in x will
cause a change in y)

Π= feedback effect (show how much of disequilibrium being corrected)

In this research, the effect of independent variables on house price in long run relationship was studied, hence Vector Error Correction Model was applied to study the significance of explanatory variables which are interest rate, GDP, inflation rate and mortgage loan on response variable which is residential house price. As per Mahalik and Mallick (n.d.) past account, they applied Vector Error Correction Model by using quarterly data of independent variables and house price shown co-integrated and significant result in long run relationship.

3.5.5 Granger Causality Test

Granger Causality test is carried out to test for the dynamic direction of causality between all stationary variables in this research.

Below is the estimation of the following VAR model,

$$y_t = a_1 + \sum_{i=1}^{n} \beta_1 x_{t-i} + \sum_{j=1}^{m} \gamma_j y_{t-j} + e_{1t}$$

$$x_t = a_2 + \sum_{i=1}^{n} \theta_1 x_{t-i} + \sum_{j=1}^{m} \delta_j y_{t-j} + e_{2t}$$

Four probable results as below:

a) y_t causes x_t

-the lagged y terms in eq2 may be statistically different from zero as a group, and the lagged x terms in eq1 not statistically different from zero.

b) x_t causes y_t

-the lagged x terms in eq1 may be statistically different from zero as a group, and the lagged y terms in eq2 not statistically different from zero.

c) there is a bi-directional feedback (causality among the variables)

-both sets of x and y terms are statistically different from zero in eq1 and eq2.

d) the 2 variables are independent

-both sets of x and y terms are not statistically different from zero in eq1 and eq2.

Hypotheses:

H_0: X does not Granger cause on Y

H_1: X does Granger cause on Y

And

H_0: Y does not Granger cause on X

H_1: Y does Granger cause on X

Decision rule: null hypothesis will be rejected if Chi-square test is greater than critical value at 1%, 5% or 10% level of significance.

In order to determine the causality relationship between two time series, Granger (1969) had proposed Granger Causality Test to execute in 1969. A brief explanation of Granger Causality Test by Harasheh and Abu-Libdeh (2011) is to identify the causality relationship between variables in time series and determine whether one variable can be used in forecasting another variable.

In this research, Granger Causality Test is conducted to achieve the objective of research which is to determine whether there is causality relationship between our variables. Granger Causality Test is one of the common test applied by past researchers to determine causality relationship between house price and its determinants (Chen & Patel, 1998; Chui & Chau, 2005; Lee, 2009; Leo, Liu & Picken, 2007; Mahalik & Mallick, n.d.).

In a nutshell, VEC Granger Causality / Block Exogeneity Wald Tests will be carried out in this study to examine whether the presence of causality relationship between all variables. Besides, this test is competent to indicate the direction of causality between all variables, as well as detects whether the variables are having unidirectional causality, bi-directional causality or independent (Asteriou & Hall, 2007).

3.5.6 Stability of AR (p) Processes

The stability of AR (p) process is used to determine the dynamically stability of the VAR or VECM estimation. If the estimation is not stable, the result of impulse respond will become invalid.

The theorem of AR (p) process as below,

$$Y_t = \mu + \varphi 1 Y_t - 1 + \varphi 2 Y_t - 2 + \ldots + \varphi p Y_{t-p} + \varepsilon_t$$

The AR roots table and graph that obtained from Eviews 8 reported the inverse roots of the characteristics polynomial. Lutkepohl (1991) stated that the VAR estimation is dynamically stability if all of the dots are lie inside the circle and all the roots have modulus with less than 1. The impulse response of standard errors will become not valid if the VAR estimation is not stable. Lutkepohl (1991) also stated that if the estimation not valid, the impulse response result will become not valid and the shock will not die out and continuously keep accumulating. For the VAR estimation, it will be the *kp* roots, where *k* represented endogenous variables and *p* represented largest lag. For the VECM estimation, it will be the *k-r* roots, where *r* represented cointegrating relations and the number of *k-r* roots should be equal to unity (Eviews 8, 2013).

3.5.7 Variance Decomposition

Variance decomposition (also called as forecast error variance decomposition) is used to identify the response of dependent variables that explained by the shock that caused by its 'own' shock and also shocks that transmitted from other variables in the model either in short run or in long run dynamics between the variable in the system (Brooks, 2008). In addition, variance decomposition is also used to measure the amount of shocks of macroeconomic and financial variables towards the fluctuation of HPI in the form of a proportion of movement accordingly by percentages. By this way, the researchers are able to figure out how's the macroeconomic and financial variable individually shocked each other in the vector autoregressive (VAR) model.

The benefit of variance decomposition can show the movement of dependents variables due to their own shocks and also shocks from other variables at the meantime. In general, variance decomposition and impulse response give almost similar statistic (Brooks, 2008). According to researcher Runkle (1987), he argue that for both variance decomposition and impulse response are extremely hard to differentiate exactly between each other and the confidence bands around variance decomposition and impulse response should be created in all the time. Thus, this paper applied variance decomposition with following hypotheses.

Hypotheses:

H_0: LNCPI/ LNEMPT/ LNEXG/ BLR do not have an impact on LNHPI

H_1: LNCPI/ LNEMPT/ LNEXG/ BLR have an impact on LNHPI

Note:

LNHPI= Natural Log of Housing Price Index

LNCPI = Natural Log of Consumer Price index

LNEMPT = Natural Log of Employment

LNEXG = Natural Log of Exchange Rate

BLR = Base Lending Rate

3.5.8 Impulse Response Function

The impulse response function is used to measure the responsiveness of the dependent variables in VAR system towards macroeconomic shocks (Brooks, 2008). Furthermore, the impulse response function is said to be reliable only when the time series data become stationary after passing through second difference. It acts as an economic function which has been used to identify the impact caused to all variable in VAR model when the variable faces some impulses (Elder, 2003). Besides, the impulse response function can detect the impact of any variable towards the all other variables in the system (Lin, 2006).

Moreover, the ordering for variables is very important to identify the impulse response function, because it may affect outcome from the test even though same data set has been used. The different between standard impulse response function and generalized impulse response function is that standard impulse response is sensitive to the ordering of variables, however the later does not. In addition, generalized impulse response function does not assume that when one variable is shocked, all other variables are switched off. According to Masih and Masih (2001), he said that generalized impulse response function does not require orthogonalization in the VAR system. So, in order to avoid this problem, this paper will apply the generalized impulse response analysis which recommended by Pesaran and Shin (1997) and Borok et al. (2005).

Next, the use of generalized impulse response function describes the reaction of the endogenous variable which in this case refers to the macroeconomic variables through the time when there is a shock. Hence, each changes of the macroeconomic variable can be detected separately according to period with the existence of shock that occur in a specific period. However, the level of affecting housing prices by this shock may or may not affect the macroeconomic variables. The previous researcher Engsted, Hviid and Pedersen (2015) used the impulse response function to investigate the housing market volatility in OECD countries.

3.6   Conclusion

In a nutshell, the data sources and collection methods have been discussed clearly above. All of the data are collected from DataStream. This chapter has clearly elaborated the proxy used for each of the variables. The research methodologies included in this study also been clearly defined and explained in this chapter. All of the tests will be carried out through Eviews 8 software. The empirical results and output of each methodology will be discussed further in the following chapter.

CHAPTER 4: DATA ANALYSIS

4.0   Introduction

This chapter will focus on analyzing, interpreting and reporting the empirical result from previous methodology. Section 4.1 presents the descriptive statistics of both dependent and independent variables. Section 4.2 explained the trends of each variable. Section 4.3 presents the Unit Root Test by using ADF test and PP test. The new empirical model of this study will be shown in next section. From section 4.5 to section 4.8 will discuss the empirical results based on Johansen & Juselius Cointegration test, Vector Error Correction Model, Granger Causality test and Inverse Roots of AR Characteristic Polynomial test. The next phase will discuss on the Variance Decomposition and Impulse Response Function. A through detail of explanation will be discussed after each of the empirical test's results. A brief conclusion of the test results will be concluded in last section.

4.1 Descriptive Statistics

Descriptive statistics are methods used to organize and summarize the data sets of all variables. It includes of mean, median, maximum, minimum, standard deviation, skewness, kurtosis and so forth which calculated by using Eviews 8.Table 4.1 shows the descriptive statistics of LNHPI, LNCPI, LNEMPT, LNEXG, BLR, LNGDP and LNHI in Malaysia from year 1996Q1 until year 2014Q4. This study used the results in table 4.1 to explain the basic features, trends and patterns of the data sets.

Table 4.1: Descriptive Statistic

DV	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis
LNHPI	4.8795	4.8239	5.3641	4.5839	0.2271	0.7311	2.3956

IV	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis
LNCPI	4.5359	4.5277	4.7155	4.3849	0.1043	0.0754	1.6077
LNEMPT	9.2925	9.2651	9.5241	9.1135	0.1198	0.5681	2.1010
LNEXG	4.5238	4.5049	4.6691	4.4389	0.0849	0.3557	1.5326
BLR	5.8390	6.0050	7.7800	4.5000	0.9422	0.2058	2.0269
LNGDP	4.4718	4.4762	4.8621	4.1076	0.2130	-0.0394	1.8825
LNHI	10.0917	10.3020	10.8409	8.4138	0.6171	-0.8021	2.5893

Source: Developed from the research

The figures between all the variables do not reflect a huge discrepancy in value because all of the variables except BLR were transformed and expressed in natural logarithm term. Lind, Marchal and Wathen (2012) stated that the outliers or noisy observations will imperatively cause the empirical model results to become inconsistent. However, as observed from table above, there are no extreme outliers.

The skewness values of LNHPI, LNCPI, LNEMPT, LNEXG and BLR are 0.7311, 0.0754, 0.5681, 0.3557 and 0.2058 respectively, indicating that the variables are positively skewed or skewed to the right. Another way to determine the skewness of the variable is to observe the mean and median value. The variable will become positively skewed if the mean is higher than median (Lind et al., 2012). For example, LNHPI mean (4.8795) is higher than median (4.8239), hence it is positively skewed. The skewness of LNGDP and LNHI are -0.0394 and -0.8021 respectively, show that this two variables are negatively skewed. In the case of mean is lower than median, the variable will become skewed to the left (Lind et al.., 2012). For example, the mean of LNGDP (4.4718) is lower than median (4.4762), hence it is negatively skewed.

There are three types of distributions namely Mesokurtic, Leptokurtic and Platykurtic. According to Lind et al. (2012), Mesokurtic distribution has excess kurtosis of zero, platykurtic distribution has negative excess kurtosis and leptokurtic distribution has positive excess kurtosis. From table 4.1, the kurtosis value of LNHPI, LNCPI, LNEMPT, LNEXG, BLR, LNGDP and LNHI are positively, which indicate that the distributions for these variables are peaked or thin and tall compared to the standard normal distribution (leptokurtic).

4.2   Graph Line

Figure 4.1: House Price Index
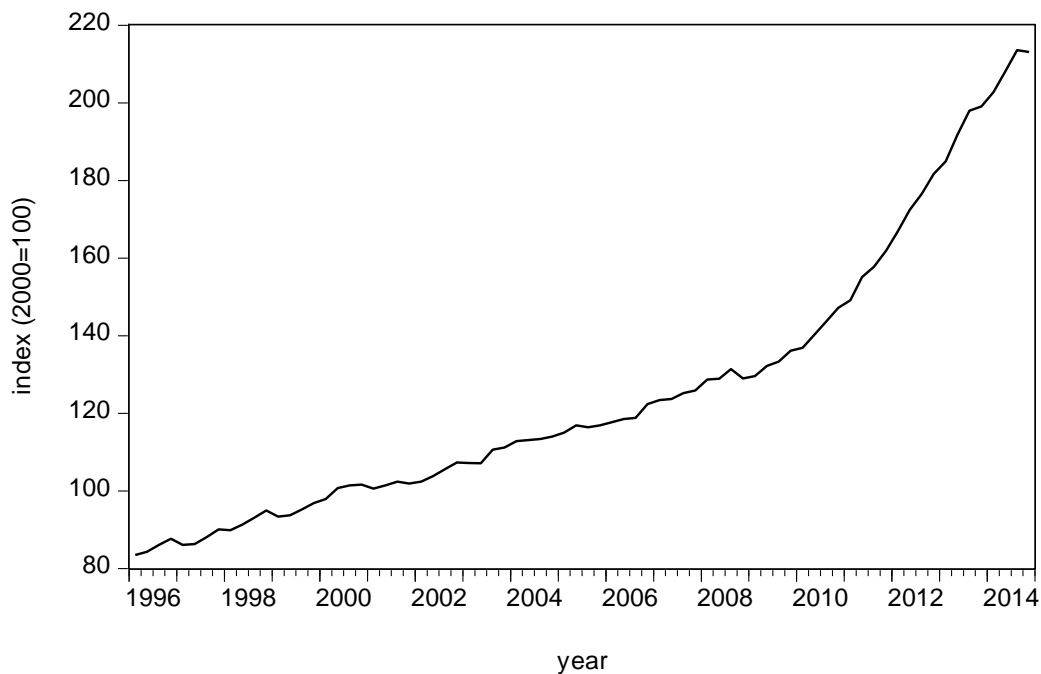
Source: Developed from the research

Figure above shows housing price index (HPI) from year 1996 first quarter until year 2014 fourth quarter. In this figure, we can see that the HPI is in consistent rise starting at the point just over 80 HPI in 1996. In addition, it moves until the end of figure and reached more than 200 HPI in year 2014 fourth quarter. Therefore, we are able to figure out the trend of HPI which is an upward sloping and percentage of rise in HPI from year 1996 until year 2014 is more than 150 percent.

Asian financial crisis happened in year 1997, economist expected the HPI to dropped because of the economic condition in the country does not perform well (Vanichvatana, 2007). But, in actual cases, HPI in Malaysia does not affect the investors and home buyers to enter into property market. During the crisis, the housing price dropped significantly due to the fact that everyone requires money to survive. Thus, most of the property holders planned to sell off their houses to make sure no additional losses in future. At this time, no matter local investors or international investors, they target on property market and therefore, they took part in housing market and purchase houses at lower price. Finally, HPI in Malaysia does not affect much by the Asian financial crisis and it continuously rises.

After the economic downturn in year 2008, the property market for 'neighbor' country was still in condition of declining. However, Malaysia's house prices especially Kuala Lumpur outperformed the rest of the countries (Sivitanides, 2015). The reason behind is that Malaysia's government implement Greater Kuala Lumpur plan, which was used to help the housing market to have a rapid recovery directly or indirectly after the crisis.

Figure 4.2: Consumer Price Index
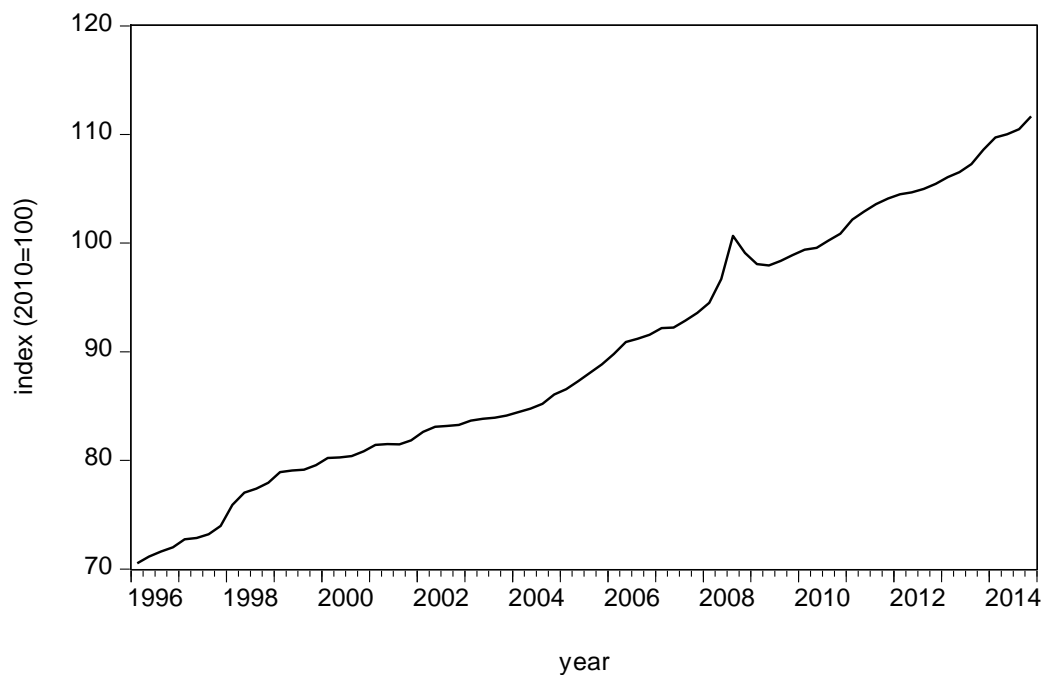
Source: Developed from the research

The inflation rate of Malaysia steadily rose from year 1996 until year 2014. However, there is a peak in year 2008 and a swift decrease stopped at year 2009. The decrease of inflation rate in year 2008 believes that is the incident of financial crisis happen (Colemana & Feler, 2015).

Figure 4.3: Employment
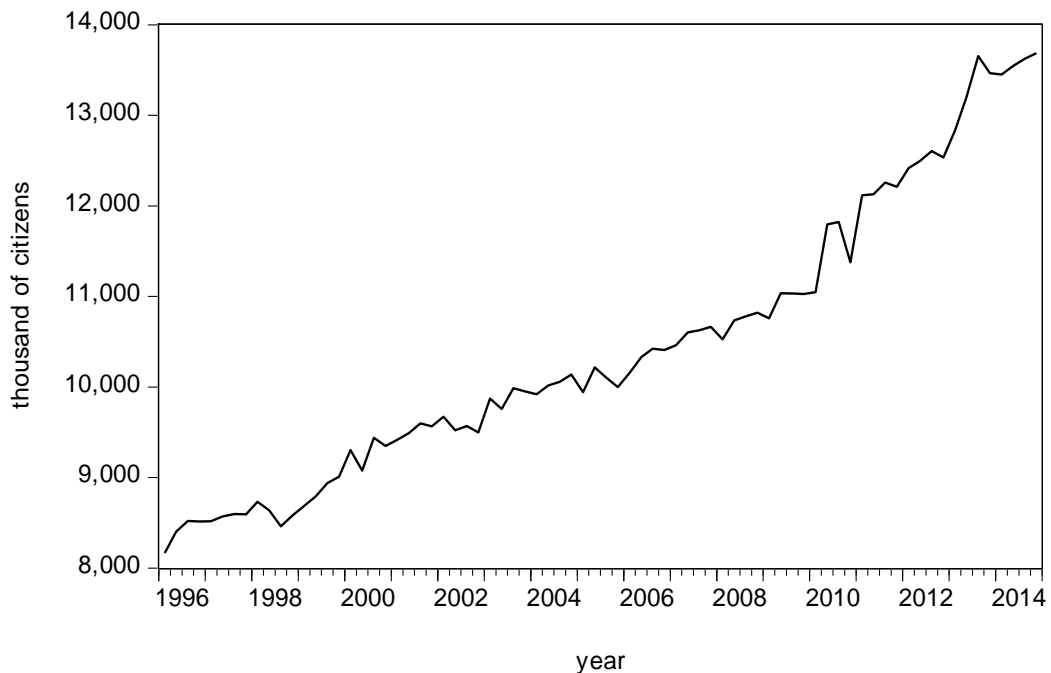
Source: Developed from the research

Figure above shows employment (in thousands people) from year 1996 first quarter until year 2014 fourth quarter. In this graph, we can see the employment is steadily rising starting at the point just over 8000 thousand people in 1996. Moreover, it moves until the end of graph and reached more than 13,000 thousands people in year 2014 fourth quarter. Thus, we have a clearer picture about the trend of employment in Malaysia which is upward sloping and percentage of growth for employment in within 19 years can be said to be more than 50.

Employment in Malaysia having upward sloping trends due to the increase in the number of people living in Malaysia as the year goes by. According to Department of Statistics Malaysia (2015), the demographic profile was growing

steadily in the past 19 years. Hence, people have to get their work, so that they have wages to survive in this world. Nowadays, more and more youngster are joining labor market when they reached 16 years olds. In July 2012, Malaysia government implemented a new policy regarding the retire age, which the maximum working age in public sector is extended to 60 years old compared to previous years which was only at maximum of 55 years old. Therefore, the graph shows employment increased rapidly and significantly in year 2012. Besides, economic growth of a country will reflect the number of job occupation in a country (Aminuddin, 2009). Malaysia had a good and consistent economic growth along the period; therefore, every sector hired more labor to carry out the work and makes the employment in Malaysia raises constantly and it is reasonable to state that employment is increasing significantly as time goes.

Figure 4.4: Exchange Rate
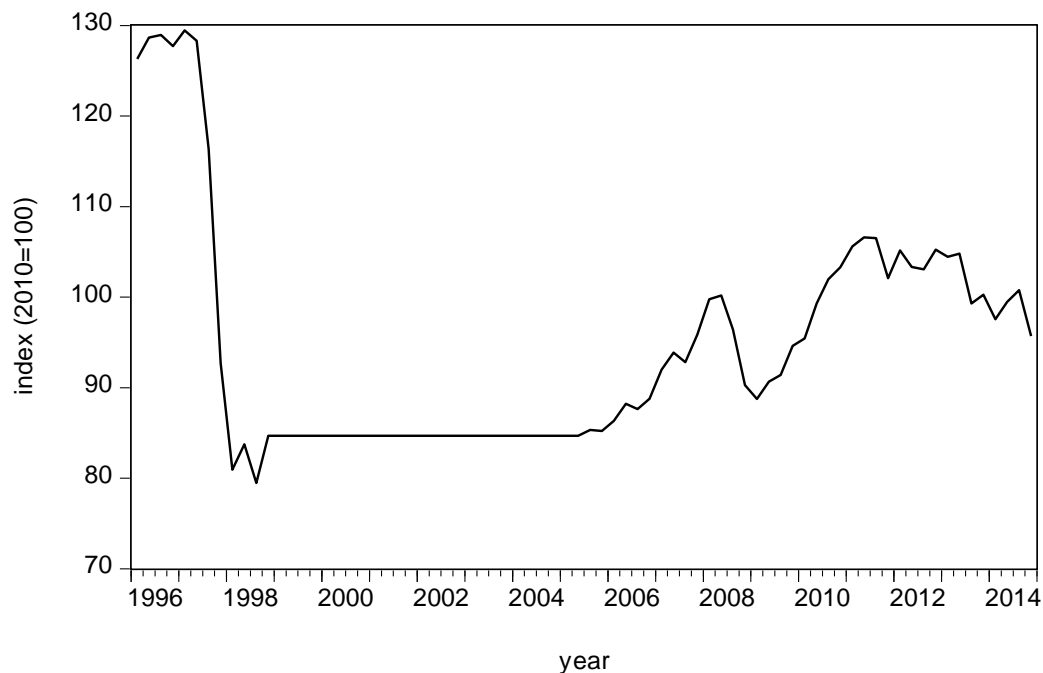
Source: Developed from the research

The exchange rate of Malaysia was fluctuating from year 1996 until the year 2014. The exchange rate remains unchanged in the beginning and dramatically declined from year 1997 due to the Asian financial crisis (Nanto, 1998). The decline of exchange rate last for only one year and stopped at year 1998. Then, the exchange rate remains unchanged from year 1998 until year 2005. Starting from year 2005,

the exchange rate gradually increase until the peak which hitted on year 2008 and slightly dropped until year 2009. Generally, the financial crisis happened in year 2008 caused the exchange rate to decline (Colemana & Feler, 2015). From year 2009 onward, the exchange rate is keep fluctuating until year 2014.

Figure 4.5: Base Lending Rate
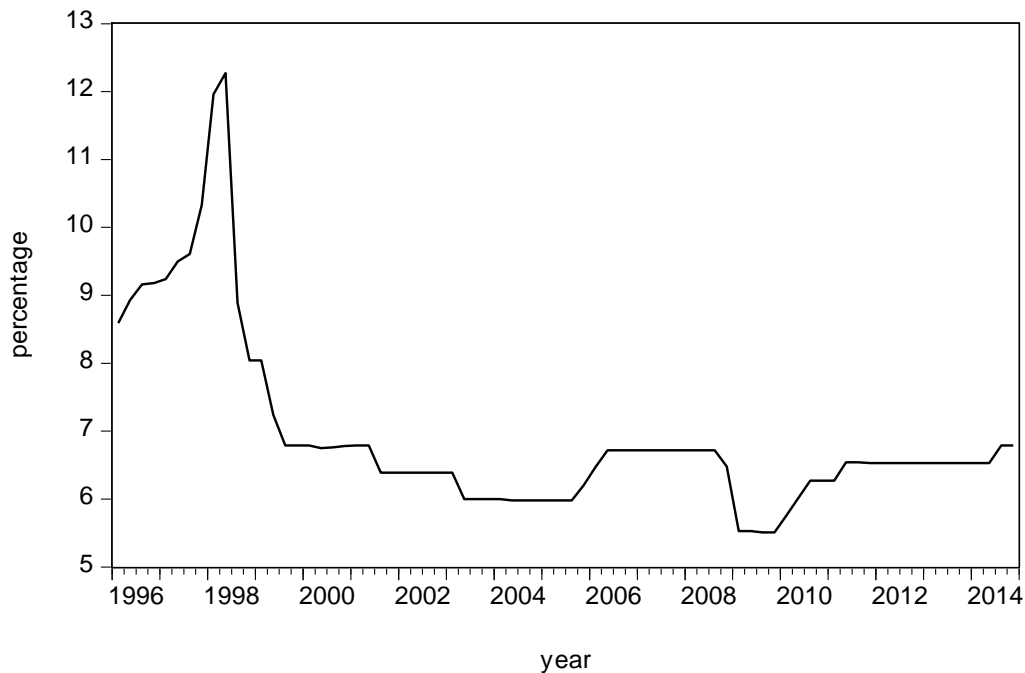
The line graph above shows the movement of base lending rate (BLR) from year 1996 until year 2014. In 1996, BLR started to increase sharply from 8.75% and reached a peak in year 1998. After the Asian financial crisis during year 1997-1998 (Nanto, 1998), BLR dramatically plummeted and keep decreasing gradually until year 2006. Over two years later, there is another financial crisis happened (Colemana & Feler, 2015), it leads to BLR fall down from year 2008 and hit the lowest point in year 2009. However, there is considerable growth of BLR in year 2010 and there is a slight upward trend in the future.

Figure 4.6: Gross Domestic Product
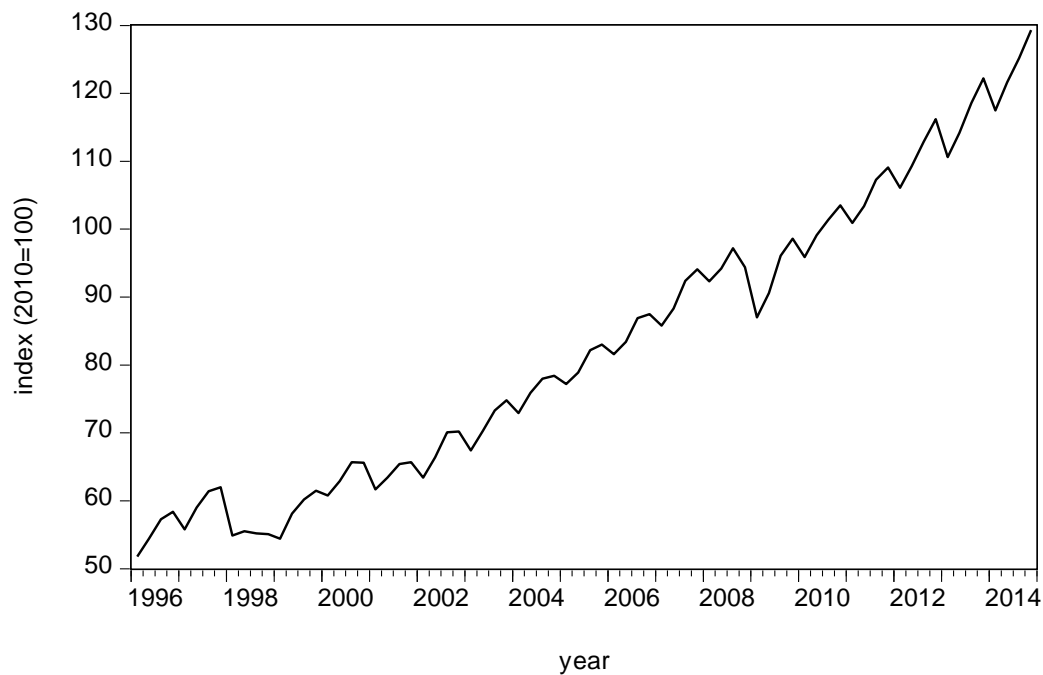
Source: Developed from the research

Figure above shows GDP per expenditure from year 1996 first quarter until year 2014 fourth quarter. In this graph, we can see the GDP per expenditure is increasing constantly starting at the point just over 50 in 1996. Moreover, it moves until the end of figure and reached around 130 GDP per expenditure in year 2014 fourth quarter. Then, we are able to know more information about the trend of GDP per expenditure in Malaysia, which is upward sloping in long run and the percentage of increment for GDP per expenditure along the period is more than 100 percent.

The GDP per expenditure in Malaysia is growing steadily along the year except for period between1998-1999 and 2008-2009. At the year of 1998-1999, there were a few events happened within the period. One of the biggest events that have the largest impact toward GDP per expenditure is the Asian financial crisis (Beltratti & Morana, 2010). The crisis was hugely influence several countries in Asian, and Malaysia was one of them. Thus, GDP per expenditure in Malaysia drop significantly due to the economic recession. However, for year 2008- 2009, the global economic system slowed down and makes the trading volume in the country decline to a certain point (Junoh, 2004). This phenomenon directly or

indirectly influences Malaysia's GDP per expenditure and cause the volume for exported goods falling-off and inflation raise at this point.

Figure 4.7: Household Income
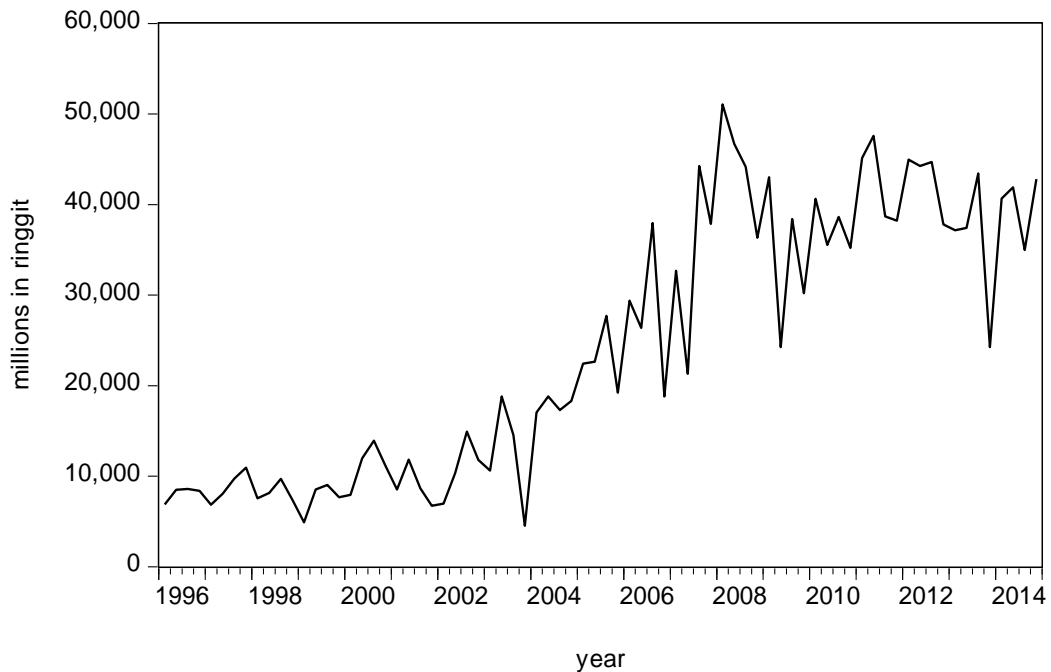
Source: Developed from the research

The figure above shown is the movement and trends of household income (HI) from year 1996 until year 2014. This diagram indicated that it is a non-stationary and trended model. HI was fluctuated for the entire lifetime, as well as there is the lowest point in year 2003 and the highest peak in year 2008. Although HI is a fluctuation model, it still have an upward trend indeed.

4.3   Unit Root Tests

Table 4.2: Unit Root Tests

	Augmented Dickey Fuller (ADF)		Phillips Perron (PP)	
	Level			
Variable	Constant Without Trend	Constant With Trend	Constant Without Trend	Constant With Trend
LNHPI	3.312504 (0)	0.703950 (0)	3.383896 [2]	0.691937 [1]
LNCPI	-0.501577 (0)	-3.052858 (1)	-0.501392 [5]	-2.610595 [2]
LNEMPT	0.735992 (1)	-1.631275 (1)	0.719925 [15]	-2.553083 [0]
LNEXG	-2.442038 (0)	-2.676733 (0)	-2.568556 [3]	-2.684838 [1]
BLR	-2.367327 (3)	-2.354213 (3)	-2.021466 [1]	-1.850385 [0]
LNGDP	0.954199 (5)	-3.996919** (5)	0.332375 [22]	-4.011386** [9]
LNHI	-0.605733 (7)	-5.478780*** (0)	-1.919259 [8]	-5.526445*** [3]
	First Difference			
LNHPI	-7.047141*** (0)	-7.893513*** (0)	-7.103084*** [3]	-7.893513*** [0]
LNCPI	-6.720632*** (1)	-6.674814*** (1)	-6.345125*** [10]	-6.276953*** [10]
LNEMPT	-12.39477*** (0)	-12.44837*** (0)	-13.28386*** [5]	-14.68545*** [8]
LNEXG	-5.342187*** (0)	-5.454898*** (0)	-5.378710*** [2]	-5.433742*** [3]
BLR	-4.509347*** (2)	-4.568441*** (2)	-6.410939*** [6]	-6.410577*** [7]
LNGDP	-5.300734*** (4)	-5.477281*** (4)	-11.86601*** [21]	-13.06865*** [20]

LNHI	-8.864258***	-6.013626***	-22.76823***	-22.88832***
	(2)	(6)	[23]	[23]

Note: ***, ** and * denotes significant at 1%, 5% and 10% significance level, respectively. The figure in parenthesis (…) represents the optimum lag length selected based on Schwarz Info Criterion. The figure in bracket […] represents the Bandwidth selected based on Newey-West Bandwidth Criterion using Bartlett kernel.

Source: Developed from the research

Hypotheses :

H_0: There is a unit root (Non-stationary)

H_1: There is no unit root (Stationary)

Decision rule: Reject null hypothesis if P-value is less than the significant level, otherwise, do not reject null hypothesis.

Regarding to the table above, both results from Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root test are unable to reject the null hypothesis of variables which are house price index (LNHPI), consumer price index (LNCPI), employment level (LNEMPT), exchange rate (LNEXG) and base lending rate (BLR) at level form. This is due to the P-value of these four variables are more than 1%, 5% or 10% level of significance. It illustrates that these four variables are not stationary and contain of unit root. Otherwise, gross domestic income (LNGDP) and household income (LNHI) are able to reject the null hypothesis since the P-value of LNGDP and LNHI are less than 5% and 1% significant level respectively. Therefore, LNGDP and LNHI are stationary and do not contain of unit root at level form.

However, proceed to the first differences to conduct both ADF and PP test, all the variables are able to reject the null hypothesis of unit root test at first difference. This is because the P-value of all variables are less than 1% significant level. Hence, it can conclude that all variables are stationary and do not contain of unit root in first differences.

In a nutshell, this research must ensure all variables are not able to reject the null hypothesis and be not stationary at level form in unit root test. Afterward, is to differentiate the data successively to become stationarity to make sure stationary series for regression analysis. However, after first differences, the model's results unable to provide valuable long-run information. Hence we proceed to examine the presence of long-run equilibrium relationship through the multivariate Johansen & Juselius Cointegration test in order to capture both short run and long run effects.

Based on the results in unit root test, LNGDP and LNHI have to be excluded in the model since these two variables unable to fulfill the criteria to perform multivariate Johansen & Juselius Cointegration Test. A new empirical model will be form after conforming to the unit root test result.

4.4   Description of the New Empirical Model

Table 4.3: New Empirical Model
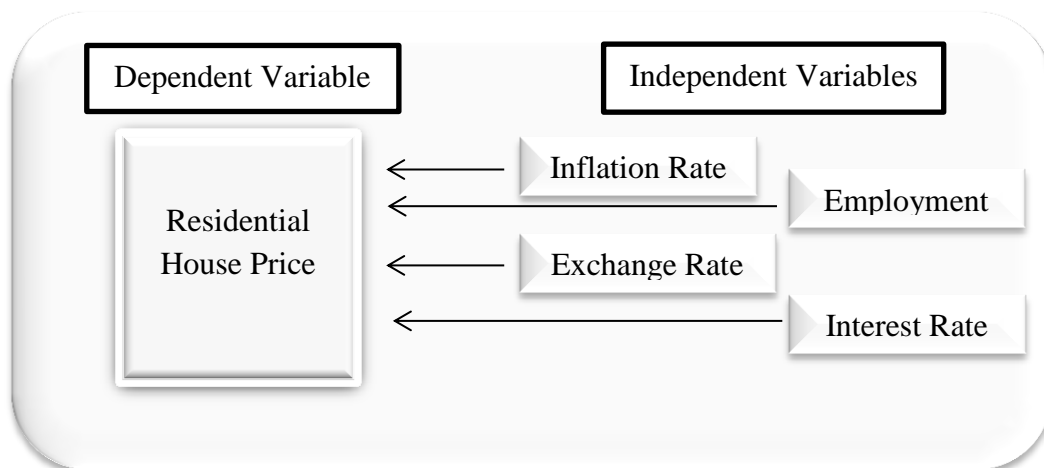
Source: Developed from the research

After conforming to the unit root results, a new empirical model is formulated as below,

$$LNHPI_t = \beta_0 + \beta_1 LNCPI_t + \beta_2 LNEMPT_t + \beta_3 LNEXG_t + \beta_4 BLR_t + \varepsilon_t$$

Where,

$LNHPI_t$ = Natural logarithm of house price index

$LNCPI_t$ = Natural logarithm of consumer price index

 $LNEMPT_t$ = Natural logarithm of employment

$LNEXG_t$ = Natural logarithm of exchange rate

BLR_t = Base lending rate

4.5   Johansen & Juselius Cointegration Test

Ljung-Box Q-statistic method was applied to determine the optimum lags. Based on the result, the optimum 1 lag length was achieved since all of the p-values from residuals are greater than 0.05.

Johansen and Juselius cointegration test was applied to determine whether there is a co-integrating relationship and how many of the co-integrating vector between the macroeconomic variables (Johansen & Juselius, 1990). In order to determine the number of co-integrating relations by referring to co-integrating vector, there are two statistics can refer to which is maximal eigenvalue statistic and trace statistic. According to Onay and Unal (2012), maximum eigenvalue statistic and trace statistic were used to compare with critical values under 5% significance level in order to make decision order on hypothesis.

Based on table 4.4, result shown trace statistics and maximal eigenvalue statistic indicated same co-integrating relationship or co-integrating vector in this model which is two co-integrating vectors in this model. In addition, based on Dao and Wolters (2008), trace statistics is superior to maximum eigenvalue in term of smallest value. Moreover, Lutkepohl et al. (1991) supported that trace statistics is better than maximum eigenvalue in term of power.

Table 4.4: Johansen & Juselius Cointegration Test

Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statistic	Critical Values (5%)	
			Trace	Max-Eigen
r = 0	126.7411*	72.08653*	69.81889	33.87687
r ≤ 1	54.65453*	30.79692*	47.85613	27.58434
r ≤ 2	23.85761	13.08042	29.79707	21.13162
r ≤ 3	10.77719	9.991865	15.49471	14.26460
r ≤ 4	0.785324	0.785324	3.841466	3.841466

*denotes rejection of the hypothesis at the 0.05 level

source: developed from the research

Therefore, in this model two co-integrating relationship were determined between the variables after applied Johansen and Juselius cointegration test. The test was performed at 5% level of significant, and the null hypothesis of no cointegration vector between all variables was rejected.

4.6   Vector Error Correction Model

Vector Error Correction Model (VECM) functioning to determine the long run co-integrating relationship in this model (Asari, Baharuddin, Jusoh, Mohamad, & Jusoff, 2011). The VECM equation constructed below:

LNHPI = -14.09250 +0.117618LNCPI +2.118768LNEMPT -0.386133LNEXG +0.076588BLR

Se	(0.22499)	(0.20953)	(0.05623)
(0.00682)

t-stat	[0.52277]	[10.1118]	[-6.86650]
[11.2379]

The value of estimator of the intercept, -14.09250 is the intercept line which indicates the average level of house price index when the level of consumer price index, employment, exchange rate and base lending rate are zero.

For inflation rate, the t-statistic is 0.52277, which was not significant at 5% level. The coefficient result of inflation rate is 0.117618, which means that if inflation rate increased by 1%, on average, housing price index will increased by 0.117618%, ceteris paribus.

For employment, it t-statistic is 10.1118, which was significant at 5% level of significance. The coefficient result of employment is 2.118768, which means that if employment increased by 1%, on average, housing price index will increased by 2.118768%, ceteris paribus.

For foreign exchange, it t-statistic is -6.86650, which was significant at 5% level of significant. The coefficient result of foreign exchange is -0.386133, which means that if exchange rate increased by 1%, on average, housing price index will decreased by 0.386133%, ceteris paribus.

For base lending rate, the t-statistic is 11.2379, which was significant at 5% level of significant. The coefficient result of base lending rate is 0.076588, which means that if base lending rate increased by 1%, housing price will increased by 0.076588%, ceteris paribus.

4.7   Granger Causality Test

Short-term granger causality test results:

Hypotheses:

H_0: There is no Granger cause relationship between dependent variable and independent variable in short run.

H_1: There is a Granger cause relationship between dependent variable and independent variable in short run.

Table 4.5: Granger Causality Results based on VECM

Dependent Variable	Independent Variables					ECTt-1 coefficient Variable (t-ratio)
	x^2-statistics of lagged 1st differenced term [p-value]					
	LNHPI	LNCPI	LNEMPT	LNEXG	BLR	
LNHPI	--	3.039110* [0.0813]	0.782804 [0.3763]	0.976109 [0.3232]	0.084836 [0.7708]	-0.049347** (-2.00959)
LNCPI	1.134934 [0.2867]	--	0.047275 [0.8279]	0.931968 [0.3344]	0.540783 [0.4621]	0.001681 (0.12262)
LNEMPT	1.673736 [0.1958]	0.000579 [0.9808]	--	1.254118 [0.2628]	0.152889 [0.6958]	0.100444*** (3.29980)
LNEXG	0.738867 [0.3900]	0.255658 [0.6131]	0.008686 [0.9257]	--	2.561042 [0.1095]	-0.054290 (-0.74964)
BLR	2.638452 [0.1043]	0.853023 [0.3557]	7.875315*** [0.0050]	48.45379*** [0.0000]	--	5.424964*** (8.11306)

(Note: ***, ** and * denotes significant at 1%, 5% and 10% significance level, respectively. The figure in the parenthesis (…) denote as t-statistic and the figure in the squared brackets […] represent as p-value)

source: Developed for the research

The above table showed Granger Causality results for the research model. The null hypothesis refers to explanatory variables do not granger cause on response variables. The null hypothesis of LNCPI does not granger cause on LNHPI is rejected. This is because the P-value (0.0813) of LNCPI is less than 10% significant level. Thus, it has sufficient evidence to conclude that there is uni-directional Granger Causality running from LNCPI to LNHPI in the short run at 10% level of significant. Besides, all the other lagged coefficients of LNEMPT, LNEXG and BLR are not granger cause LNHPI at any level of siginificant, thus the three variables are not granger causal for LNHPI.

Besides that, the null hypothesis of LNEXG does not granger cause on BLR is rejected due to the P-value (0.0000) of LNEXG is less than 1% significant level. It indicates that there is sufficient evidence to conclude that there is uni-directional

Granger Causality running from LNEXG to BLR in the short run at 1% level of significant.

In addition, the null hypothesis of LNEMPT does not granger cause on BLR is rejected since the P-value (0.0050) of LNEMPT is less than 1% significant level. Thus, it has sufficient evidence to conclude that there is uni-directional Granger Causality running from LNEMPT to BLR in the short run at 1% level of significance. The rest of the variables are failed to reject the null hypothesis, even at 10% level of significance. It means that only LNEXG and LNEMPT has short run dynamic granger cause on BLR.

As conclusion, all the dynamic causal interactions among the variables are figured out and reported. Otherwise, the rest of the variables do not have any granger cause relationship among the variables due to the null hypothesis cannot be rejected, as well as its P-value less than significant level.

The causal channels can be summarized as below:

LNHPI   LNEMPT

                              BLR

LNCPI   LNEXG
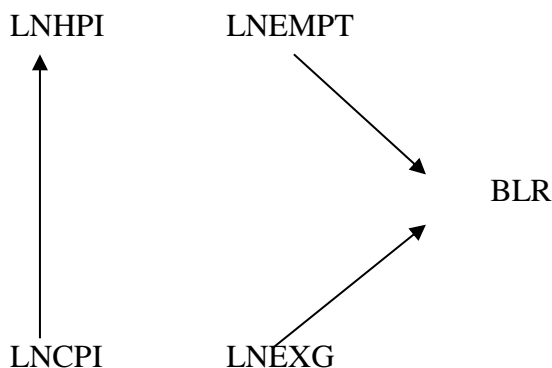
Other than that, based on the results of t-test of the error correction term in the right hand side, it demonstrated that the dependent variable house price index (LNHPI) has significant negative coefficients of the error correction term since its t-statistic (-2.00959) is less than the lower critical value at 5% significant level. It indicated that the adjustment of LNHPI seems to be constant that 49.35% of the disequilibrium is corrected by house price index changes in the long run and converge towards equilibrium.

Furthermore, the results also showed that employment level (LNEMPT) and base lending rate (BLR) have significant positive coefficients of the error correction term due to its t-statistic (3.29980) and (8.11306) respectively, are greater than the upper critical value at 1% level of significant. It illustrated this two variables are not able adjust to correct for any deviations from the long-run relationship, as well as diverge from equilibrium. Furthermore, the remaining variables which are consumer price index (LNCPI) and exchange rate (LNEXG) have insignificant coefficients of the error correction term due to its t-statistics are fallen in the rejection area.

4.8   Inverse Root of AR Characteristic Polynomial

Table 4.6 Inverse Roots of AR Characteristic Polynomial
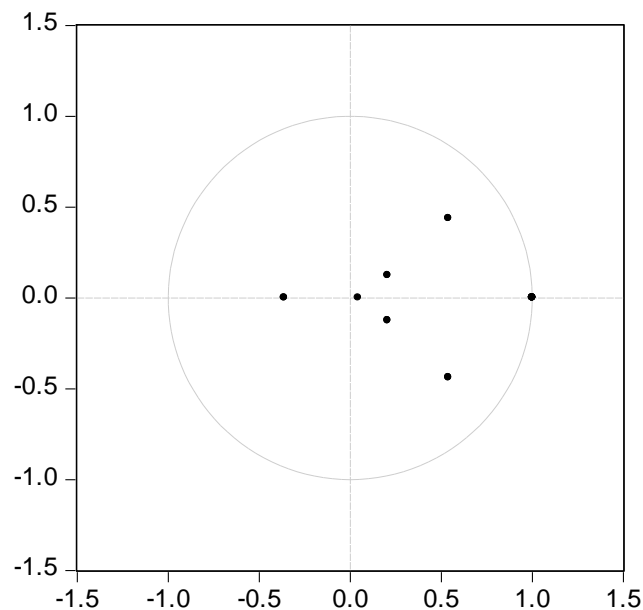
Root	Modulus
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
0.539600 - 0.437192i	0.694482
0.539600 + 0.437192i	0.694482
-0.363460	0.363460
0.205641 - 0.123823i	0.240042

0.205641 + 0.123823i	0.240042
0.042532	0.042532

source: Developed from the research

The graph of inverse roots of AR Characteristics Polynomial above shows that all dots are lie inside the circle. These prove that the VECM is dynamically stability.. The result shows that VECM have 4 unit roots that equal to the unity (table 4.6). According to Giles (2013), if the dots lie outside the circle, the model is not stationary and this will lead to the result of impulse response become invalid. The shock will not die out and the shock effect will be continuously accumulating.

4.9   Variance Decomposition

To consider the dynamic interaction of the variables which is beyond the sample period, the Forecast Error Variance Decomposition is implied. The variance decomposition is a tool that used to define how the housing price index is affected by the shock of macroeconomic and financial variable in using percentage form. The aim of using this test is to detect how important is the LNCPI shocks, LNEMPT shocks, LNEXG shocks, and BLR shocks that accounting for observed fluctuation in HPI in Malaysia.

Table 4.7: Variance Decomposition of LNHPI in Malaysia

Percentage of Forecast Variance explained by Innovations					
Period	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	100.0000	0.000000	0.000000	0.000000	0.000000
2	96.21052	1.286979	2.056993	0.241130	0.204379
3	94.49776	1.990245	2.840958	0.171990	0.499048
4	93.50090	2.171721	3.363149	0.151112	0.813118
5	92.97563	2.168472	3.531832	0.268327	1.055740
6	92.66954	2.140732	3.549711	0.434643	1.205378
7	92.50811	2.137475	3.506468	0.566400	1.281546
8	92.42412	2.160365	3.459461	0.640803	1.315253

| 9 | 92.37387 | 2.196318 | 3.426736 | 0.673134 | 1.329944 |
| 10 | 92.33414 | 2.232725 | 3.410252 | 0.684007 | 1.338877 |

source: Developed from the research

Table 4.7 tabulates the variance decomposition of each variable for ten periods, and then the results were reported based on short run towards long runs. From the table, we can see that, in the first period, all the independent variables do not transmit any shocks from each of them to LNHPI. Starting from the second period, shock to LNHPI account for 96.21 percent variation of the fluctuation of LNHPI, in the other word, which is called as own shock. Next, in quarter two, the percentage of LNCPI to the variation LNHPI is 1.286 percent; shock to LNEMPT can cause 2.057 percent of fluctuation in LNHPI; impulse to LNEXG can cause 0.2411 percent of fluctuation towards LNHPI which is considering as low impact; impulse to BLR account for 0.2044 percent variation of the fluctuation in LNHPI.

From the table 4.15, it can be seen that in period 10, LNCPI, LNEMPT and BLR in explaining the variability of LNHPI has increased significantly in the long run. However, shock to LNEXG provides small percentage impact towards LNHPI compare with previous variables, which is not achieving 0.7 percent in long run. In term of LNCPI, the percentage of influence to LNHPI has increased from period 1 to period 4 after that fluctuate until period 10 and lastly having 2.233percent of LNCPI contribute to the fluctuation of LNHPI. Then, Shock to LNEMPLOYMENT can contribute 3.41 percent fluctuation in the variance of LNHPI in period 10. Furthermore, impulse to LNEXG can cause 0.684 percent fluctuation in LNHPI in the long run. Lastly, BLR did contribute 1.339 percent in the fluctuation of LNHPI.

Last but not least, the influence of LNCPI and LNEMPT to LNHPI is the most significant, from 1.287 percent and 2.057 percent at the first period to 2.233 percent and 3.41 percent in tenth period. As a conclusion, the volatility of LNHPI is mainly affected by its own discrepancy, after followed by LNEMPT, LNCPI, BLR, and LNEXG.

Table 4.8: Variance Decomposition of LNCPI in Malaysia

Percentage of Forecast Variance explained by Innovations					
Period	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	0.019613	99.98039	0.000000	0.000000	0.000000
2	0.470036	98.91815	0.080444	0.428461	0.102909
3	1.072402	97.50032	0.094438	1.137696	0.195143
4	1.586397	96.27118	0.150931	1.767767	0.223723
5	1.948559	95.50149	0.207566	2.125499	0.216886
6	2.177362	95.10435	0.255474	2.263747	0.199066
7	2.310660	94.93997	0.286603	2.280995	0.181776
8	2.386590	94.88797	0.304347	2.252839	0.168259
9	2.433027	94.87538	0.313639	2.219180	0.158772
10	2.466721	94.86607	0.318878	2.195822	0.152506

source: Developed from the research

From the table 4.8, we can see that in period 10, LNHPI, LNEMPT, and LNEXG in explaining the variability of LNCPI has increase significantly in the long run. However, shock to BLR provides smallest percentage of impact towards LNCPI compare with remaining independent variables, which is not achieving 0.2 percent in long run. In addition, the percentage of influence to LNCPI by BLR has increased from period 1 to period 4 after that declines until period 10 and lastly having 0.1525 percent of BLR contribute to the fluctuation of LNCPI. Then, Shock to HPI can contribute 2.467 percent fluctuation in the variance of LNCPI in period 10. Furthermore, impulse to LNEXG can cause 2.1958 percent fluctuation in LNHPI in the long run. Lastly, BLR did contribute 0.1525 percent in the fluctuation of LNCPI.

Table 4.9: Variance Decomposition of LNEMPT in Malaysia

Percentage of Forecast Variance explained by Innovations					
Period	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	2.837572	0.465611	96.69682	0.000000	0.000000
2	8.520595	0.376693	89.65250	0.328198	1.122011
3	9.601945	0.911142	85.86667	0.968608	2.651639
4	9.303304	1.723147	81.70291	3.078627	4.192008
5	8.290234	2.278905	78.64487	5.752878	5.033112
6	7.435046	2.537028	76.89005	7.739820	5.398059
7	6.834397	2.610142	76.17131	8.884381	5.499765
8	6.468490	2.610066	75.96914	9.438181	5.514125
9	6.257029	2.593932	75.94276	9.690533	5.515748

| 10 | 6.130101 | 2.585549 | 75.92267 | 9.829215 | 5.532467 |

source: Developed from the research

From table 4.9 above, we can explain that the influence of LNHPI and LNEXG to LNEMPT is the most significant, which is from 2.8376 percent and 0 percent at the first period to 6.1301 percent and 9.8292 percent in tenth period. In overall point of view, the volatility of LNEMPT is mainly affected by its own discrepancy, after that follow by LNEXG, LNHPI, BLR, and LNCPI respectively in the long run.

Table 4.10: Variance Decomposition of LNEXG in Malaysia

Percentage of Forecast Variance explained by Innovations				
Period	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	0.079713	0.136698	1.182673	98.60092	0.000000
2	0.263289	0.772328	1.663378	97.03707	0.263936
3	0.775524	0.979245	2.068014	95.86015	0.317069
4	1.218045	0.928306	2.586596	95.01032	0.256735
5	1.480045	0.813148	3.038133	94.47159	0.197083
6	1.596147	0.709730	3.384133	94.14757	0.162423
7	1.628194	0.632169	3.617441	93.97932	0.142873
8	1.623552	0.576717	3.763417	93.90799	0.128329
9	1.609135	0.538020	3.852057	93.88526	0.115529
10	1.597370	0.511101	3.909064	93.87812	0.104349

source: Developed from the research

Table 4.10 tabulates the variance decomposition of each variable for ten periods, and the results were reported. In the first period, LNHPI, LNCPI, and LNEMPT have small amount transmit of shocks towards LNEXG which is less than 1 percent. However, only BLR does not transmit any shocks from itself towards LNEXG. In second period, shock to LNCPI account for 0.7723 percent variation of the fluctuation of LNEXG, in the other word, for short run, shock on LNCPI cause highest impact among other variables to LNEXG.

Table 4.11: Variance Decomposition of BLR in Malaysia

Percentage of Forecast Variance explained by Innovations				
Period	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	2.049869	12.71339	0.144876	2.679573	82.41229
2	9.627112	13.22947	4.308163	10.13610	62.69915
3	15.89861	10.28993	13.22362	12.30023	48.28763
4	19.29024	8.310247	21.01160	10.11463	41.27327
5	19.80509	7.271106	26.44624	10.04876	36.42880
6	18.74560	6.629158	28.96689	13.09194	32.56641
7	17.44177	6.070310	29.94474	16.74187	29.80131
8	16.45064	5.571747	30.51514	19.34483	28.11764
9	15.82873	5.152760	31.13434	20.73534	27.14882
10	15.48263	4.800799	31.87026	21.34167	26.50465

source: Developed from the research

From the table 4.11, it can be conclude that in period 10, LNHPI, LNCPI, LNEMPT, and LNEXG in explaining the variability of BLR has increase significantly in the long run. However, shock to LNEMPT and LNEXG provides high percentage of impact towards BLR compare with the other two variables, which are more than 20 percent in long run respectively. In term of LNCPI, the percentage of influence to BLR has declines start from period 2 to period 10 and end up with 4.8 percent impact towards LNCPI. In the other hand, shock in LNHPI can cause 15.4826 percent fluctuation in BLR in the long run.

4.10 Generalized Impulse Response Function

In order to study impulse response, we chose generalized impulse response analysis from unrestricted VAR that was suggested by Pesaran and Shin (1997). The results retrieved from variance decomposition and generalized impulse response functions are commonly found to be highly depended on the lag length selected and the type of ordering in variables. Therefore, the reason used to generalized IRFs is because generalized IRFs react differently with standard IRFs, however, generalized IRFs do not affect the outputs if ordering of independent variable is randomly plugged into the equation and do not assume that when one variable is shocked, all other variables are switched off. Sims (1980) also

mentioning that standard IRFs approach has its limitation in the output depend on the ordering of the variable unless there is no contemporaneous correlations among independent variables.

From Figure 4.8, generalized IRFs from shock by one standard deviation to individually of four independent variables (LNCPI, LNEMPT, LNEXG, and BLR) are traced out. We can observe that the one standard deviation of LNEXG will cause a positive impact to LNHPI. The LNEXG significantly increased from the first period until the tenth period, in other words; LNEXG gives positive impact towards LNHPI. While the response of LNHPI to LNEMPT tend to have positive impact in a beginning period and declining to zero after that, it turns to become negative impact towards LNHPI.

On the other hand, the response of HPI to LNCPI shows the negative impulse stating from the first period. The response drops and then reverts upwards in long run relationship after about third period. Responses of shock from BLR to LNHPI have temporary negative impact in the first 3 period, after that it return to the positive upward sloping on period 4 onwards and turn to a positive impact to LNHPI.

In the final analysis, LNCPI and BLR have negative impact towards LNHPI, while LNEMPT and LNEXG have positive impact towards LNHPI. The results also show that shocks of LNCPI, LNEMPT, LNEXG and BLR are not significantly towards LNHPI.

Figure 4.8: Generalized Impulse response functions for ten periods
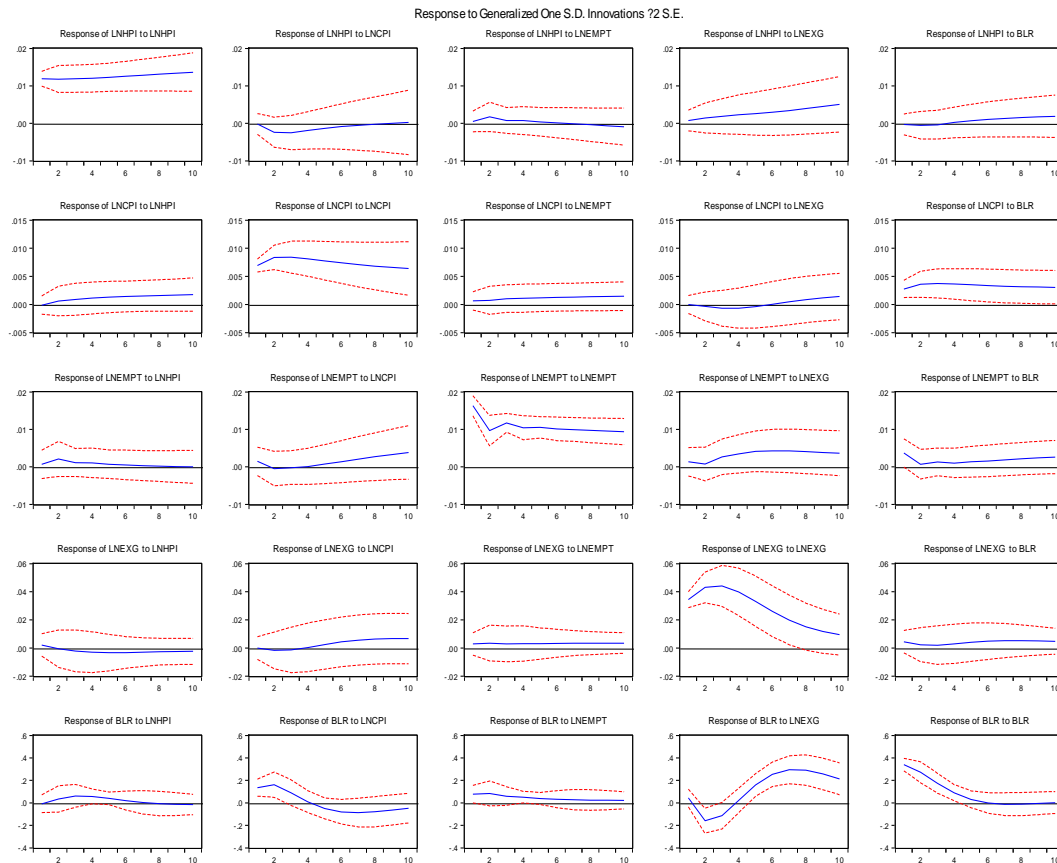
4.11 Conclusion

Initially, the descriptive statistics of each variables is being reviewed. The graph patterns of each variables also have been widely discussed. Due to the fact that most of the variables looks like trend data, hence it may be non-stationary. To figure out whether the variables are stationary, the unit root tests are employed in this study instead of using Ordinary Least Square estimation. Based on the ADF and PP tests, most of the variables are not stationary at level, except GDP and HI which are stationary at level. The others five variables are stationary after the first different of both ADF and PP tests.

In order to proceed to Johansen & Juselius Cointegraton test, the new empirical model is form by dropping the two variables which reach the stationary at level. After the new empirical model is formulated, this study proceed to Johansen &

Juselius Cointegration test. The lag length is selected based on the Ljung-Box test. The study found that with lag length 1, there is no autocorrelation problem in this model, hence the lag length of 1 is selected before proceeding to cointegration test.

Based on the trace statistics and maximal eigenvalue statistics, both results showed that the empirical model has two cointegrating vectors and there is a long run relationship of this model. Since there is a long run relationship in this model, hence this study proceeded with VECM approach. The VECM results showed that employment, exchange and base lending rate are significant to house price index, while consumer price index is not significant. The sign of employment and base lending rate is positively related to HPI and exchange rate is negatively related to HPI.

For the determination of short run and causality direction of the model, the Granger Causality is being used. From the results, it clearly showed that EXG and EMPT are uni-directional towards the base lending rate and only consumer price index is uni-directional to house price index. Hence, we can conclude that only CPI has granger causality and short run relationship to the HPI.

The inverse root of AR characteristics polynomial is used to test the dynamic stability of the empirical model. The result shows that with VECM approach, the empirical model is dynamically stable. The results of variance decomposition and impulse response function also are shown clearly above. According to variance decomposition results, the volatility of HPI is mainly affect by its own shocks, after follow by EMPT, CPI, BLR and EXG. For generalized impulse response function, the shocks effects of all independent variables are not significant towards HPI.

Overall, this chapter has simplified all of the empirical results and findings in figure, diagram and table form. In order to provide a clearer picture, the precise explanations are written below on each of the test results. The limitations, suggestions and findings of the whole research study will be explained and discussed in the chapter 5.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

The main objective of this study is to examine the determinant of residential housing price in Malaysia based on four macroeconomic factors and two financial factors. This chapter comprised the empirical result from previous chapter and the detail will be explained accordingly. A new empirical model is form after the unit root test and the selected variables are inflation rate, employment, exchange rate and interest rate. The major findings of the selected variables will be discussed in deep consistent with the objectives of this research and the empirical results in chapter 4. Besides, the implication of this study and the limitations that occurred in the study will be thoroughly discussed. Lastly, recommendations for future studies also will be provided.

5.1 Summary of Statistical Analyses

The empirical results from previous chapter are managed to achieve the objectives and solve the research questions of this research. Initially, this study overviews the descriptive statistics of all the variables. After that, this study proceed to graph line, which elaborated the graph moving pattern and discussed the phenomenon of the fluctuation of each variables. Due to most of the macroeconomic variables are non-stationary and in order to prevent from spurious regressions, the unit root tests are carried out. Both ADF and PP tests are employed to test for the stationarity of each variables and the results show that out of the seven variables, only five variables include HPI, CPI, EMPT, EXG and BLR are stationary at first difference can be proceed to multivariate Johansen-Julius Cointegration test. In order to confirm the unit root test results, a new empirical model is form and

proceed to the rest of the empirical estimation. The two variables that dropped from this study are GDP and HI. The new empirical model is HPI with CPI, EMPT, EXG and BLR.

Since the unit root tests of new empirical model's variables are stationary at first difference, hence this study will proceed with Johansen & Juselius Cointegration test to examine the long run relationship effect of the model. before proceed to Johansen & Juselius Cointegation test, the optimum lag length is determined by Ljung-Box test. The empirical results of Johansen & Juselius Cointegration test shows that the model has long run equilibrium relationship between HPI with CPI, EMPT, EXG and BLR. Consequently, this study will proceed by using VECM model instead of using VAR model which is test for the short run equilibrium.

From the VECM results, only three variables (EMPT, EXG and BLR) are significant to the house price index. CPI is not significant to HPI, hence this variable will not be further discuss in major findings below. The EMPT, EXG and BLR will be further discussed in great detail in the following sub topic. Next, the short run relationship and the causality direction of the model will tested by Granger Causality test. The summary of short run granger causality between all of the variables are shown in the table below.

Table 5.1 short-term granger causality relationship between all variables

Variables	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
LNHPI		10%	-	-	-
LNCPI	-		-	-	-
LNEMPT	-	-		-	-
LNEXG	-	-	-		-
BLR	-	-	1%	1%	

The causal channels can be summarized as below:

LNHPI   LNEMPT

BLR

LNCPI   LNEXG
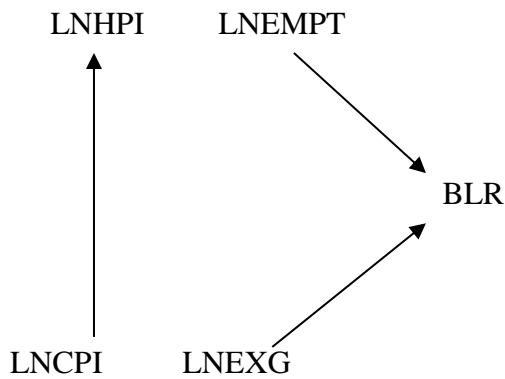
source: Developed from the research

Based on Granger Causality test results, this research found that in the short run there is uni-directional Granger Causality running from LNEXG to BLR. As well, there is uni-directional Granger Causality running from LNEMPT to BLR in the short run. Therefore, the movement of BLR is affected by both LNEXG and LNEMPT in the short run. Furthermore, there is uni-directional Granger Causality running from LNCPI to LNHPI in the short run, whereby the movement of LNCPI tends to influence the movement of LNHPI in the short run.

After that, the stability of AR (p) process is tested. The results showed that the empirical model is dynamically stable, hence the impulse response results are valid. In order to explain the dynamic interaction of this research, the variance decomposition and impulse response test are carried out. The volatility of HPI is mainly affect by its own discrepancy rather than by other independent variables. CPI and BLR are negatively impact HPI, whereas EMPT and EXG are positively impact HPI. However, the shocks of these variables are not significant affect the HPI.

5.2 Discussions of Major Findings

5.2.1 Employment

In the research paper of Mcquinn and O'Reilly (2005), they claimed that employment has been classified as a significant determinant towards housing price. Then, the test results for this researcher was alike to the past researchers results, which is that employment was positive and significant to residential housing price in Malaysia, which is on par with the study done by Dohmen (2005) and Khan et al. (2012). In contrast, the results in this study are consistent with the past researchers Bump et al. (2014) and Kitov et al. (2008). In their research papers, they claim that all the results and findings are in line although they conducted their studies in different country, background, and culture. In addition, there is long run and short run relationship between employment and housing price and the results was alike with study conducted by Valletta (2013).

Next, the total number of citizens in a country being employed reflects the economic condition of a country. Thus, when more and more citizen in the society has their jobs, they tend to receive permanent income from their occupations, so is reasonable to own a house near to their working places in order to shorten the time needed to go to their work place. Hence, the demand of residential housing will increase as well as the housing price due to the market condition (Altman, 2006). Therefore, highly employed country could reflect the positive economic growth that significantly affects residential housing price because the citizens in the country have more wealth to acquire a house. Similarly, this phenomenon will lead to increase in house price due to the high demand of residential house.

Furthermore, rise in employment in a country can lead to more stable economic condition. This is obvious to see that when employment rate is rising, more people are caprable to purchase a house. Thus, high employment may encourage people to enter into housing market. Moreover, expectation on housing market is an important factor to determine an employer whether they are willing to take the

risk or not. But, if all employers choose to own a house, it could reflect a favorable housing market. Hence, in the good economic condition, people are more confident to enter the housing market. As a result, demand of housing is larger the supply of housing. This situation is fully supported by the theory of supply and demand (Loganathan, 2007). Concisely, it is to determine that employment is positively affecting the housing price.

5.2.2 Exchange Rate

This paper found that the exchange rate is significant at 5% significance level. Moreover, it is negatively affecting the house price in Malaysia in long run. The finding in this paper was consistent with the expected sign as stated previous.

Furthermore, Abelson et al. (2005) found that house price and exchange rate is negatively correlated in Australia. As local exchange rate is depreciating, local house price tends to increased and exist in long-run relationship. Besides, Mallick and Mahalik (2015) have stated that house price and exchange rate is negatively correlated in India.

The reason that Malaysia exchange rate has a negative relationship to its house price is because foreigner investors have attracted to Malaysia housing property at a lower exchange rate compared to their currency. The negative relationship of house price and exchange usually exist in developing countries like India and Australia. According to Mascarenhas (2012), Malaysia housing property market had attracted some foreign investors holding stronger currency like China, Singapore, South Korea and Japan. As the exchange rate of Malaysia is depreciating, this could create an incentive for foreign investors as their relevant currencies are becoming stronger. This could increase the attractiveness of housing assets to foreign investors. In relative, the demand of housing assets in Malaysia increase and this will cause the residential house price increase.

5.2.3 Interest Rate

Based on empirical results of this research, there was a significant positive relationship between the interest rate (BLR) and the residential housing price at 5% of significance level. It indicated that interest rate had a significant impact on the residential housing price in Malaysia , as well as consistent with the findings of past researchers in literature review part in this study. In contrast, there was a positive relationship between the interest rate and the residential housing price that conflicted with the expected sign in the study. It also implied that all the results and findings can be different from country to country due to there is a lot of differences in historical background, culture and civilization, government policy, economic circumstance and so on in different countries. Thus, it was inconsistent with the expected sign since most of the researchers found that interest rate is negatively influence residential housing price.

In general, rising in interest rate often happen in a strong and healthy economic circumstance where it can be expected there is an inflation in future price. Indeed, higher interest rate drives up cost of borrowing, but it also arises in periods with rising incomes, higher degree of consumer confidence, higher standards of employment rate and so forth. It is able to enhance the affordability of the workforce and the possibility from renting to buying a house. Hence, a rise in interest rate can reflect a broadening economy with other positive economic factors that significantly affect residential housing price. Eventually, this kind of factors will lead to an increase in demand for housing market and subsequently bring out upward pressure on residential housing price (Larock, 2010; Ming, 2013).

In addition, an increase in interest rate can also cause constructors to suffer in higher cost of capital to develop houses. Thus, constructors will raise the house price in order to gain a better return for compensation. As well, a rise in interest rate can reflect a favorable economy, all people are capable to afford the interest rate charged by banks and try to pursue their desired types of house. During good economic circumstance, people will be more confident and optimistic in regard to

the housing market, as a result of demand is exceed supply in housing market. According to the explanation above, it is an undeniable fact that interest rate having a positive impact toward the price of residential housing price in Malaysia (Ming, 2013; Ong, 2013).

5.3   Implications of the Study

This study contributes for foreign investors, local home buyers, government, policy makers and relevant future researchers.

Malaysia residential housing assets have become one of an attractive investment for foreign investors and local home buyers. It is important for investors to know which macroeconomic variables or financial determinants such as inflation, employment, foreign exchange and interest rate is bringing the utmost effect to house price in Malaysia.

In this study, investors recommended to refer interest rate and foreign exchange rate when making decisions. Although investors can't control the interest rate and foreign exchange rate, however, they can have a better understanding of fluctuation of interest rate and foreign exchange in Malaysia economy. With sufficient knowledge, they can try to avoid or performing hedge when investing in residential housing assets. As reported in the previous chapter, interest rate and foreign exchange significantly correlate with house price in Malaysia. When interest rate increases, house price will increase too. On the other hand, the foreign exchange rate and house price have a negative relationship. Investors can refer this study in their investment decision making on when is the right time to purchase.

As one of the developing country, residential housing market in Malaysia indicated one of the important industry in Malaysia economy. The Malaysian government understands that the housing is a basic need for every resident (Ong, 2013). Hence, a housing policy that enforces the commitment of private segment

in housing construction which follow the national housing scheme development is imposed by the Malaysian government (Asiah, 1999). Besides, Malaysian government works hard to achieve the target by programmers and different variety of policies assisting.

In this study, four macroeconomic determinants such as inflation, employment, exchange rate and gross domestic product and three financial factors which are interest rate and household income are determined. Results show that only the significant variables that affect the house price in Malaysia are employment, exchange rate and interest rate only. Policy makers and government are recommended to take account these three variables. Based on this study, authorities are capable to determine the latest variables that are most significant with house price, analyze the supply and demand behind and impose a new policy or adjust the existing policy in order to maintain a healthy and stable housing market in Malaysia. Currently, house price of Malaysia keeps increasing. This actually reflects the economic distortion in Malaysia (Ong, 2013). Therefore, authorities need to be well prepared and stabilize the housing price to prevent the worse cases scenario from happening.

In Malaysia, some other researchers came up with different conclusions and results. According to Ong (2013), interest rate has no significant relationship with house price. Besides, he also stated that GDP is having a significant relationship with residential housing price in Malaysia which in contrast with this paper. In a nutshell, this study provides a different view of perspective with different methodology applied. Hence, this paper served as a guide in determinants affecting house price in Malaysia in future research.

5.4   Limitations of Study

Throughout this research, several limitations can be found to impede this research to optimize its results and step forward to become an ideal research. As well, it was rare to find a perfect research without any limitation in reality. First and

foremost, this study can considered as the lack of independent variables are taken to investigate their relationship with the response variable which is residential house price in Malaysia. At the beginning, this study consisted of six independent variables as determinants of residential housing price in Malaysia. Unfortunately, this study excluded two independent variables because the problem of unit root test. Whereby it was able to influence the accurateness of the result and cause this research to become invalid. However, all the independent variables are applied in this research might not be able to completely reflect the variation of residential housing price in Malaysia as it is possible to omit some significant variables in this research.

Besides that, there was a limitation that insufficient theories of all variables in this study. In practice, there are a lot of theories of house prices are based on primary data rather than secondary data, as well as less relevant theories can be found. Hence, this study unable to carry out an adequate review of relevant theoretical models to support the selected variables. Moreover, due to the limited knowledge of econometrics tests, this research was not able to explore and carry out more advanced tests to examine the relationship between the response variable and the explanatory variables. Consequently, it obstructed the enhancement and consistency of the empirical results.

In addition, this study encountered problem that the limited data can be obtained from UTAR library DataStream. This study only used the time series data from year 1996 to year 2014 as the study period. Besides, this study used the quarterly data as the sampling method and provides 76 observations have been introduced for each variable. It has limited the extent of study period and the validity of this study.

Last but not least, all the results and findings from this research might only be applicable in Malaysia market, as well as become useful for local people and policy makers. The reason was all the data sources of this research are retrieved from Malaysia and concentrate on the housing market in Malaysia. Besides, country is a unique individual, there is a lot of differences in historical background,

culture and civilization, government policy, economic circumstance and so forth in different countries. Therefore, the results and findings from this research can vary from country to country and not suitable to other countries, and it can only serve as a reference for other countries.

5.5   Recommendations for Future Research

Research recommendations produce an overall view about what is expected in this research and what could future studies practice in order to produce a better study. It is usually an important part of a project in the sense of avoiding mistakes to be repeated and provide a better result for future research. Thus, it is highly recommended that future researches to carry out more advance test statistics in order to get a clearer picture regarding long run and short run relationships more accurately. Next, future researchers need to verify the test statistics that going to use in their model whether is correctly specified or not, so that it could be obtain a better result in their study.

According to researcher Korb (2013), variables are both important and tricky in any research and a variable is representing its features of an individual in the model, group of variables or the research environment in a research. When a similar study is conducted, researchers may include more variables to enhance the model. However, the variables chosen to be use in the model must be relevant with the study and most importantly, it is the characteristic of the variables itself that must be significant to the study. For instant, including more variables in a study would provide more research information to policy makers or readers and therefore, enhance the significance of the study.

In the other hand, future researchers should take global financial crisis into consideration which may lead to an amount of impact towards the housing price in different countries. Besides, the sensitivity of housing price that caused by global financial crisis may differ in developing and developed countries. This information might help investors to make their investment rule. In addition, future

studies should focus more on before, during and after the global financial crisis that affecting housing price.

Next, sample size is the big problem that many researchers facing when conduct a study, it is suggested to future researchers should use larger sample size to conduct their study. According to Central Limit Theorem (CLT), researchers may use monthly data rather than using quarterly data to make the research has more observations and this could avoid the problem of multicollinearity, autocorrelation, and heteroscedasticity problems if the study is using ordinary least square (OLS) to test their model.

The future researchers may propose other types of research method for data collection such as interview. According to Gill et al. (2008), he claimed that the major function of using research interview is to explore the views, beliefs, and individual motivations. Furthermore, interviews are classified as qualitative methods which is said to provide a more 'detail' information of social phenomena, for example questionnaires. Other than using questionnaire, structure interview is also another option for researchers to choose. Structure interview is referring to two way communications in which both parties can get information from each other. By using questionnaire, the respondents are not able to ask for a question regarding any doubt in the topic, but in the other way, using structure interview are encourage respondents to do so and interviewer could ask any questions or uncertainties about the study conducted to enhance their research objective and purpose of the research.

Last but not least, insert any other significance variables or new variable such as personal income by replacing irrelevant variables will further improve the model. Then, if the same model as this study is used, it suggests that future researcher may conduct more minor test such as super exogenous test in order to improve their model. As in any research, it is frequently use different method to conduct their study. So, this study recommends that future researcher may use other methods such as Hedonic Pricing Model and Repeat Sales Method, rather than using Vector Error Correlation Model (VECM).

5.6   Conclusion

In the final analysis, due to the rapid increases of house price in the countries of Asia Pacific since the subprime mortgage crisis 2008, it raised the attention of public whether the continuous increment trends will lead to housing bubbles. It is important to know the determinants of macroeconomic and financial factors to the residential property markets, especially for the policy makers, government, investors, homeowners and homebuyers. The study reviews a certain among of past research paper and journals in order to get overall picture of the residential property markets. The theoretical framework of the house price index also had been widely discussed.

Besides of investigate the relationship between macroeconomic and financial factors towards residential market in Malaysia, this study also examined the long run, short run, causality direction, dynamic stability and shocks of the empirical model of this study. All of the methodologies of this time series data analysis are discussed in great detail. The empirical results are tested through Eview 8.

Lastly, based on the empirical results and discussion, this research found that employment, exchange rate and interest rate are significant determinant of Malaysian house price index, while inflation rate is not significant. The gross domestic product and household income are excluded because the unit root test results show that both are stationary at level which not suitable in proceed to Johansen & Juselius Cointegration test. The major findings, implication, limitation and future studies have been widely discussed in the last chapter of this study.

REFERENCES

Abelson, P., Joyeux, R., Milunovich, G., & Chung, D. (2005). House prices in Australia: 1970 to 2003 facts and explainations. *Economic Record, 81*(1), 96-103.

Abraham, J., & Hendershott, P. (1996). Bubbles in metropolitan housing markets. *Journal of Housing Research, 7(*2), 191-207.

Adam, Z., & Fuss, R. (2010). Macroeconomic determinants of international housing markets. *Journal of Housing Economic 19*, 38-50.

Agnello, L., & Schuknecht, L. (2009). Booms and bursts in housing markets: determinants and implications. *European Central Bnak.*

Aherne, A. G., Ammer, J., Doyle, B. M., Kole, L. S., & Martin, R. F. (2005). House prices and monetary policy: a cross-country study. *International Finance Discussion Papers.*

Ali, S., Mohammad S., Sabri, S., & Jislan, F. (n.d.). Sexual harassment in workplace: experience of employees in hospitality industry in Malaysia.

Altman, M. (2006). Involuntary unemployment, macoeconomic policy, and a behavioral model of the firm: why high real wages need not cause high unemployment. *Research in Economics 60,* 97-111.

Alvarez, F., Lucas, R. E., & Weber, W. E. (2008). Interest Rate and Inflation. *The American Economic Review, 91*, 219-225.

Aminuddin, M. (2009). Employment relations in Malaysia: past, present, and future. *New Zealand Journal of Asian Studies 11*(1), 304-317.

Antipova, A. (2015). Black, white, male, and female concentrated employment: the effect of spatial and aspatial labor factors. *Cities 42,* 160-172.

Asari, F. F. A. H., Baharuddin, N. S., Jusoh, N., Mohamad, Z., & Jusoff, N. S. K. (2011). A Vector Error Correction Model (VECM) Approach in Explaining the Relationship Between Interest Rate and Inflation Towards Exchange Rate Volatility in Malaysia. *World Applied Science Journal, 12,* 49-56.

Asghar, Z., & Abid, I. (2007). Performance of lag length selection criteria in three different situations.

Asteriou, D., & Hall, S. G. (2007). Applied Econometrics: A Modern Approach Using Eviews and Microfit, Revised Edition. Palgrave Macmillan.

Aura, S., & Davidoff, T. (2008). Supply constraints and housing prices. *Economics Letters 99*, 275–277.

Bain, K. (n.d.). *Monetarist Models of Exchange Rate Determination.* Retrieved from http://homepages.uel.ac.uk/K.Bain/flowmon.pdf

Bank Negara Malaysia (2012). *Monetary policy in 2012*. Retrieved from http://www.bnm.gov.my/files/publication/ar/en/2012/cp03.pdf

Bardhan, A. D., Datta, R., Edelstein, R. H., & Lam, S. K. (2003). A tale of two sectors: upward mobility and the private housing market in Singapore. *Journal of Housing Economics 12*, 83–105

Bekhet, H. A., & Othman, N. S. (2011). Causality analysis among electricity consumption, consumer expenditure, gross domestic product (GDP) and foreign direct investment (FDI): Case study of Malaysia. *Journal of Economics and International Finance*, *3*(4), 228-235

Beltratti, A., & Morana, C. (2010). International house prices and macroeconomic fluctuations. *Journal of Banking & Finance 34*, 533–545.

Bilozor, M. R., & Wisniewski, R. (2012). The impact of macroeconomic factors on residential property prices indices in Europe.

Blankenau, W., Kose, M. A., & Yi, K. M. (2001). Can world real interest rates explain business cycles in a small open economy?. *Journal of Economic Dynamics and Control, 25(*6), 867-889.

Borok, V. I., Soloviev, A. A., Allegre, C. B., Sobolevskii, A. N., & Intrilligator, M. D. (2005). Patterns of macroeconomic indicators preceding in unemployment rise in Western Europe and the USA.

Box, G. E. P., & Pierce, D. A. (1970). Distribution of residual autocorrelation in autoregressive-integrated moving average time series model. *Journal of the American Statistical Association, 65*, 1509-1526.

Bracke, P. (2011). How long do housing cycles last? A duration analysis for 19 OECD countries. *Journal of Housing Economics 22*, 213–230.

Breitenfellner, A., Cuaresma, J. C., & Mayer, P. (2015). Energy inflation and house price corrections. *Energy Economics 48*, 109–116.

Brooks, C. (2008). *Introductory Econometric for Finance.* (2nd.ed.). Cambridge University Press.

Brunnermeier, M. K., & Juliard, C. (2007). Money illusion and housing frenzies. *Review of Financial Studies, bank University Press for Society for Financial Studies, 21*(1), 135-180.

Bujang, A. A., Zarin, H. A., & Jumadi, N. (2010). The relationship between demographic factors and housing affordability. *Malaysia Journal of Real Estate, 5*(1).

Bump, B., Levkov, A., & Garriga, J. (2015). Financing constraints and unemployment: Evidence from the great recession. *Financial of Monetary Economics*. Cambridge University Press.

Burns, P. (2002). Robustness of the Ljung-Box test and its rank equivalent.

Çağlayan, E., & Saçıldı, İ. S. (2010). Does purchasing power parity hold in OECD countries?. *International Research Journal of Finance and Economics 37*, 138-146.

Caldera, S., & Johansson, A. (2013). The Price Responsiveness of Housing Supply in OECD Countries. *Journal of Housing Economics 22,* 231–249.

Campbell, J. Y., & Cocco, J. F. (2007). How do house prices affect consumption? Evidence from micro data*. Journal of Monetary Economics, 54*(3), 591-621.

Capozza, D. R., Hendershott, P. H., Mack, C., & Mayer, C. J. (2002). Determinants of real house price dynamics.

Carlson, D., Haveman, R., Kaplan, T., & Wolfe, B. (2012). Long-term earnings and employment effects of housing voucher receipt. *Journal of Urban Economics, 71*(1), 128-150.

Carol, A. (1999). Optimal hedging using cointegration. *The Royal Society*. 2039-2058.

Chang, K. L., Chen N. K., & Leung, C. K. L. (n.d.). The dynamics of housing returns in Singapore: How important are the international transmission mechanism? *Regional Science and Urban Economics 42*, 516–530.

Chen, M. C., & Patel, K. (1998). House price dynamics and granger causality: An analysis of Taipei new dwelling market. *Journal of the Asian Real Estate Society, 1*(1), 101-126.

Cheung, Y. W., & Lai, K. S. (1997). Bandwidth selection, prewhitening, and the power of the Phillips-Perron test. *Econometric Theory, 13*(5), 679-691.

Chien, M., Lee, C., & Cai, S. (2014). A panel cointegration analysis for macroeconomic determinants of international housing market. *International Journal of Social, Education, Economics and Management Engineering 8*, 7.

Chinn, M., Ferrara, L., & Mignoon, V. (2014). Explaining US employment growth after the great recession: The role of output–employment non-linearities. *Journal of Macroeconomics 42*, 118-129.

Cho, D. (2006). Interest rate, inflation, and housing price: with an emphasis on chonsei price in Korea. *Monetary Policy under Very Low Inflation in the Pacific Rim, NBER-EASE, 15.*

Chui, L. H. T., & Chau, K. W. (2005). An empirical study of the relationship between economic growth, real estate prices and real estate investments in Hong Kong. *Surveying and Built Enviroment, 16*(2), 19-32.

Coleman, N., & Feler, L. (2015). Bank ownership,lending,and local economic performance during the 2008-2009 financial crisis. *Journal of Monetary* Economics, 55-60.

Court, A. T. (1939). Hedonic price indexes without automotive examples. *In the Dynamics of Automobile Demand*, General Motors Corporation, 99-117, New York.

Craig, R. S., & Hua, C. (2011). Determinants of property prices in Hong Kong SAR: implications for policy. *International Monetary Fund.*

Crotty, J. (2009). Structural causes of the global financial crisis: a critical assessment of the 'new financial architecture'. *Cambridge Journal of Economics 2009, 33*, 563-580.

Dao, C. M., & Wolters, J. (2008). Common stochastic volatility trends in international stock returns. *International Review of Financial Analysis, 17*, 431-445.

Demary, M. (2009). The link between output, inflation, monetary policy and housing price dynamics (Working Paper No. 15978).

Department of Statistics Malaysia. Retrieved April 20, 2015, from http://www.statistics.gov.my

Diewert, W. E. (2001). The consumer price index and index number purpose. *Journal of Economic and Social Measurement*, *27,* 167-248.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, *74*(366a), 427-431.

Dohmen, T. J. (2005). Housing, mobility and unemployment. *Regional Science and Urban Economics 35,* 305-325.

Dritsaki, C., & Dritsaki, M. (2010). Government expenditure and national income: causality tests for twelve new members of EE. *Romanian Economic Journal, 13*(38), 67-89.

Egert, B., & Mihaljek, D. (2007). Determinants of housing prices in central and eastern Europe. *Monetary and Economic Department.*

Eita, J. H. (2012). Modelling macroeconomic determinants of stock market prices: Evidence from Namibia. *The Journal of Applied Business Research, 28*(5), 871-883.

Elder, J. (2003). An impulse-response function for a vector autoregression with multivariate GARCH-in-mean. *Economics Letters, 79*(1), 21-26.

Englund, P., & Ioannides, Y. (1997). House price dynamics: An international empirical perspective.

Engsted, T., Hviid, S. J., & Pedersen, T. Q. (2015). Explosive bubbles in house prices? Evidence from OECD countries.

Eviews 8. (2013). *Eviews 8 user's guide 2*. Retrieved from www. eviews.com

Fox, R., & Finlay, R. (2012). Dwelling prices and household income. 13-22.

Frappa, S., & Mesonnier, J. S. (2010). The housing price boom of the late 1990s: Did inflation targeting matter? *Journal of financial Stability, 6*, 243-254.

Gaines, J. P. (2015). Home Prices, Incomes Create Affordability Gap. *Real Estate Center. Texas A&M University.*

Gallin, J. (2006). The long-run relationship between house prices and income: evidence from local housing markets. *Real Estate Economics, 34*(3), 417-438.

Gattini, L., & Ganoulis, I. (2012). House Price Responsiveness of Housing Investments across Major European Economies. *European Central Bank.*

GE, X. J. (2009). Determinants of house prices in New Zealand. *Pacific Rim Property Research Journal ,15*(1), 90-112.

Gill, P. et al. (2008). Methods of Data Collection in Qualitative Research: Interviews and Focus Groups. *British Dental Journal, 204,* 291-295. Retrieved from http://www.nature.com/bdj/journal/v204/n6/full/bdj.2008.192.html

Giles, D. (2013, June 13). When is an autoregressive model dynamically stable? [Blog post]. Retrieved from http://davegiles.blogspot.com/2013/06/when-is-autoregressive-model.html

Glindro, E. T., Subhanij, T., Szeto, J., & Zhu, H. (2011). Determinants of House Prices in Nine Asia-Pacific Economies. *International Journal of Central Banking, 7*(3), 163-204.

Goodhart, C., & Hofmann, B. (2008). House Prices, money, Credit and the Macroeconomy. *European Central Bank..*

Granger, C. W. J. (1969). Investigation Causal Relationship by Econometric Models and Cross-spectral Methods. *Econometrica, 37*(3), 424-438.

Guirguis, H., Giannikos, C. I., & Anderson, R. I. (2005). The US housing market: Asset pricing forecast using time varying coefficients. *Journal of Real Estate Finance and Economics, 30*(1), 33-35.

Gujarati, D. N., & Porter, D. C. (2009). Basic econometrics (5th ed). USA: McGraw- Hill. Boston, MA: McGraw-Hill/Irwin.

Harasheh, M., & Abu-Libdeh, H. (2011). Testing for correlation and causality relationship between stock prices and macroeconomic variables: The case of Palestine Securities Exchange. *International Review of Business Research Paper,7*(5), 141-154.

Hartley, P. R., Medlock, K. B., Temzelides, T., & Zhang, X. (2015). Local employment impact from competing energy sources: shale gas versus wind generation in Texas.

Hashim, Z. A. (2010). House price and affordability in housing in Malaysia. *Akademika, 78*, 37-46.

Hill, R.C., Griffiths, W. E., & Lim, G. C. (2007). Principles of Econometrics. *Third (3rd) Edition.*

Hoffman, B. (2003). Bank lending and property prices: some international evidence.

Hott, C. (2009). Banks and Real Estate Prices (No. 2009-08). Swiss National Bank.

Hott, C. (2009). Explaining housing price fluctuations. *Swiss national bank working papers.*

Huma, C. H. (2012). A comparative study of private housing price between Hong Kong and worldwide major countries.

Iacoviello, M. (2002). House Prices and Business Cycle in Europe: A VAR Analysis.

Igan, D., & Loungani, P. (2012). Global housing cycles. *International Monetary Fund.*

International Monetary Funds. (2015). Housing price index. Retrieved from http://www.imf.org/external/index.htm

Ismail, M., Lee, K. C., & Chan, F. B. (2007). Factors influencing sexual harassment in the Malaysian workplace. *Asian Academy of Management Journal, 12*(2), 15-31.

Johansen, S., & Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration- With Applications To The Demand For Money. *Oxford bulletion of Economics and Statstics, 52(*2), 0305-9049.

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vector in Gaussian Vector Autoregressive Models. *Econometrica, 59*(6), 1551-1580.

Junoh, M. Z. (2004). Predicting GDP growth in Malaysia using knowlegde-based economy indicators: A comparision between neutral network and econometric approaches.

Kang, H. H., & Liu, S. B. (2014). The Impact of the 2008 Financial Crisis on Housing Prices in China and Taiwan: A Quantile Regression Analysis.

Kasa, K. (1992). Common stochastic trends in international stock markets. *Journal of Monetary Economics, 29,* 95-124.

Katz, L. F. (1988). Some recent developments in labor economics and their implications for macroeconomics. *Journal of Money, Credit and Banking*, 507-522.

Khan, J., Shamshad, & Hassan T. (2012). Unemployment and levels of socio-economic deprivation in India: a regional perspective. *British Journal of Humanities and Social Sciences, 3*(2).

Kitov, I. O., Kitov, O. I., & Dolinskaya, S. A. (2008). Relationship between inflation, unemployment and labor force change rate in France: cointegration test.

Klau, M., & Fung, S. S. (2006). The new BIS effective exchange rate indices. *BIS Quarterly Review*.

Korb, K. A. (2013). *Conducting Education Research*. Retrieved from http://korbedpsych.com/R00Steps.html

Labonte, M. (2011). Inflation: causes, costs, and current status. *Congressional Research Service.*

Larock, D. (2010). Do Higher Interest Rates Cause Lower House Prices? Dave The Mortgage Planner.

Laxman, L., Som, H., Saat, M., & Low, H. H. (n.d.). A study on sexual harassment in small and medium enterprises of Malaysia.

Lecat, R., & Mesonnier, J. S. (2005). What role do financial factors play in house price dynamics?

Lee, C. L. (2009). Housing Price Volatility and its Determinants. *International Journal of Housing Markets and Analysis, 2*(3), 293-308.

Lee, K. C., & Pesaran, M. H. (1993). Persistence profiles and business cycle fluctuations in a disaggregated model of UK output growth. *Ricerche Economiche, 47*(3), 293-322.

Lee, Y. S., & Kim, T. H., & Newbold, P. (2005). Spurious nonlinear regressions in econometrics. *Economics Letters, 87*, 301-306.

Leo, Z., Liu, C., & Picken, D. (2007). Granger Causality among House Price and Macroeconomic Variables in Victoria. *Pacific Rim Property Research Journal,13*(2), 234-256.

Lin, J. L. (2006). Teaching notes on impulse response function and structural VAR.

Lind, D. A., Marchal, W. G., & Wathen, S. A. (2012). Statistical technique in business and economics (4th ed.). *New York: McGraw –Hill*.

Ljung, G. M., & Box, G. E. P. (1978). On a measure of lack of fit in time series models. *Biometrika, 65*, 297-303.

Loganathan, V. (2007). Economic Theory. Retrieved from http://kushnirs.org/economics/general_theory_of_distribution.php

Longhi, S., & Taylor, M. (2013). Employment and unemployed job seekers and the business cycle. *Institution for Social and Economic Research.*

Lutkepohl, H. (1991). Vector autoregressive models for multivariate time series.

Määttänen, N., & Terviö, M. (2014). Income distribution and housing prices: an assignment model approach. *Journal of Economic Theory*, 151, 381-410.

Maclennan, D., Muellbauer, J., & Stephens, M. (2000). Asymmetries in Housing and Financial Market Institution and EMU.

Madsen, J. B. (2012). A behavioral model of house prices. *Journal of Economic Behavior & Organization 82,* 21–38.

Magee, L. (2013). *Unit Roots, Cointegration, VARs and VECMs*.

Mahalik, M. K., & Mallick, H. (n.d.). What Causes Asset Price Bubble in an Emerging Economy? Some Empirical Evidence in the Housing Sector of India. *International Economic Journal, 25*(2), 215-237.

Mallick, H., & Mahalik, M. K. (2015). Factors determining regional housing prices: evidence from major cities in India. *Journal of Property Research, 32*(2), 123-146.

Malpezzi, S. (1999). A simple error correction model of house prices. *Journal of housing economics, 8*(1), 27-62.

Mascarenhas, B. (2012). Cheap Malaysian Property Riddled With Risks, as Singapore Investors Find Out. Retrieved from http://www.cnbc.com/id/48204468

Masih, R., & Masih, M. (2001). Long and Short Term Dynamic Causal Transmission amongst International Stock Markets. *Journal of International Money and Finance 2,* 563- 587, 2001.

Mayer, C., & Hubbard, R. G. (2008). House prices, interest rates, and the mortgage market meltdown. *Columbia Business School, New York.*

Mcquinn, K., & O'Reilly, G. (2005). A model of cross-country house prices. *Central Bank anf Financial Services Authority of Ireland (CBFSAI).*

McQuinn, K., & O'Reilly, G. (2008). Assessing the role of income and interest rates in determining house prices. *Economic modelling, 25*(3), 377-390.

Meidani, A. A. N., Zabihi, M., & Ashena, M. (2011). House prices, Economic Output, and Inflation Interactions in Iran. *Research in Applied Economics, 3*(1).

Ming, N. (2013). Impact of changing interest rates on house prices. *Atchison Consultants.*

Motu. (2006). Regional Housing Markets In New Zealand: House Price, Sales and Supply Responses. *Centre for Housing Research, Aotearoa New Zealand.*

Muellbauer, J., & Murphy, A. (1997). Booms and busts in the UK housing market. *The Economic Journal, 107*(445), 1701-1727.

Nakajima, M. (2011). Understanding house price dynamics. Retrieved from https://www.philadelphiafed.org/

Nanto, D. K. (1998). The 1997-98 Asian Financial Crisis. Congressional Research Service, the Library of Congress.

Onay, C., & Unal, G. (2012). Cointegration and Extreme Value Anayses of Bovespa and the Istanbul Stock Exchange. *Finance a uver-Czech Journal of Economics and Finance, 62*(1).

Ong, T. S. (2013). Factors Affecting the Price of Housing in Malaysia. *Journal of Emerging Issues in Economics, Finance and Banking, 1,* 5.

Ong, T. S., & Chang, Y. S. (2013). Macroeconomic determinants of Malaysian housing market. *Human and Social Science Research 1*, 2, 119-127.

Orsal, D. D. K. (2014). Do the global stochastic trends drive the real house prices in OECD countries? *Economic letters 123*, 1, 9-13.

Otrok, C., & Terrones, M. E. (2005). House price, interest rate and macroeconomic fluctuations: international evidence.

Ott, H. (2014). Will Euro Area House Prices Sharply Decrease? *Economic Modelling 42*, 116–127.

Ozkan, B. (2012). Predictability of Real Estate Price Index Returns in Emerging Markets.

Paciorek, A. (2013). Supply constraints and housing market dynamics. *Journal of Urban Economics 77*, 11–26.

Peseran, M. H., & Shin, Y. (1997). Generealized Impulse Response Analysis in Linear Multivariate Models.

Piana, V. (2002). Interest rates. Economics Web Institute. Retrieved from http://www.economicswebinstitute.org/glossary/interest.htm

Plakandaras, V., Gupta, R., Gogas, P., & Papadimitriou, T. (2015). Forecasting the U.S. Real House Price Index. *Economic Modelling 45,* 259–267.

Pour, M. S., Khani, P. N., Zamanian, G., & Barghandan, K. (2013). Specifying the Effective Determinants of House Price Volatilities in Iran. *Journal of Economics and Business*, *11*(2), 15-20.

PwC & Urban Land Institute (2014). Emerging trends in real estate: Asia Pacific 2014. Retrieved from http://www.pwc.com/sg/en/publications/assets/aprealestemerging_2014.pdf

PwC & Urban Land Institute (2015). Emerging trends in real estate: Asia Pacific 2015. Retrieved from http://uli.org/wp-content/uploads/ULI-Documents/Emerging-Trends-Asia-Pacific-2015.pdf

Ray, S. (2012). Testing granger causal relationship between macroeconomic variables and stock price behavior: Evidence from India. *Advances in Applied Economics and Finance, 3*(1), 470-481.

Rehda (2014). Overview of property market report 2013. Retrieved from rehda.com/wp-content/uploads/2014/06/may_feature_2014.pdf

Rogers, J. H. (2001). Price level convergence, relative prices, and inflation in Europe. *FRB International Finance Discussion Paper*.

Runkle, D. E. (1987). Vector Autoregressions and Reality. *Federal Reserve Bank of Minneapolis and Brown University.*

Rupert, P., & Wasmer, E. (2012). Housing and labor market: time to move and aggregate unemployment. *Journal of Monetary Economics 59*, 24-36.

Shiller, R. J. (2007). Understanding recent trends in house prices and home ownership. *National Bureau of Economic Research.*

Sims (1980). Vector Auto Regresssion. Retrieved from https://www2.bc.edu/~iacoviel/teach/0809/EC751_files/var.pdf

Sivitanides, P. (2015). Macroeconomic influences on Cyprus house prices. Retrieved from http://www.nup.ac.cy/wpcontent/uploads/2015/01/Macroeconomic-Influences-on-Cyprus-House-Prices-by-Petros-Sivitanides.pdf

Shi, S., Jou, J. B., & Tripe, D. (2013). Policy Rate, Mortgage Rate and Housing Prices: Evidence from New Zealand.

Sutton, G. D. (2002). Explaining changes in housing price. *BIS Quarterly Review.*

Tan, T. H. (2010). Base Lending Rate and Housing Prices: Their Impacts on Residential Housing Activities in Malaysia. *Journal of Global Business and Economics, 1*(1).

Triplett, J. E., & McDonald, R. J. (1977). Assessing the quality error in output measures: The case of refrigerators. *Review of Income and Wealth 23*, 137-56.

Tsatsaronis, K., & Zhu, H. B. (2004). What drives housing price dynamics: cross-country evidence. *BIS Quarterly Review.*

Tse, C. B., Rodgers, T., & Niklewski, J. (2014). The 2007 financial crisis and the UK residential housing market: Did the relationship between interest rates and house prices change? *Economic Modelling, 37*, 518-530.

Tse, R. Y. C., Ho, C. W., & Gansesan, S. (1999). Matching Housing Supply and Demand: An Empirical Study of Hong Kong's Market. *Journal of Construction Management and Economics, 17*, 625-633.

Tucker, W. R. (2000). Effective interest rate. *Bankakademie Micro Banking Competence Center.*

Tumbarello, P., & Wang, S. (2010). What Drives House Prices in Australia? A Cross-Country Approach. *International Monetary Funds.*

Valadez, R. M. (2010). The housing bubble and the U.S. GDP: a correlation perspective. *Journal of Case Research in Business and Economics, 3*, 10-490.

Valletta, R. (2013). House lock and structural unemployment. *Journal of Labour Economics 23*, 86-97.

Vanichvatana, P. S. (2007). Thailand real estate market cycles: case study of 1997 economic crisis. *GH Bank Housing Journal 1*, 1.

VPC Asia Pacific (2015). Malaysia market review 2H2014. Retrieved from http://www.vpcasiapacific.com

Wang et al. (2011). Impact of urban economic openness on real estate prices: evidence from thirty-five cities in China. *China Economic Review 22*, 42-54.

Wu, L., & Zheng, X. P. (n.d.). Determination of Urban Land and Housing Prices in Japan from 1990 to 2009. *The Ritsumeikan Economic Review 60, 5.*

Xu, X. E., & Chen, T. (2012). The effect of monetary policy on real estate price growth in China. *Pacific-Basin Finance Journal, 20*(1), 62-77.

Xue, J. Gao, & W. Guo, L. (2014). Informal employment and its effect on the income distribution in urban China. *China Economic Review 31*, 84-93.

Yiu, C. Y. (2007). Housing Price Gradient Changes between Macau and Hong Kong.

Zabel, J. E. (2012). Migration, housing market, and labor market responses to employment shocks. *Journal of Urban Economics 72*, 267-284.

Zainuddin, Z. (2010). An Empirical Analysis of Malaysian Housing Market: Switching and Non-Switching Models.

Zhang, Y. B., Hua, X. P., & Zhao, L. (2011). Monetary policy and housing prices; A case study of Chinese experience in 1999-2010. *BOFIT-Institute for Economies in Transition.*

Zhang, Y.B., Hua, X. P., & Zhao, L. (2012). Exploring determinants of housing prices: A case study of Chinese experience in 1999-2010. *Economic Modelling 29*, 2349–2361.

Zhu, H. (2006). The structure of housing financial markets and house price in Asia. *BIS Quarterly Review.*

APPENDICES

Appendix 4.1: Descriptive Statistic of Common Sample

	LNHPI	LNCPI	LNEMPT	LNEXG	LNGDP	LNHI	BLR
Mean	4.799409	4.490239	9.243579	4.542475	4.381931	9.860644	6.938684
Median	4.759176	4.473722	9.222164	4.504906	4.385005	9.915430	6.530000
Maximum	5.364105	4.715519	9.524092	4.863295	4.862135	10.84091	12.27000
Minimum	4.424467	4.256085	9.007747	4.375254	3.947390	8.413795	5.510000
Std. Dev.	0.255706	0.129756	0.143155	0.126001	0.258675	0.713558	1.335329
Skewness	0.642503	0.024106	0.388597	1.105110	0.068864	-0.240623	2.163681
Kurtosis	2.521559	1.854867	2.206425	3.498325	1.764676	1.595678	7.721763
Jarque-Bera	5.953805	4.159901	3.907011	16.25577	4.892481	6.978440	129.9002
Probability	0.050950	0.124936	0.141776	0.000295	0.086619	0.030525	0.000000
Sum	364.7551	341.2582	702.5120	345.2281	333.0267	749.4090	527.3400
Sum Sq. Dev.	4.903910	1.262747	1.537006	1.190719	5.018468	38.18742	133.7327
Observations	76	76	76	76	76	76	76

**Appendix 4.2: Augmented Dickey-Fuller unit root tests results
(without trend, level)**

1. HPI
Null Hypothesis: LNHPI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		3.312504	1.0000
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

*MacKinnon (1996) one-sided p-values.

2. CPI
Null Hypothesis: LNCPI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.501577	0.8843

Test critical values:	1% level	-3.520307
	5% level	-2.900670
	10% level	-2.587691

*MacKinnon (1996) one-sided p-values.

3. EMPT
Null Hypothesis: LNEMPT has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	0.735992	0.9922
Test critical values: 1% level	-3.521579	
5% level	-2.901217	
10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

4. EXG
Null Hypothesis: LNEXG has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.442038	0.1340
Test critical values: 1% level	-3.520307	
5% level	-2.900670	
10% level	-2.587691	

*MacKinnon (1996) one-sided p-values.

5. BLR
Null Hypothesis: BLR has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.367327	0.1545
Test critical values: 1% level	-3.524233	
5% level	-2.902358	
10% level	-2.588587	

*MacKinnon (1996) one-sided p-values.

6. GDP
Null Hypothesis: LNGDP has a unit root
Exogenous: Constant

Lag Length: 5 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	0.954199	0.9957
Test critical values: 1% level	-3.527045	
5% level	-2.903566	
10% level	-2.589227	

*MacKinnon (1996) one-sided p-values.

7. HI
Null Hypothesis: LNHI has a unit root
Exogenous: Constant
Lag Length: 7 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.605733	0.8618
Test critical values: 1% level	-3.530030	
5% level	-2.904848	
10% level	-2.589907	

*MacKinnon (1996) one-sided p-values.

**Appendix 4.3: Phillips-Perron unit root tests results
(without trend, level)**

1. HPI
Null Hypothesis: LNHPI has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	3.383896	1.0000
Test critical values: 1% level	-3.520307	
5% level	-2.900670	
10% level	-2.587691	

*MacKinnon (1996) one-sided p-values.

2.CPI
Null Hypothesis: LNCPI has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-0.501392	0.8843
Test critical values: 1% level	-3.520307	

5% level	-2.900670	
10% level	-2.587691	

*MacKinnon (1996) one-sided p-values.

3. EMPT
Null Hypothesis: LNEMPT has a unit root
Exogenous: Constant
Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.719925	0.9919
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

*MacKinnon (1996) one-sided p-values.

4. EXG
Null Hypothesis: LNEXG has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.568556	0.1040
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

*MacKinnon (1996) one-sided p-values.

5. BLR
Null Hypothesis: BLR has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.021466	0.2772
Test critical values:	1% level	-3.520307	
	5% level	-2.900670	
	10% level	-2.587691	

*MacKinnon (1996) one-sided p-values.

6. GDP
Null Hypothesis: LNGDP has a unit root
Exogenous: Constant
Bandwidth: 22 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	0.332375	0.9786
Test critical values: 1% level	-3.520307	
5% level	-2.900670	
10% level	-2.587691	

*MacKinnon (1996) one-sided p-values.

7. HI
Null Hypothesis: LNHI has a unit root
Exogenous: Constant
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-1.919259	0.3219
Test critical values: 1% level	-3.520307	
5% level	-2.900670	
10% level	-2.587691	

*MacKinnon (1996) one-sided p-values.

**Appendix 4.4: Augmented Dickey-Fuller unit root tests results
(with trend, level)**

1. HPI
Null Hypothesis: LNHPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	0.703950	0.9996
Test critical values: 1% level	-4.085092	
5% level	-3.470851	
10% level	-3.162458	

*MacKinnon (1996) one-sided p-values.

2. CPI
Null Hypothesis: LNCPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.052858	0.1254
Test critical values: 1% level	-4.086877	
5% level	-3.471693	

	t-Statistic	Prob.*
10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

3. EMPT
Null Hypothesis: LNEMPT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.631275	0.7710
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

4. EXG
Null Hypothesis: LNEXG has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.676733	0.2491
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

*MacKinnon (1996) one-sided p-values.

5. BLR
Null Hypothesis: BLR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.354213	0.4000
Test critical values:	1% level	-4.090602	
	5% level	-3.473447	
	10% level	-3.163967	

*MacKinnon (1996) one-sided p-values.

6.GDP
Null Hypothesis: LNGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.996919	0.0131
Test critical values: 1% level	-4.094550	
5% level	-3.475305	
10% level	-3.165046	

*MacKinnon (1996) one-sided p-values.

7. HI
Null Hypothesis: LNHI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.478780	0.0001
Test critical values: 1% level	-4.085092	
5% level	-3.470851	
10% level	-3.162458	

*MacKinnon (1996) one-sided p-values.

**Appendix 4.5: Phillips-Perron unit root tests results
(with trend, level)**

1. HPI
Null Hypothesis: LNHPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	0.691937	0.9996
Test critical values: 1% level	-4.085092	
5% level	-3.470851	
10% level	-3.162458	

*MacKinnon (1996) one-sided p-values.

2. CPI
Null Hypothesis: LNCPI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.610595	0.2770
Test critical values: 1% level	-4.085092	
5% level	-3.470851	
10% level	-3.162458	

*MacKinnon (1996) one-sided p-values.

3. EMPT
Null Hypothesis: LNEMPT has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.553083	0.3027
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

*MacKinnon (1996) one-sided p-values.

4. EXG
Null Hypothesis: LNEXG has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.684838	0.2458
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

*MacKinnon (1996) one-sided p-values.

5. BLR
Null Hypothesis: BLR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.850385	0.6701
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

*MacKinnon (1996) one-sided p-values.

6. GDP
Null Hypothesis: LNGDP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.011386	0.0123

Test critical values:	1% level	-4.085092
	5% level	-3.470851
	10% level	-3.162458

*MacKinnon (1996) one-sided p-values.

7. HI
Null Hypothesis: LNHI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.526445	0.0001
Test critical values:	1% level	-4.085092	
	5% level	-3.470851	
	10% level	-3.162458	

*MacKinnon (1996) one-sided p-values.

Appendix 4.6: Augmented Dickey-Fuller unit root tests results (without trend, first difference)

1. HPI
Null Hypothesis: D(LNHPI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.047141	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

2. CPI
Null Hypothesis: D(LNCPI) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.720632	0.0000
Test critical values:	1% level	-3.522887	
	5% level	-2.901779	
	10% level	-2.588280	

*MacKinnon (1996) one-sided p-values.

3. EMPT
Null Hypothesis: D(LNEMPT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.39477	0.0001
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

4. EXG
Null Hypothesis: D(LNEXG) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.342187	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

5. BLR
Null Hypothesis: D(BLR) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.509347	0.0005
Test critical values:	1% level	-3.524233	
	5% level	-2.902358	
	10% level	-2.588587	

*MacKinnon (1996) one-sided p-values.

6. GDP
Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.300734	0.0000
Test critical values:	1% level	-3.527045	

5% level	-2.903566
10% level	-2.589227

*MacKinnon (1996) one-sided p-values.

7. HI
Null Hypothesis: D(LNHI) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=11)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-8.864258	0.0000
Test critical values: 1% level	-3.524233	
5% level	-2.902358	
10% level	-2.588587	

*MacKinnon (1996) one-sided p-values.

Appendix 4.7: Phillips-Perron unit root tests results
(without trend, first difference)

1. HPI
Null Hypothesis: D(LNHPI) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-7.103084	0.0000
Test critical values: 1% level	-3.521579	
5% level	-2.901217	
10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

2. CPI
Null Hypothesis: D(LNCPI) has a unit root
Exogenous: Constant
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-6.345125	0.0000
Test critical values: 1% level	-3.521579	
5% level	-2.901217	
10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

3. EMPT
Null Hypothesis: D(LNEMPT) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-13.28386	0.0001
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

4. EXG
Null Hypothesis: D(LNEXG) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.378710	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

5. BLR
Null Hypothesis: D(BLR) has a unit root
Exogenous: Constant
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.410939	0.0000
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

6. GDP
Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant
Bandwidth: 21 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.86601	0.0001
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	

	Adj. t-Stat	Prob.*
10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

7. HI
Null Hypothesis: D(LNHI) has a unit root
Exogenous: Constant
Bandwidth: 23 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-22.76823	0.0001
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

Appendix 4.8: Augmented Dickey-Fuller unit root tests results (with trend, first difference)

1. HPI
Null Hypothesis: D(LNHPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.893513	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

2. CPI
Null Hypothesis: D(LNCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.674814	0.0000
Test critical values:	1% level	-4.088713	
	5% level	-3.472558	
	10% level	-3.163450	

*MacKinnon (1996) one-sided p-values.

3. EMPT

Null Hypothesis: D(LNEMPT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.44837	0.0001
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

4. EXG

Null Hypothesis: D(LNEXG) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.454898	0.0001
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

5. BLR

Null Hypothesis: D(BLR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.568441	0.0024
Test critical values:	1% level	-4.090602	
	5% level	-3.473447	
	10% level	-3.163967	

*MacKinnon (1996) one-sided p-values.

6. GDP

Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.477281	0.0001
Test critical values:	1% level	-4.094550	
	5% level	-3.475305	
	10% level	-3.165046	

*MacKinnon (1996) one-sided p-values.

7. HI
Null Hypothesis: D(LNHI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.013626	0.0000
Test critical values:	1% level	-4.098741	
	5% level	-3.477275	
	10% level	-3.166190	

*MacKinnon (1996) one-sided p-values.

Appendix 4.9: Phillips-Perron unit root tests results (with trend, first difference)

1. HPI
Null Hypothesis: D(LNHPI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.893513	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

2. CPI
Null Hypothesis: D(LNCPI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.276953	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

3. EMPT
Null Hypothesis: D(LNEMPT) has a unit root

Exogenous: Constant, Linear Trend
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-14.68545	0.0001
Test critical values: 1% level	-4.086877	
5% level	-3.471693	
10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

4. EXG
Null Hypothesis: D(LNEXG) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-5.433742	0.0001
Test critical values: 1% level	-4.086877	
5% level	-3.471693	
10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

5. BLR
Null Hypothesis: D(BLR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-6.410577	0.0000
Test critical values: 1% level	-4.086877	
5% level	-3.471693	
10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

6. GDP
Null Hypothesis: D(LNGDP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 20 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-13.06865	0.0001
Test critical values: 1% level	-4.086877	
5% level	-3.471693	
10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

7. HI
Null Hypothesis: D(LNHI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 23 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-22.88832	0.0001
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

Appendix 4.10: Ljung-Box Q statistics

1. Correlogram of resid01

Included observations: 74

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.025	-0.025	0.0490	0.825
		2	0.055	0.055	0.2890	0.865
		3	0.051	0.054	0.4952	0.920
		4	0.307	0.308	8.0461	0.090
		5	0.065	0.090	8.3940	0.136
		6	0.027	0.004	8.4534	0.207
		7	0.152	0.127	10.398	0.167
		8	0.137	0.058	11.991	0.152
		9	0.117	0.084	13.181	0.155
		10	0.007	-0.010	13.186	0.213
		11	0.129	0.039	14.679	0.198
		12	-0.042	-0.127	14.839	0.250
		13	0.080	-0.011	15.430	0.281
		14	-0.084	-0.133	16.085	0.308
		15	0.044	-0.055	16.270	0.364
		16	0.067	0.075	16.706	0.405
		17	-0.065	-0.102	17.129	0.446
		18	-0.061	-0.060	17.500	0.489
		19	0.049	0.068	17.744	0.540
		20	0.003	-0.030	17.745	0.604
		21	-0.064	0.014	18.184	0.637
		22	-0.094	-0.050	19.138	0.637
		23	0.036	0.033	19.277	0.685
		24	0.048	0.076	19.538	0.723
		25	-0.044	0.039	19.763	0.759
		26	-0.016	0.033	19.794	0.801
		27	-0.025	-0.030	19.866	0.836
		28	-0.084	-0.117	20.734	0.836
		29	0.015	0.017	20.763	0.868
		30	0.023	0.050	20.829	0.893
		31	-0.025	-0.012	20.908	0.914
		32	-0.082	-0.085	21.817	0.912

2. Correlogram of resid02

Date: 06/25/15   Time: 02:55
Sample: 1996Q1 2014Q4
Included observations: 74

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.048	0.048	0.1779	0.673
		2	-0.231	-0.234	4.3466	0.114
		3	-0.093	-0.072	5.0246	0.170
		4	0.067	0.022	5.3802	0.250
		5	-0.071	-0.120	5.7864	0.328
		6	-0.020	0.002	5.8186	0.444
		7	-0.095	-0.140	6.5826	0.474
		8	0.029	0.018	6.6564	0.574
		9	0.038	-0.011	6.7810	0.660
		10	0.016	-0.008	6.8034	0.744
		11	0.053	0.080	7.0513	0.795
		12	0.066	0.043	7.4499	0.827
		13	0.005	0.040	7.4519	0.877
		14	-0.046	-0.019	7.6543	0.907
		15	0.001	0.029	7.6545	0.937
		16	-0.071	-0.077	8.1430	0.944
		17	-0.082	-0.071	8.8004	0.946
		18	-0.098	-0.117	9.7564	0.940
		19	-0.112	-0.179	11.040	0.922
		20	-0.061	-0.135	11.427	0.934
		21	0.016	-0.122	11.456	0.953
		22	0.082	-0.014	12.182	0.954
		23	-0.086	-0.203	13.003	0.952
		24	-0.093	-0.163	13.980	0.947
		25	0.103	-0.001	15.195	0.937
		26	0.086	-0.053	16.054	0.935
		27	-0.064	-0.050	16.551	0.942
		28	-0.083	-0.078	17.398	0.940
		29	0.015	0.011	17.424	0.955
		30	0.065	0.039	17.962	0.959
		31	0.005	0.019	17.965	0.970
		32	-0.068	-0.017	18.588	0.972

3. Correlogram of resid03

Date: 06/25/15   Time: 02:57
Sample: 1996Q1 2014Q4
Included observations: 74

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.074	-0.074	0.4181	0.518
		2	-0.219	-0.226	4.1775	0.124
		3	0.076	0.042	4.6371	0.200
		4	0.200	0.171	7.8569	0.097
		5	-0.088	-0.035	8.4907	0.131
		6	-0.147	-0.095	10.276	0.114
		7	0.061	-0.005	10.593	0.157
		8	0.148	0.095	12.471	0.131
		9	-0.070	-0.004	12.895	0.167
		10	-0.112	-0.052	14.002	0.173
		11	-0.075	-0.156	14.503	0.206
		12	0.240	0.175	19.722	0.073
		13	0.062	0.123	20.073	0.093
		14	-0.169	-0.044	22.757	0.064
		15	-0.002	-0.028	22.757	0.089
		16	0.124	-0.024	24.244	0.084
		17	-0.024	0.002	24.301	0.111
		18	-0.207	-0.103	28.592	0.054
		19	0.067	0.038	29.046	0.065
		20	0.077	-0.065	29.663	0.076
		21	-0.088	-0.051	30.478	0.083
		22	-0.150	-0.087	32.909	0.063
		23	0.074	0.054	33.514	0.073
		24	-0.064	-0.164	33.974	0.085
		25	-0.079	-0.101	34.698	0.094
		26	-0.123	-0.133	36.475	0.083
		27	0.061	0.009	36.927	0.096
		28	0.058	0.047	37.343	0.111
		29	0.087	0.150	38.298	0.116
		30	-0.097	-0.003	39.492	0.115
		31	-0.109	-0.188	41.044	0.107
		32	0.064	-0.046	41.594	0.119

4. Correlogram of resid04

Date: 06/25/15   Time: 03:00
Sample: 1996Q1 2014Q4
Included observations: 74

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.032	0.032	0.0810	0.776
		2	-0.032	-0.033	0.1608	0.923
		3	-0.049	-0.047	0.3529	0.950
		4	-0.027	-0.025	0.4108	0.982
		5	0.084	0.083	0.9838	0.964
		6	-0.062	-0.072	1.3056	0.971
		7	0.152	0.162	3.2363	0.862
		8	-0.088	-0.103	3.8891	0.867
		9	0.061	0.086	4.2109	0.897
		10	-0.022	-0.040	4.2530	0.935
		11	-0.028	-0.003	4.3226	0.960
		12	0.034	-0.000	4.4283	0.974
		13	0.012	0.053	4.4426	0.986
		14	0.034	-0.026	4.5485	0.991
		15	-0.031	0.021	4.6393	0.995
		16	0.054	0.025	4.9239	0.996
		17	0.036	0.053	5.0501	0.998
		18	-0.023	-0.037	5.1049	0.999
		19	0.020	0.034	5.1472	0.999
		20	0.018	0.013	5.1796	1.000
		21	-0.031	-0.039	5.2802	1.000
		22	-0.007	-0.001	5.2849	1.000
		23	0.006	0.002	5.2883	1.000
		24	0.038	0.027	5.4467	1.000
		25	-0.020	-0.020	5.4944	1.000
		26	0.018	0.019	5.5334	1.000
		27	-0.005	-0.010	5.5368	1.000
		28	-0.036	-0.021	5.6920	1.000
		29	0.038	0.022	5.8681	1.000
		30	-0.018	-0.013	5.9113	1.000
		31	-0.047	-0.066	6.2040	1.000
		32	-0.003	0.019	6.2052	1.000

5. Correlogram of resid05

Date: 06/25/15   Time: 03:01
Sample: 1996Q1 2014Q4
Included observations: 74

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.074	0.074	0.4242	0.515
		2	0.002	-0.004	0.4244	0.809
		3	0.198	0.200	3.5404	0.316
		4	0.002	-0.029	3.5406	0.472
		5	-0.179	-0.182	6.1515	0.292
		6	-0.120	-0.143	7.3444	0.290
		7	-0.126	-0.115	8.6672	0.277
		8	-0.237	-0.169	13.451	0.097
		9	-0.089	-0.026	14.144	0.117
		10	-0.181	-0.186	17.027	0.074
		11	-0.080	-0.047	17.602	0.091
		12	0.044	0.004	17.780	0.123
		13	0.036	0.002	17.898	0.161
		14	0.091	0.040	18.680	0.178
		15	0.131	0.010	20.322	0.160
		16	0.145	0.035	22.352	0.132
		17	0.049	-0.035	22.584	0.163
		18	0.162	0.091	25.213	0.119
		19	0.166	0.151	28.040	0.083
		20	-0.062	-0.045	28.434	0.100
		21	-0.016	0.003	28.463	0.128
		22	-0.069	-0.071	28.971	0.146
		23	-0.002	0.135	28.971	0.181
		24	0.009	0.178	28.980	0.221
		25	-0.021	0.105	29.032	0.263
		26	-0.082	-0.014	29.826	0.275
		27	-0.075	-0.087	30.504	0.292
		28	-0.051	-0.051	30.823	0.325
		29	-0.104	-0.017	32.180	0.312
		30	-0.069	-0.068	32.797	0.331
		31	-0.045	-0.069	33.058	0.367
		32	-0.059	-0.141	33.522	0.393

Appendix 4.11: Johansen & Juselius Cointegration test result

Date: 06/25/15   Time: 03:03
Sample (adjusted): 1996Q3 2014Q4
Included observations: 74 after adjustments
Trend assumption: Linear deterministic trend
Series: LNHPI LNCPI LNEMPT LNEXG
BLR
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**

None *	0.622484	126.7411	69.81889	0.0000
At most 1 *	0.340435	54.65453	47.85613	0.0101
At most 2	0.162021	23.85761	29.79707	0.2065
At most 3	0.126306	10.77719	15.49471	0.2256
At most 4	0.010556	0.785324	3.841466	0.3755

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.622484	72.08653	33.87687	0.0000
At most 1 *	0.340435	30.79692	27.58434	0.0187
At most 2	0.162021	13.08042	21.13162	0.4449
At most 3	0.126306	9.991865	14.26460	0.2125
At most 4	0.010556	0.785324	3.841466	0.3755

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendix 4.12: Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 06/25/15   Time: 02:51
Sample (adjusted): 1996Q3 2014Q4
Included observations: 74 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNHPI(-1)	1.000000
LNCPI(-1)	-0.117618
	(0.22499)
	[-0.52277]
LNEMPT(-1)	-2.118768
	(0.20953)
	[-10.1118]
LNEXG(-1)	0.386133
	(0.05623)
	[6.86650]
BLR(-1)	-0.076588
	(0.00682)

				[-11.2379]	
C		14.09250			

Error Correction:	D(LNHPI)	D(LNCPI)	D(LNEMPT)	D(LNEXG)	D(BLR)
CointEq1	-0.049347	0.001681	0.100444	-0.054290	5.424964
	(0.02456)	(0.01371)	(0.03044)	(0.07242)	(0.66867)
	[-2.00959]	[0.12262]	[3.29980]	[-0.74964]	[8.11306]
D(LNHPI(-1))	0.163383	0.068696	0.185247	-0.292833	5.109244
	(0.11551)	(0.06448)	(0.14319)	(0.34067)	(3.14544)
	[1.41445]	[1.06533]	[1.29373]	[-0.85957]	[1.62433]
D(LNCPI(-1))	-0.397410	0.213537	-0.006802	-0.339948	5.733347
	(0.22796)	(0.12726)	(0.28259)	(0.67233)	(6.20766)
	[-1.74330]	[1.67796]	[-0.02407]	[-0.50563]	[0.92359]
D(LNEMPT(-1))	0.076548	-0.010501	-0.284877	-0.023781	6.611590
	(0.08652)	(0.04830)	(0.10725)	(0.25517)	(2.35598)
	[0.88476]	[-0.21743]	[-2.65620]	[-0.09320]	[2.80630]
D(LNEXG(-1))	0.040975	-0.022351	-0.057573	0.437597	-7.861259
	(0.04147)	(0.02315)	(0.05141)	(0.12232)	(1.12935)
	[0.98798]	[-0.96538]	[-1.11987]	[3.57759]	[-6.96088]
D(BLR(-1))	-0.000913	0.001286	0.001519	-0.014790	0.338727
	(0.00313)	(0.00175)	(0.00388)	(0.00924)	(0.08533)
	[-0.29127]	[0.73538]	[0.39101]	[-1.60033]	[3.96957]
C	0.012445	0.003962	0.006112	0.002924	-0.190055
	(0.00258)	(0.00144)	(0.00320)	(0.00762)	(0.07036)
	[4.81674]	[2.74688]	[1.90821]	[0.38370]	[-2.70122]
R-squared	0.125827	0.098665	0.277572	0.224787	0.586812
Adj. R-squared	0.047542	0.017948	0.212877	0.155365	0.549810
Sum sq. resids	0.010101	0.003148	0.015522	0.087862	7.490152
S.E. equation	0.012278	0.006854	0.015221	0.036213	0.334355
F-statistic	1.607305	1.222362	4.290462	3.237984	15.85897
Log likelihood	224.2684	267.4073	208.3730	144.2326	-20.25384
Akaike AIC	-5.872118	-7.038035	-5.442514	-3.708988	0.736590
Schwarz SC	-5.654166	-6.820082	-5.224561	-3.491036	0.954542
Mean dependent	0.012536	0.006094	0.006591	-0.003997	-0.028919
S.D. dependent	0.012581	0.006917	0.017156	0.039403	0.498322

Determinant resid covariance (dof adj.)	1.89E-16
Determinant resid covariance	1.15E-16
Log likelihood	832.9559
Akaike information criterion	-21.43124
Schwarz criterion	-20.18580

Appendix 4.13: VEC Granger Causality/ Block Exogeneity Wald Tests

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 06/25/15   Time: 03:08
Sample: 1996Q1 2014Q4
Included observations: 74

Dependent variable: D(LNHPI)

Excluded	Chi-sq	df	Prob.
D(LNCPI)	3.039110	1	0.0813
D(LNEMPT)	0.782804	1	0.3763
D(LNEXG)	0.976109	1	0.3232
D(BLR)	0.084836	1	0.7708
All	5.517766	4	0.2382

Dependent variable: D(LNCPI)

Excluded	Chi-sq	df	Prob.
D(LNHPI)	1.134934	1	0.2867
D(LNEMPT)	0.047275	1	0.8279
D(LNEXG)	0.931968	1	0.3344
D(BLR)	0.540783	1	0.4621
All	2.632842	4	0.6210

Dependent variable: D(LNEMPT)

Excluded	Chi-sq	df	Prob.
D(LNHPI)	1.673736	1	0.1958
D(LNCPI)	0.000579	1	0.9808
D(LNEXG)	1.254118	1	0.2628
D(BLR)	0.152889	1	0.6958
All	3.022041	4	0.5541

Dependent variable: D(LNEXG)

Excluded	Chi-sq	df	Prob.
D(LNHPI)	0.738867	1	0.3900
D(LNCPI)	0.255658	1	0.6131

D(LNEMPT)	0.008686	1	0.9257
D(BLR)	2.561042	1	0.1095
All	4.098182	4	0.3929

Dependent variable: D(BLR)

Excluded	Chi-sq	df	Prob.
D(LNHPI)	2.638452	1	0.1043
D(LNCPI)	0.853023	1	0.3557
D(LNEMPT)	7.875315	1	0.0050
D(LNEXG)	48.45379	1	0.0000
All	53.63876	4	0.0000

Appendix 4.14: Inverse Roots of AR Characteristics Polynomial

Inverse Roots of AR Characteristic Polynomial
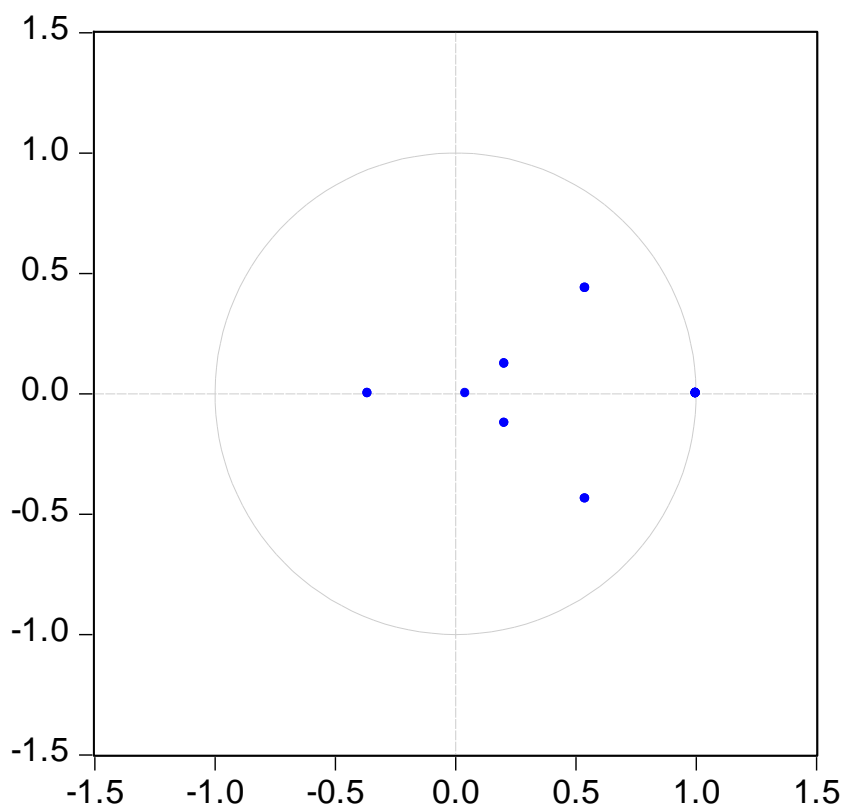
Roots of Characteristic Polynomial
Endogenous variables: LNHPI LNCPI LNEMPT LNEXG
BLR
Exogenous variables:

Lag specification: 1 1
Date: 06/25/15   Time: 03:09

Root	Modulus
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
0.539600 - 0.437192i	0.694482
0.539600 + 0.437192i	0.694482
-0.363460	0.363460
0.205641 - 0.123823i	0.240042
0.205641 + 0.123823i	0.240042
0.042532	0.042532

VEC specification imposes 4 unit root(s).

Appendix 4.15: Variance Decompositions

LNHPI:

Period	S.E.	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	0.012278	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.019247	96.21052	1.286979	2.056993	0.241130	0.204379
3	0.024571	94.49776	1.990245	2.840958	0.171990	0.499048
4	0.029074	93.50090	2.171721	3.363149	0.151112	0.813118
5	0.033106	92.97563	2.168472	3.531832	0.268327	1.055740
6	0.036797	92.66954	2.140732	3.549711	0.434643	1.205378
7	0.040186	92.50811	2.137475	3.506468	0.566400	1.281546
8	0.043305	92.42412	2.160365	3.459461	0.640803	1.315253
9	0.046192	92.37387	2.196318	3.426736	0.673134	1.329944
10	0.048891	92.33414	2.232725	3.410252	0.684007	1.338877

LNCPI:

Period	S.E.	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	0.006854	0.019613	99.98039	0.000000	0.000000	0.000000
2	0.010954	0.470036	98.91815	0.080444	0.428461	0.102909
3	0.014168	1.072402	97.50032	0.094438	1.137696	0.195143
4	0.016823	1.586397	96.27118	0.150931	1.767767	0.223723
5	0.019074	1.948559	95.50149	0.207566	2.125499	0.216886
6	0.021034	2.177362	95.10435	0.255474	2.263747	0.199066
7	0.022788	2.310660	94.93997	0.286603	2.280995	0.181776
8	0.024401	2.386590	94.88797	0.304347	2.252839	0.168259
9	0.025913	2.433027	94.87538	0.313639	2.219180	0.158772
10	0.027347	2.466721	94.86607	0.318878	2.195822	0.152506

LNEM

PT:

Period	S.E.	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	0.015221	2.837572	0.465611	96.69682	0.000000	0.000000
2	0.017692	8.520595	0.376693	89.65250	0.328198	1.122011
3	0.020843	9.601945	0.911142	85.86667	0.968608	2.651639
4	0.023599	9.303304	1.723147	81.70291	3.078627	4.192008
5	0.026467	8.290234	2.278905	78.64487	5.752878	5.033112
6	0.029101	7.435046	2.537028	76.89005	7.739820	5.398059
7	0.031488	6.834397	2.610142	76.17131	8.884381	5.499765
8	0.033628	6.468490	2.610066	75.96914	9.438181	5.514125
9	0.035584	6.257029	2.593932	75.94276	9.690533	5.515748
10	0.037410	6.130101	2.585549	75.92267	9.829215	5.532467

LNEXG:

Period	S.E.	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	0.036213	0.079713	0.136698	1.182673	98.60092	0.000000
2	0.062816	0.263289	0.772328	1.663378	97.03707	0.263936
3	0.086553	0.775524	0.979245	2.068014	95.86015	0.317069
4	0.106435	1.218045	0.928306	2.586596	95.01032	0.256735
5	0.122404	1.480045	0.813148	3.038133	94.47159	0.197083
6	0.135339	1.596147	0.709730	3.384133	94.14757	0.162423
7	0.146271	1.628194	0.632169	3.617441	93.97932	0.142873
8	0.156042	1.623552	0.576717	3.763417	93.90799	0.128329
9	0.165191	1.609135	0.538020	3.852057	93.88526	0.115529
10	0.173985	1.597370	0.511101	3.909064	93.87812	0.104349

BLR:

Period	S.E.	LNHPI	LNCPI	LNEMPT	LNEXG	BLR
1	0.334355	2.049869	12.71339	0.144876	2.679573	82.41229
2	0.521720	9.627112	13.22947	4.308163	10.13610	62.69915
3	0.657169	15.89861	10.28993	13.22362	12.30023	48.28763
4	0.734426	19.29024	8.310247	21.01160	10.11463	41.27327
5	0.791889	19.80509	7.271106	26.44624	10.04876	36.42880
6	0.845847	18.74560	6.629158	28.96689	13.09194	32.56641
7	0.895775	17.44177	6.070310	29.94474	16.74187	29.80131
8	0.939171	16.45064	5.571747	30.51514	19.34483	28.11764
9	0.977275	15.82873	5.152760	31.13434	20.73534	27.14882
10	1.012494	15.48263	4.800799	31.87026	21.34167	26.50465

Cholesky
Ordering:
LNHPI
LNCPI
LNEMPT
LNEXG
BLR

Appendix 4.16: Generalized Impulse Response Functions

Generalized impulses- dof adjusted- multiple graphs- analytic (asymptotic)

Response to Generalized One S.D. Innovations ?2 S.E.