M01

FUNDAMENTAL DETERMINANTS OF HOUSING PRICE IN MALAYSIA (EMPIRICAL AND STATISTICAL INVESTIGATION)

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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 13, 351 words.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
AIC	Akaike Info Criterion
ARCH	Autoregressive Conditional Heteroscedasticity
ARDL	Auto Regression Distributed Lag
CCR	Canonical Cointegrating Regression
CPI	Consumer Price Index
DF	Dickey Fuller
DOLS	Dynamic Ordinary Least Square
ECM	Error Correction Model
ERS	Elliott-Rothenberg-Stock Point-Optimal
FMOLS	Fully Modified Ordinary Least Square
HPI	House Price Index
IMF	International Monetary Fund
KPSS	Kwiatkowski-Philips-Schmidt-Shin
LR	Lending Rate
PP	Philips Perron
Q1, Q2, Q3, Q4	Quarter 1,2,3,4
RGDP	Real Gross Domestic Product
UECM	Unrestricted Error Correction Model
UK	United Kingdom
UNEM	Unemployment Rate
US	United State
USA	United State of America
VAR	Vector Auto Regressive

ABSTRACT

We examine how the fundamental variables affect housing price in Malaysia. In this paper we employed Cointegrating Regression- Fully-modified OLS (FMOLS), Dynamic OLS (DOLS) and Canonical Cointegrating Regression (CCR), Error Correction Model (ECM), and Granger Causality Test, to investigate the long run and short run relationship between lending rate (LR), real gross domestic product (RGDP) and unemployment rate (UNEM) with housing price in Malaysia over period 2000Q1 to 2014Q4. In short run, ECM showed unemployment have a negative relationship and real gross domestic product have a positive relationship with Malaysia housing Price. However, lending rate found no significant influence on Malaysian housing price in the short run. ECM result also showed that the model can get back to the long run equilibrium by speed of adjustment 28.36 percent. FMOLS, DOLS and CCR result showed the lending rate and unemployment rate have a negative relationship with Malaysia housing price in long run while real gross domestic product have a positive relationship. Among these three variables, unemployment have the highest impact on Malaysian house price. Using this long run regression results, we have computed the overvaluation of house price and found that the overvaluation is significant over the period from 2011 to 2013. Through those robust results, we strongly believe that the three variables: LR, RGDP and UNEM are real fundamental determinants of house prices.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

The reason we choose the fundamental determinants of housing price in Malaysia as our topic is that we notice the Malaysian house prices keep on rising without basing on fundamentals. Most house buyers use bank loans to purchase their house. This increased households' debt burden has weakened households home purchase power especially for younger households. The consequences are many young households not able to afford to buy house. As such we attempt to find a possible solution to this affordability of housing problem. One way is to find out which cluster of determinants would affect the house prices the most.

This chapter begin with the background of the study (1.1). In the section background of the study we describe the present/past property market situation in Malaysia (1.1.1), fundamental determinants of Malaysia house prices (1.1.2) and also some possible factors which could affect housing demand and supply which further effect on house prices (1.1.3). In 1.1.4, we had discuss the overvaluation. The next section problem statement (1.2), problems which caused by soaring property price was pointed out in this part and followed by research objective (1.3) which consist of both general objectives and specific objectives. Research question (1.4) and significance of study (1.5) are discussed in this chapter as well. The last section in this chapter will be the outline (1.6).

1.1 Background of the study

In this section, we discuss property market in Malaysia, fundamental determinants of housing price, general factors influencing house prices and lastly what constitute overvaluation of house price.

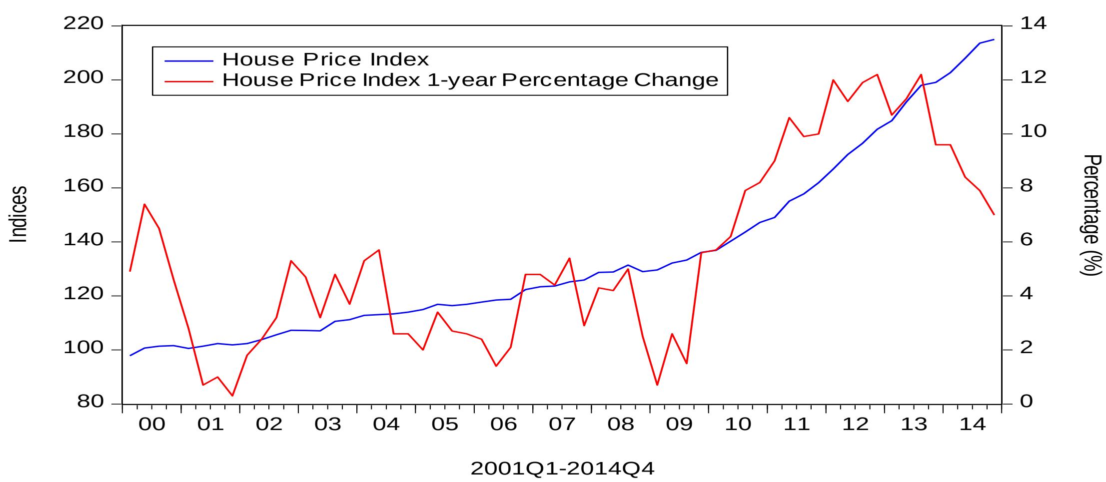
1.1.1 Property Market in Malaysia

Malaysia is a Southeast Asian country with land area 328,657 square kilometers (Central Intellingence Agency, n.d.), 29,947,600 population (Department of Statistics Malaysia, 2015). The economic performance of Malaysia was relatively strong. 2000-2014, Malaysia has averaged 5 percent annual percentage growth rate of gross domestic product (GDP), and around 2.3 percent for both inflation (CPI) and real interest rate.

Malaysia has been ranked as the 29th highest property price index (price to income ratio) among 40 Asia countries (Numbeo, 2015). The contribution of real estate and business services subsector to gross domestic product expanded by 5.75 percent during 2014 (2005: 4.65 percent) (Department of Statistics and Ministry of Finance, Malaysia, 2015). The "average" all house price in Malaysia keep on increasing and hit RM302, 716 in 2015Q1 (2000: RM138, 712) (Valuation Property Services Department and MOF Malaysia, 2015). A dramatically rising house price has captured a great deal of attention of government, individual as well as institution.

Based on Figure 1.1.1, growth rate of Malaysia house price index recorded as 4.9 percent in Q1 2000 and growth relatively stable with fluctuating around an average 3.28 percent of growth rate per annual from 2001 to 2008. However, due to the 2008 Global Financial Crisis, Malaysia's GDP has dropped to around 6.4 percent from 2008 to 2009. The economic downturn has caused many firms starting to retrench or reduce their labor working hours, that is indirectly affecting the housing market and the growth rate has dropped to around 4.3 percent within 3 quarters from 2008Q3(5.0 percent) to 2009Q1 (0.7 percent), then started to rise back. Over the period of Q1 2010 to Q2 2012, the house prices experienced a strong average increase of 9.1 percent annually. The growth rate was significantly rise since Q4 of 2009 as much as around 4.1 percent from 2009 Q3 which 1.5 percent to 5.6 percent. The reasons behind were that during that time Malaysia was recovering from the Global Financial Crisis. Consumer price index rose around 2.1 percent from Q3 2009 (-2.3 percent) to Q4 2009 (-0.2 percent) which represent the higher input cost and rent. This directly and indirectly resulted in the rising of the housing price. The growth rate of house price index continuously rise and hit the highest as recorded in 2000-2014 at 2012 Q4 and 2013 Q3 with 12.2 percent. After the growth rate hit the peak it started to fall to a level as recorded as 7.0 percent in Q4 of 2014.

Figure 1.1.1: Malaysia House Price Index and House Price 1-year Percentage Change from 2000Q1 – 2014Q4



Source: Jabatan Penilaian dan Perkhidmatan Harta

1.1.2 Fundamental Determinants of Housing Prices

Macroeconomic event exert high impact to all members of society which include, household, business man, policymaker, economist and so on so forth (Snowdon & Vane, 2002). In addition, gross domestic product (GDP) can be contributed by housing through private housing investment and consumption spending on housing services. Both GDP and housing always linked to each other to explain the economic growth. In United State, real estate industry plays an important role in the economy. It has been proven real estate industry contributed significantly to U.S economy. Growth in GDP can enhance the employment rate by providing millions jobs, hence generating hundreds of billions dollar in economic output each year. According to Lam (2015) as written in the magazine has mentioned that profit from housing market is one of the indicators showing that economy is healthy. Valadez (2010) discusses the relationship between real gross domestic product and housing prices and concluded that there is a relationship between the two variables. Meanwhile, some researchers such as Guo and Wu (2013), Ong (2013), Hu, Jin and Cheng (2011) and Meidani, Zabihi and Ashena (2011) also find that the relationship between the housing prices and gross domestic product are significant. Thus, real gross domestic product must be included in any analysis of housing price determinants.

Unemployment has become a very important issue for every country especially for developing country with a tremendous large population. A country with a high unemployment rate means that the labor resources of the country are not being used efficiently. In consequences, full employment should be a major macroeconomic goal of government. According to Mahon (2015) unemployment rate is an important indicator to determine the economy condition and it will affect the housing prices. Based on the economic theory, when the unemployment rate is high, the household income will fall and lead to a low affordability in consumption. Therefore, the demand of house will decrease and lead to a fall in house price. From the review, we found that there are many researchers using unemployment rate as the determinant of housing price in their study including Pinter (2015), Jacobsen and Naug (2005) and Vermeulan and Ommeren (2009), Zhu (2010), Geerolf and Grjebine (2014). At the same time, these researchers also found that unemployment is significant determinants of house price.

In general, lending rate that is charged by financial institutions provide funds to customers. Many researchers are using lending rate as one of the independent variable to assess the effects on the housing price in other country, such as Turkey, Ramazan et al. (2007); United State, Shiller (2005) and Gallin (2003); Singapore, Lum (2004). According to Chin, Ng, and Chau (2004), this variable is a common factor that will affect the house prices and consumption directly. In economy theory, when lending rate decreases, people can afford to qualify for more mortgage funds, thus demand for house rises, consumption increases and lastly increase the GDP for the country.

1.1.3 General Factors That Influence the Housing Price Level

Based on economic theory, we can classify the factors of house prices into demand and supply, two categories. According to Flavin and Yamashita (2002), McQuinn and O'Reilly (2006), Ong (2013), they shows that this theory will affect the housing price by the interactions of demand and supply. In demand side, demographic change is one of the factors among the main driver of housing demand which included population, age, family members and income (Hood, 1999). Besides, education level also will influence the demand under demographic aspect (Mar Iman, 2012). Majority of higher education group creating demand for medium high cost property product especially residential.

In addition, geographic also one of the factor affect demand and the price level of real estates. People would like to buy the house that close to city center because there provide a better accessibility. However, due to the higher land cost and demand the income growth will affect who would like to own a house near to city center (Flavin & Yamashita 2002).

On the other hand, supply of property market tend to be relatively inelastic (Mar Iman, 2012) which represent the supply was scanty capacity respond to changes of demand (Arrazole, Hevia, Romero-Jordan, & Sanz-Sanz, 2015). Physical factor is one of the major factor that will affect the house price. When there is increase of land supply and with lesser land regulation, it will lead to rise on housing supply by builder. Besides, government also play an important role to affect house supply. In China, direct government control will significant decrease in land supply and put downward pressure on new housing supply (Yan & Ge, 2014). Government act as market participant and supply land to demander directly.

1.1.4 Overvaluation of House Prices

Price-to-income ratio is one of the popular measures of overvaluation. However, Fox and Tulip (2014) argue that the purpose of using Price-to-income ratio in overvaluation measure was unclear. The house is relatively expensive to income cannot represent that whether the purchase is sensible. Result of regressing the actual house prices on housing determinants can defined as fundamental house prices or fitted house prices. Yip, Wong, and Woo (2016) explained that overvaluation is the difference between the actual and fundamental prices. According to Fry, Martin, and Voukelatos (2010) research, the factor driving overvaluation in Australian housing market are housing demand shock, macroeconomic shock and wealth effect from equity market.

Based on a Malaysian housing research, the overvaluation can happened due to the normal prices adjustment or speculative activity (Yip, Wong & Woo, 2016).

The housing bubble burst in United State, Japan and some European country have left a deep impression on us. Stiglitz (as cited in Himmelberg, 2005) defined the asset bubbles as: “If the reason that the price is high today is only because investors believe that the selling price is high tomorrow -- when ‘fundamental’ factors do not seem to justify such a price -- then a bubble exists. At least in the short run, the high price of the asset is merited, because it yields a return (capital gain plus dividend) equal to that on alternative assets.” In simple, the bubble can exist when the price rising much faster than the fundamental price (boom) and then also decline faster than the falling in fundamental price (burst). Mayer (2011) provided second definition states that bubbles represent extreme movements of house prices, during which housing prices rise rapidly, growing 20 percent, 30 percent , or even 40 percent per year for two or three years, and then falling just as rapidly in the following three years. Based on Mayer’s definition, Yip, Wong and Woo (2016) had redefined it to suit the Malaysia economic condition as if the overvaluation of house prices more than 10 percent then the bubble exist. They estimate the overvaluation by using Cointegrating Regression and its long term mean.

$$\text{Overvaluation} = \text{HPI}_t - \widehat{\text{HPI}} \qquad (1)$$

1.2 Problem Statement

Based on Figure 1.1.1, Malaysian house prices keep on moving up throughout the years and skyrocketed from year 2010. Undeniable, a zoomed up house price will bring negative impact to Malaysia economic and increase the risk of housing bubble.

Figure 1.2 showed annual proxy household income has risen relative slowly to the Malaysian housing price and the situation become worsen from 2007 which the global financial crisis occur. While the annual proxy household income have been rising, house price have been increasing even more. Increase in income does not catch up with surge in house price, which will cause a crisis of housing affordability especially for young and freshmen in the society.

According to Numbeo (2015), the top 3 area with high property price to income ratio are: 1st Johor Bahru (17.13), 2nd Kuching (11.00) 3rd Kuala Lumpur (10.10). The ratio represent that Johor residents have to spent 17.13 years salary then only can owned a house and this situation have a large possibility caused by speculator. With the inelastic supply in property market, it has probability caused demand supply mismatch (Mar Iman, 2012). Speculator and constructor who aim at foreigner market aggravated the situation. From 1 March 2014, the minimum threshold for foreign property buyers in Malaysia had increase 2 times from RM500, 000 to RM 1million (Ministry of Finance Malaysia, 2013). Even the main purpose for this regulation was increase the barrier of foreign buyers, however, constructor may be attract by this restriction since a higher price property provide a greater profit. In consequence, the situation of oversupply of high-cost property occur.

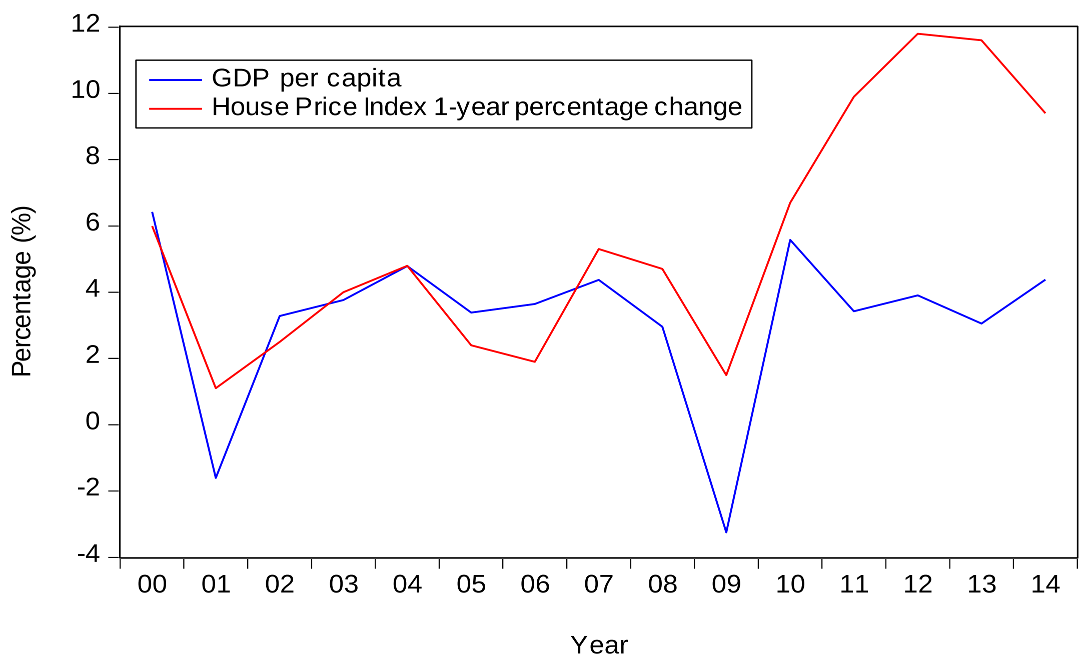
Sin Chiew Daily (2015) had report, Malaysian have a very high household debt (146 percent) and it stand 86.68 percent of GDP, this level was even higher than the United States when the period before 2008 global financial crisis. A high house hold debt can cause the country economic more vulnerable and limit the interest rate and imbalance in financial aspect. Besides, nowadays the rate of bank reject to borrow mortgages also reach a new high (35 percent), this restrict household's ability to having their own asset especially for younger households.

Looking further into the macroeconomic situation, researchers expect the global economic to slow down in 2016 and the risk of global recession rising (Leslie, 2016). The forecast of Malaysian GDP growth had trimmed at 4 percent to 4.5 percent in 2016 (Chong & Ramasamy, 2016). With the hot issue in 2016- slumping oil price (The Star,

2016) and job cut in banking and oil sector (The Star, 2015), we can clearly know that, in 2016, Malaysia amidst in a challenging external environment.

Some researchers are of the opinion that rising in house prices is good for economic since the household spending will contribute to national gross domestic product. However, after figure out issue mentioned above, we can conclude that a fast speed rising in Malaysian house prices was not a good thing for households especially younger and fresh graduate household. The fast increase house price had weaken their affordability and purchasing power. The thing we interested is, does the house really worth for the higher price? Does households paying a higher prices in purchasing property asset? What are the real fundamental variables of house prices in Malaysia and their impact? In light of this, we conduct a research for estimating the impact of fundamental variables on house prices in the hope that we can shed some light on the housing dynamics in the Malaysian property market

Figure 1.2 The Annual Growth Rate of GDP per capita and House price



Source: World Bank Data; Jabatan Penilaian Dan Perkhidmatan Harta

1.3 Research Objective

In this section, we present our general and specific objectives for this study.

1.3.1 General Objective

To investigate how the determinants of lending rate (LR), real gross domestic product (RGDP) and unemployment (UNEM) can explain the movement of the house prices in Malaysia.

1.3.2 Specific Objective

i. To examine the impact of the three determinants on the house prices.

ii. To estimate overvaluation of house prices.

1.4 Research Questions

i. Is there any significant relationship between lending rate, real gross domestic product and unemployment with house prices in Malaysia?

ii. Are lending rate, real gross domestic product and unemployment rate the real fundamental determinants on house prices in Malaysia?

iii. Is there any overvaluation of house prices in Malaysia?

1.5 Significance of the Study

Most of the empirical literatures have examined the impact of the fundamental determinants on house prices. However, until now, there are still no consensus on what determinants are constitute the real fundamental determinants of house prices. Real fundamental determinants are crucial, because we only can assume the forecast fundamental house prices and overvaluation are accurate after we obtain a real fundamental determinants. In this research, we may able to filling the gap resulted from past researchers.

The main contribution of this research is we shed light on how fundamental variables: real gross domestic product (RGDP), lending rate (LR) and unemployment rate (UNEM) can affect Malaysia house prices movement. In this research, we will be able to provide a robust results on the impact of these three variables on Malaysian house prices and determine whether they are the real fundamental determinants by using all three types of Cointegrating Regression: Fully-modified OLS, Dynamic OLS and Canonical Cointegrating Regression. So far for our knowledge, there was no researches using all three types of Cointegrating Regression in their research. In addition, we used graphical analysis in this research. Graphical analysis is introduced to have a clear movement of housing prices throughout the 15 years and provide the realistic respond and relationship which is much easier to understand. At the same time, it provides the initial idea of the correlation of the fundamental housing prices before proceeds to the data testing. It is more convincing to reader when the data testing is significance then.

Based on our results and current Malaysian property market condition, we suggest and explain some appropriate policies implement which may can enhance the efficiency and effectiveness in cool down the skyrocketing house prices in Malaysia. Thus, this research can help policy maker to better understand the effect of macroeconomic variables towards the housing market. We hope this research also can helping them in making a wise and sound policies and strategies.

Furthermore, we provide sufficient information and conduct robust test in this research. Through this research, student can have a better understanding on how the relevant variables will influence Malaysian house prices. Hence, this research can used by educators as a references to guide students in the future. This research not only benefits for policy makers and students, but also investor and public. Beside from the main three fundamental variables we discuss in this research, we also included some general factor which will affect the Malaysian house prices in chapter 1. This can help investor and public make an effective investment decision and reduce the exposure risk.

1.6 Outline

The rest of the chapters were organized as followed. In Chapter 2, a brief synoptic review of the empirical literature will be provided. Next, Chapter 3 discussed the empirical methodology employed in the study. The research was followed by the result interpretations based on the estimation output in Chapter 4. Lastly, Chapter 5 had concluded our research by summarize the major findings, contributions of study, limitation of study and some of the recommendations for future research.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

The previous chapter has described our research background, problem statement, general and specific objectives and significance of our study about the housing price in Malaysia. Before proceeding to the empirical analysis, we reviewed the previous researchers' studies that are related to the determinants of housing prices.

In this chapter, we investigate the relationship between the independent variables (GDP, unemployment rates and lending rates) and housing prices. In addition, we also discuss about the methods used by various researchers to conduct their study as well as the major findings that are found by other researchers.

2.1 GDP and House Prices

Earlier studies have shown that the macroeconomic aggregates such as GDP, unemployment, inflation, and economic growth have influenced the dynamics of the housing sector. GDP is a traditional tool that is used to measure economic progress. GDP comprises all the public and private consumption, government spending, investment and export minus import except illegal activities and unpaid work (Callen T, 2008). Any changes in the components will bring effect in GDP and indirectly affect housing prices. Besides, GDP is important for every country. It indicates the health or the economy condition of a country. Economist, policy maker, businessman, speculators, even consumers are concerning on the GDP in their country as any changes in GDP may result in financially lost or profited. So do housing price, it is also determined by the GDP. Lam (2015), written in the magazine, has mentioned that profited of housing market is one of the indicator showing the economy is healthy.

When the GDP is high, it means that the country is growing and performing well in its economy, as well as creating more jobs to citizen and promote household at the same time. As a result, the expanding economy rises up the standard living and as a result income level rises, causing housing developer to develop more houses in the country in order to get profit from the situation (Dietz, 2015).Adams and Füss (2008) stated that an increase in economic activities drives the demand of houses thus increasing the house prices in long run. However, when a country is facing depression which is known as bad economy, the citizens will struggle with little income and facing jobless situation and subsequently causing citizen could not afford loans and decrease the demand of houses. When these happened, it brings impact to the supplier and forces the supplier to lower down the housing price in order to sell out the house. By looking into the economic history, great depression was originated from United State in year 1929 was lasting for 10 years until 1939. It brought a tremendous impact to countries especially in United State and Europe. During the depression period, the whole nations were facing terrible internal and external economic problem such as high unemployment rate, declined in GDP, reduce in international trade and panic of financial and banking. Even construction also facing a sharp drop during great depression and result in decreased housing prices (Bordo, 1998).

Factors that are not quantitative in nature make the empirical test difficult to conduct, therefore Guo and Wu (2013) conducted an empirical analysis and found positive relationship between GDP and housing prices, but negative relationship between housing prices and loan and interest rate. Ong (2013) found a lot of macroeconomic variables such as population, GDP, labor force, interest rate, inflation rate and real property gain tax were used to test the relationship with housing prices and result population, GDP and real property gain tax were significantly affect housing prices. Clark and Daniel (2006), who did forecasting house price in South Africa, also found exactly the similar relationship after using Augmented Dicky Fuller (ADF) to forecast. When the loan and the interest rate are high, cost of borrowing increase with a result high housing prices and make the consumers cannot afford to buy a house. Besides, Hu, Jin & Cheng (2011) proved that short term rate of GDP and income changes had brought impact to housing price in their study. In the study of housing price in Iran which conducted by Meidani, Zabihi and Ashena (2011) ;Pour, Khani, Zamanian and Barghandan (2013) using Toda and Yamamoto approach and ADF test showed there is relationship between housing prices and the macroeconomics factors. By using the causality test, it showed positive relationship between housing prices and GDP and both are interacted with each other. Hashim (2010) in his research paper also stated that changes of housing price are influenced by real income growth, stock prices, interest rate, population growth and economy activity. Syedberg and Trygger (2008) also found that GDP is associated with increasing real estate prices. There was a case in Malaysia as well which the housing prices in Klang Valley keep on rising resulted by fluctuation in housing market, increase in house demand and populations growth. After conducting a survey, it is found that 44 percent of the respondents agreed that the high gross domestic product brought up the house prices. (Liew & Haron, 2013).

However, there are some researcher stating that there is no relationship between GDP and real estate investment. Chui and Chau (2005) found no relationship between GDP and housing prices in Hong Kong. The lack of a relationship between real estate investment and economic growth in their paper was due to the project's duration in Hong Kong whereas residential and office shows relationship towards economic growth. From the result, they found that GDP and house price does not granger cause with each other. They conclude that, the real estate investments are not good leading indicator of economic performance in Hong Kong.

2.2 Unemployment Rate and House Prices

In economic theory, unemployment occurs when a person who is searching for job actively but they are unable to find. Unemployment rate measure by the total number of unemployed divided by the number of people in labour force. According to Mahon (2015), there are few rates to determine the health of the economy and one of the rate is unemployment rate. The lower the unemployment showing that the country with a stronger economy and it will affect the property prices. Based on the demand and supply theory, the more people who is unemployed will lead to a less affordability to buy a house. According to Dr Wilson, when the income falls, unemployment rate will increase and will lead to a fall in housing price. Therefore according to the theory, when unemployment rate increase it will lead to a decrease in house price and it shows a negative relationship between house price and unemployment rate.

Based on the review on the studies of previous researcher, we found out that most of the result is showing consistency to the theory but there are some researcher found out that there is a positive relation between house price and unemployment rate. According to Pinter (2015), Jacobsen and Naug (2005) and Vermeulan and Ommeren (2007), there is a negative impact between house price and unemployment rate. Pinter (2015) was using the quarterly data of consumption, output, house price index, consumer price index, population, credit and unemployment in UK from year 1983 to year 2014. By using Bayesian VAR model, Pinter shows that the house price shock is determine by 20-30 percent of fluctuations of unemployment and job separation rates together with the 10-20 percent of output fluctuations. Besides, Jacobsen and Naug (2005) found out that unemployment is an important variables to explain on the housing price. Jacobsen and Naug was using graphical analysis to see the results. From the graph of unemployment and house price, it clearly shows that there is an inverse relationship between this two components. According to Vermeulen and Ommeren, they had done a survey on 142 cities in 12 countries and found that there is a strong negative correlation between house price and unemployment.

Zhu (2010) found out that the house price is more sensitive toward the unemployment in the richer region compare to the poorer region because based on the theory, when the income decrease, the willingness of the employ household to get a house reduce and it will lead to a decrease on house price. Besides, Geerolf and Grjebine (2014) also found that there is an inverse relationship between house price and unemployment rate. This researchers was using the house price data from year 1970 to year 2010 on an annually basis for 34 countries as the dependent variable and the independent variable is unemployment rate, percentage of active population and percentage of total employment. From the result of the research, by using OLS and 2 stage least square, it showed a depreciation of 10 percent in house price yields when a 3.4 percent increase in unemployment rate. It clearly shows that there is a negative impact on house price and unemployment rate.

Xu and Tang (2014) examined on the determinant of UK house prices by using cointegration approach and error correction model. They used nominal house prices as dependent variable, construction cost, credit, GDP, household disposal income, interest rate, money supply and unemployment rate as independent variable. Data range is from 1971-2012 quarterly basis. According to the result from cointegration vector, it showed a positive relationship between house price and unemployment which is different with the theory and the result from other researchers above mentioned. However, the authors claimed that this result still make sense in the UK housing market environment because there is no obvious correlation in UK house prices and unemployment rate.

2.3 Lending Rate and House Prices

Lending rate is also known as interest rate charged by the bank in order to get the loan. Different bank will offer different rate base on the credit of the potential buyers. The interest rate charges by the bank will affect the demand of the house. The lending rate is also known as a cost of borrowing for the borrower. According to Larock and Geffner (n.d.), when the mortgage rate increase, the affordability of buying a house decrease. Thus decrease in demand and lead to fall in housing price.

Figure 2.3.1: Malaysia Bank Lending Rate from Year 2006-2014.

Source: Central Bank of Malaysia

In Malaysia, the domestic bank will have a base lending rate which is set by the central bank of Malaysia. According to the data shown in trading economic. For this 10 year (2006-2016) period, Malaysia lending rate was showing a decreasing trend and the house price index was in an increasing trend. From the graph, we can make the assumption of lending rate and house price have a negative relationship.

According to Jacobsen and Naug (2005), Clark and Daniel (2006) and Sa, Towbin and Wieladek (2011), from their research they found out that interest rate shows a negative relationship to the house price. Jacobsen and Naug used graphical analysis to find the relationship between interest rate and house price. From the graphical analysis, it was shown clearly that when the interest rate rises, house price index falls; when the interest rate falls, house price index rises. The authors also mentioned that interest rates is one of the important variable to the explanatory for house price. Besides, the lending rate are more sensitive when the household are highly indebted (Sa, Tawbin & Wieladek, 2011). It means that, when there is a small change in interest rate, will lead to a large effect on the ability to pay back the debt. Therefore, the housing demand will be more sensitive to interest rates. Besides, Hubbard and

Mayer (2009) also said that interest rate has a very important impact on the housing prices. By using the graphical analysis for various country for the house price index and the real mortgage rate, it shows that increase in the mortgage rate increase will lead to a reduce in house price.

In the case of Malaysia, Ibrahim and Law (2013) found that there is a negative long run relationship between house price and interest rates by using the data range from year 1999Q1 to year 2011Q4 with the cointegration, granger causality, ADF and PP test. Inoguchi (2011) has found out that the coefficient of the house price index using dynamic panel regression is insignificant. However, the lagged valued is positively significant after the crisis. The researcher conclude that with the over identifying restriction is not satisfied for the regression after crisis. And he suggests that the real estate price in Malaysia would not affect the lending pattern of the domestic banks.

2.4 Development of hypothesis

H1: GDP will have positive relationship with house price.

H2: Unemployment rate will have negative relationship with house price.

H3: Lending rates will have negative relationship with house price.

H4: GDP has granger cause on house prices.

H5: Unemployment rate has granger cause on house prices.

H6: Lending rates has granger cause on house prices.

2.5 Gap of the Studies

Based on the literature review that had been done, there are many studies discussing about the relationship between house price and its macroeconomic determinants in different countries. From this review, it is noted that the researchers' result for the relationship of house price and the macroeconomic variables are not consistent. Perhaps one reason is that they are from different country and thus, policies will be different. Therefore, we would like to examine the significant relationship for house price and the independent variables in order to shed some light on the inconsistent findings of the various researchers. For the next chapter, we will discuss on the data and methodology use to conduct the test.

CHAPTER 3 RESEARCH METHODOLOGY

3.0 Introduction

In this chapter, econometric methods are used to determine the relationship between house prices and the various macroeconomic variables in Malaysia.

Graphical analysis is used to show the visual effect of different macroeconomic variables on house price in Malaysia and then compared with developed country, United State. Next, we applied unit root tests such as Augmented Dickey Fuller (ADF) test, and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and Elliott-Rothenberg-Stock Point-Optimal (ERS) test to examine the stationarity of the data.

After showing that the variables are I(1) or I(0) series, cointegration regression model is used to test the long run and short run relationship between house prices with the independent variables. We use Pesaran ARDL cointegration test approach to examine the cointegration for the whole model. Pesaran ARDL cointegration test is specially good for small sample and also if the variables are a mixture of I(1) and I(0). Moreover, to make sure that regression does not have any error and all the independent variables are significant with house price, diagnostic checking is applied. Lastly Granger Causality Test is applied to find out whether there is any causality among the variables. In this study, long-run estimation result is examined for computing the overvaluation of housing price in Malaysia housing market.

3.1 Data Resources and Definitions

Time series analysis is employed to investigate the fundamental determinants of housing price in Malaysia. Data from year 2000 to 2014 based on quarterly bases was collected from various sources.

Table 3.1: Data Resources and Definitions

Variables	Definitions	Source of data
HPI	House Price Index in Malaysia (percentage)	Jabatan Pernilaian dan Perkhidmatan Harta
RGDP	Real Gross Domestic Price (percentage)	International Monetary Fund (IMF)
LR	Lending Rate (percentage)	International Monetary Fund (IMF)
UNEM	Unemployment Rate (percentage)	International Monetary Fund (IMF)
μ	Random error (residual)	-------------
t	t-th (time period)	__________

3.1.1 Econometric Model

Our basic econometric model is the basic linear regression model

Econometric Model:

House Price Index = f (Real Gross Domestic Product, Lending Rate, Unemployment Rate)

$HPI_t = \beta_0 + \beta_1 RGDP_t + \beta_2 LR_t + \beta_3 UNEM_t + u_t$

3.2 Econometric Methods

In this chapter, time series method is applied to estimate the economic model and estimation model. Time series is a stochastic process itemize by time and forecast according the pass of economic data. The methodology applied in this study consists of various tests in the next section to determine the relationship between house price and the macroeconomic variables in Malaysia:

(1) Graphical Analysis
(2) Unit Root Test
(3) Co-integration
(4) Diagnostic Checking
(5) Granger Causality Test

3.2.1 Graphical Analysis

To investigate the fundamental of the housing price, graphical analysis is used to state the relationship between the housing price with interest rates, real gross domestic price (RGDP), inflation rates, lending rate, and unemployment, for 15 years, but 60 observations, from year 2000 to 2014, in quarterly form. In economic form, graphical analysis can easily show the patterns, trends, and the process of data description then make summaries based on it. In our study, this method is used to perform any trend of the movement for the independent variables affect the housing price index in Malaysia. Index form cannot be used to compare price levels across cities, but it can be used to calculate growth rates and to compare prices over time.

Besides, the changes of annual growth rate of housing price index between Malaysia with United State are compared in this study in percentage form. United State is a develop country, where Malaysia is developing country. The reasons by using these two countries to compare the house price index are United State have a strong economic condition, income level, education, population and so on if compare with Malaysia. By using two different economic environments, the effect of the macroeconomic variables on the house price can be shown (Lum, 2004).

3.2.2 Unit Root Test

Unit root test is employed to examine the stochastic trend. Variables in the regression model should be stationary so that forecast of the economy situation can be done accurately. If the variables are nonstationary, assumption for asymptotic analysis will be invalid. In other words, R-square values and t-statistics are no longer valid to undertake the hypothesis tests. Besides, non-stationary series have no tendency to return to a long-run path. The Variance of the series is time-dependent and goes infinity as time approaches infinity, which results in a series of problems in forecasting. Here, ADF test, KPSS test and ERS test are employed to examine the stationarity of the variables. If all variables are in the same order of the integration, the equation 1 can be estimated with the OLS method.

I. Augmented Dickey-Fuller (ADF) Unit Root Test

This test was further improved by Dickey and Fuller (1981). This test is able to encounter serial correlation by adding lagged of dependent variable （ΔYt） and the optimal lag length of test is based on the minimum information criterion. So, ADF test is the alternative unit root test to improve the inadequacy of DF test. Besides, the null and alternative hypotheses are constructed as the following:

H0: βt is non-stationarity (βt has unit root)

H1: βt is stationarity (βt has no unit root)

Decision rule: Reject Ho if absolute t-statistic is higher than absolute critical value. Otherwise, do not reject Ho.

II. Kwiatkowski-Philips-Schmidt-Shin (KPSS) Stationary Test

This test developed by Kwiatkowski, Philips, Schmidt, Shin (1992). It is intended to complement unit root test. This test is used as a stationary test to confirm the stationary of a series and it can provide more robust result.

Hypothesis Statement:

H0: βt is non-stationarity (βt has unit root)

H1: βt is stationarity (βt has no unit root)

Decision rule: Reject Ho if absolute t-statistic is higher than absolute critical value. Otherwise, do not reject Ho.

III. Elliott-Rothenberg-Stock Point-Optimal (ERS) Test

Elliott, Rothenberg and Stock (1996) developed this method to improve the power for this unit root test and the variables tested are non-stationary. ERS proposed a modified ADF t-statistic by using GLS trend data. Besides, the use of this test is to determine that variables stationarity and the order of integration. Elliott, Rothenberg and stock develop 'p-test', as a feasible point optimal test, which the model includes the error term that have serial correlation.

Hypothesis Statement:

H0: βt is non-stationarity (βt has unit root)

H1: βt is stationarity (βt has no unit root)

Decision rule: Reject Ho if P-statistic is higher than critical value. Otherwise, do not reject Ho.

3.2.3 Cointegration Regression Model

The concept of cointegration test refers to the variables used should integrated of the same order and linear combination of non-stationary variables (Gujarati, 2008). It shows the long run relationship between the integrated series. In this study, this test examines whether the non-stationary variables are cointegrated or not cointegrated. The aim of using this test is to avoid spurious regression and thereby estimate the long run equilibrium solution.

There are three estimators for long run regression: Fully Modified Ordinary Least Square (FMOLS), Dynamic Ordinary Least Square (DOLS), and Canonical Co-integrating Regression (CCR). We use all the three estimators to examine the long run relationship between those variables. Then, Error

Correction Model (ECM) is used to examine the short-run relationship and to verify the validity of the cointegration result.

I. ARDL Approach

Auto Regression Distributed Lag (ARDL) test is employed to examine the cointegretion for the whole model between the house price index with Malaysia's macroeconomic variables. The reason ARDL approach is used is because sample size too small and will lead to get reliable results (Harris & Sollis, 2003). Besides, this approach does not require same order at I (0) or I (1) for the independent variables (Pesaran & Pesaran, 1997; Pesaran & Shin, 1999). Furthermore, unbiased parameters can be presented by ARDL approach for this model.

By selecting the optimal lags length that need to used, the smallest result of the Akaike Info Criterion (AIC) and Schwarz Criterion are chosen to prevent autocorrelation occur between error term. The result will be present by using E-View 9.

Here, to examine the integration for whole model, equation of Unrestricted Error Correction Model (UECM) is interpreted as follow:

$$\Delta HPI_t = \alpha_0 + \alpha_{HPI}\, HPI_{t-1} + \alpha_{LR} LR_{t-1} + \alpha_{RGDP}\, RGDP_{t-1} + \alpha_{UNEM} UNEM_{t-1} + \sum_{p=0}^{g} \alpha_p\, \Delta\, HPI_{t-1} + \sum_{q=0}^{h} \alpha_q\, \Delta\, LR_t + \sum_{r=0}^{i} \alpha_r\, \Delta\, RGDP_t + \sum_{s=0}^{j} \alpha_s\, \Delta\, LUNEMR_t + \mu_t$$

Hypothesis Statement:

H0: $\alpha_{HPI} = \alpha_{LR} = \alpha_{RGDP} = \alpha_{UNEM} = 0$ (there is no long run relationship)

H1: At least one $\alpha_t \neq 0$, where t = HPI, LR, RGDP, UNEM (there is long run relationship)

Decision rule: Reject H_0 if the p-value is lower than $\alpha=0.05$.

Next, after examined the relationship, ARDL's Residual Unit Root Test is used to investigate whether there are unit root for residual or not.

Hypothesis Statement:

H_0: ARDL Residual has a unit root.

H_1: ARDL Residual has no unit root.

Decision rule: Reject H_0 when the T-statistics higher than critical value in right tail test or lower than critical value in left tail test. Otherwise do not reject null hypothesis.

II. Fully Modified Ordinary Least Square (FMOLS)

FMOLS is attributed to Phillips and Hansen (1990) to give optimal estimates of co-integrating regressions. It modifies least squares to explicate the serial relationship between dependent and independent variables. These tests better that Engle and Granger method, because result of t-test more valid and accurate for long-run estimations (Amarawickrama & Hunt, 2007).

Hypothesis Statement:

Ho: $\beta1=\beta2=\beta3=\beta4=0$

H1: at least one of the β_t is $\neq 0$, where t =1, 2, 3, 4

Decision rule: Reject Ho when the p-value is lower than significant level. Otherwise do not reject Ho.

III. Dynamic Ordinary Least Square (DOLS)

DOLS is designed by Saikkonen (1991) and Stock and Watson (1993). It is used to construct an asymptotically accurate and efficient estimator in the cointegrating system. In these three test, the long run covariance estimate is based on Bartlett kernel, Newey-West fixed bandwidth=4.0000.

Hypothesis Statement:

Ho: $\beta1=\beta2=\beta3=\beta4=0$

H1: at least one of the βt is $\neq 0$, where t =1, 2, 3, 4

Decision rule: Reject Ho when the p-value is lower than significant level. Otherwise do not reject Ho.

IV. Canonical Co-integrating Regression (CCR)

DOLS may ignore the dependence across individual for estimation process. So, Park (1992) developed CCR test and based on nonparametric correction. This test will show an efficient result than FMOLS and DOLS. CCR test has better small sample properties than others estimators and provide efficient normal estimation even there are nonstationary disturbances (Ogaki & Park, 1997). Where, this test is used to determine the long run relationship among those variables

Hypothesis Statement:

Ho: $\beta1=\beta2=\beta3=\beta4=0$

H1: at least one of the βt is $\neq 0$, where t =1, 2, 3, 4

Decision rule: Reject Ho when the p-value is lower than significant level. Otherwise do not reject Ho.

V. Error Correction Model (ECM)

Although we have observed the long run equilibrium in the fundamentals of housing prices, we also interest to consider the short run evolution of the variables. Therefore, Error Correction Model (ECM) was applied to observe the short run relationship between variables. This model allows us to adjust and correct the deviation in short term disequilibrium relationship between the variables to achieve the long run equilibrium.

Hypothesis Statement:

Ho: $\beta 1=\beta 2=\beta 3=\beta 4=0$

H1: at least one of the βt is $\neq 0$, where t =1, 2, 3, 4

Decision rule: Reject Ho when the p-value is lower than significant level. Otherwise do not reject Ho.

3.2.4 Diagnostic Checking

Before proceed to Granger Causality test, the econometrioc model should be checked whether econometric problem such as heteroscedasticity, autocorrelation and specification errors occur or not. Besides, this step is also used to make sure that the model must fulfill the OLS assumption, BLUE (Best, Linear and Unbiased Estimator).

I. Breusch-Godfrey Serial Correlation LM Test

Correlation between members of series of observations ordered in time could be defined as autocorrelation terms (Gujarati, 2008), whereas serial correlation is the lag correlation between the two different series. So, when the error terms correlate with each other, meaning that serial correlation occurs. This test is employed to detect autocorrelation problem. Higher orders of autocorrelation will be detected after used this test. The Breusch-Godfrey Serial Correlation LM Test will show by using E-View 9.

Hypothesis Statement:

Ho: There is no autocorrelation problem.

H1: There is autocorrelation problem.

Decision Rule: Reject Ho if p-value is less than significance level (α) at 1 percent, 5 percent and 10 percent. Otherwise, do not reject Ho.

II. Autoregressive Conditional Heteroscedasticity (ARCH) Test

Heteroscedasticity arise when the variance of the error term different or inconsistent between the independent variables. If there is heteroscedasticity problem occur, re-estimate the model should be done. The efficiency of the model will be much higher if compare to OLS method (Holgersson & Shukur, 2004). To detect the heteroscedasticity problem in this model, ARCH is employed because time series data taken by this study.

This test will present by using E-View 9.

Hypothesis Statement:

Ho: There is no heteroscedasticity problem.

H1: There is heteroscedasticity problem.

Decision Rule: Reject Ho if p-value is less than significance level (α) at 1 percent, 5 percent and 10 percent. Otherwise, do not reject Ho.

III. Ramsey-Reset Test

Specification error can be detected by using this test. However, if this error occurs, there is no way to solve this problem. The reason that this error happened because of include irrelevant variables or using wrong measurement. The most problem will occur in time series model is multicollinearity problem, because the independent variables are highly correlated.

Hypothesis statement:

Ho: There is no specification error problem.

H1: There is specification error problem.

Decision Rule: Reject Ho if p-value is less than significance level (α) at 1 percent, 5 percent and 10 percent. Otherwise, do not reject Ho.

IV. Normality Test (Jarque-Bera Test)

Normality of error term can be identified by using Jarque-Bera test. OLS estimators is easily interpreted when the error term is normality and the 9 assumption of OLS fulfilled (Gujarati, 2008).

Hypothesis statement:

Ho: The error term is normally distributed.

H1: The error term is not normally distributed.

Decision rule: Reject Ho if p-value is less than significance level (α) at 1 percent, 5 percent and 10 percent. Otherwise, do not reject Ho.

Jarque-Bera test statistic in manual:

$$JB = \frac{N}{6}\left(S^2 + \frac{(K-3)}{4}\right)^2$$

Where, N = Sample size; S = Skewness; K = Kurtosis

3.2.5 Granger Causality Test

Granger causality test was first proposed by Granger in year 1969 and modified by Sims in year 1972. The purpose of this test is to show the correlation between one variable causes movement in another variable. We chose to use this test because we want to find out is there any causality among the variables. This method is slightly different compared with other econometric tests because it assumes that all variables are endogenous or exogenous.

To examine the causal relationship between house prices and other variables which are GDP, interest rate, lending rate, unemployment rate and household consumption in Malaysia during year 2000 to 2014. This study will be start with the following regression equation:

$$\Delta HPI_t = \gamma_1 + \sum_{i=1}^{m} \alpha_{1i}\, \Delta HPI_{t-i} + \sum_{j=1}^{m} \rho_{1j}\, \Delta GDP_{t-j} + \sum_{j=1}^{m} \varphi_{1j}\, \Delta LR_{t-j} + \sum_{j=1}^{m} \omega_{1j}\, \Delta UNEM_{t-j} + \mu_{1t}$$

$$\Delta GDP_t = \gamma_2 + \sum_{j=1}^{m} \rho_{2j}\, \Delta GDP_{t-j} + \sum_{i=1}^{m} \alpha_{2i}\, \Delta HPI_{t-i} + \sum_{j=1}^{m} \varphi_{2j}\, \Delta LR_{t-j} + \sum_{j=1}^{m} \omega_{2j}\, \Delta UNEM_{t-j} + \mu_{2t}$$

$$\Delta LR_t = \gamma_4 + \sum_{j=1}^{m} \varphi_{4j}\, \Delta LR_{t-j} + \sum_{j=1}^{m} \rho_{4j}\, \Delta GDP_{t-j} + \sum_{i=1}^{m} \alpha_{4i}\, \Delta HPI_{t-i} + \sum_{j=1}^{m} \omega_{4j}\, \Delta UNEM_{t-j} + \mu_{4t}$$

$$\Delta UNEM_t = \gamma_6 + \sum_{j=1}^{m} \omega_{5j}\, \Delta UNEM_{t-j} + \sum_{j=1}^{m} \varphi_{5j}\, \Delta LR_{t-j} + \sum_{j=1}^{m} \rho_{5j} + \sum_{i=1}^{m} \alpha_{5i}\, \Delta HPI_{t-i} + \mu_{5t}$$

The following will shows the procedure of Granger Causality Test:

Ho: independent variable X does not granger-cause the dependent variable Y.

H1: independent variable X does granger-cause the dependent variable Y, and

Ho: dependent variable Y does not granger-cause the independent X.

H1: dependent variable Y does granger-cause the independent X.

Decision Rule: Reject H_0 if the F-statistic is greater than the critical value at 1 percent, 5 percent or 10 percent level of significant.

Besides, to show the hypothesis testing for this test, F-test used, which is as follow:

Test statistic: $F = \frac{(RSS_{UR} - RSS_R)/m}{RSS_{UR}\, /\, (n-k)}$

Based on the formula given above, RSS_{UR} represent R^2 from unrestricted model; RSSR indicates R^2 from restricted; n is the number of observation; k refer to the number of explanatory variables in the unrestricted regression.

Hypothesis Statement:

Ho: β1=β2=β3=β4=0

H1: At least one of the βt is ≠0, where t =1, 2, 3, 4

Decision Rule: If F-statistic higher than the critical value at 1 percent, 5 percent or 10 percent level of significant, Ho will be reject. Otherwise, do not reject Ho.

After that, we can conclude that there are relationship between X and Y or not.

3.2.6 Overvaluation of Market Price

Preliminary Model (Market Price):

$$HPI_t = \beta_0 + \beta_1 \, RGDP_t + \beta_2 \, LR_t + \beta_3 \, UNEM_t + u_t$$

Long-Run Estimation Model (Fitted Value):

$$\widehat{HPIt} = \widehat{\beta 0} + \beta 1 \, \widehat{RGD}Pt + \widehat{\beta 2 \, LR}t + \beta 3 \, \widehat{UNE}Mt$$

Overvaluation of Market Price:

$$HPI_t - \widehat{HPI} = \text{Overvaluation}$$

Here, the preliminary model also known as market price for the house price. While long run estimation model will be the fitted value. So, to find out the valuation of the market price, market price will minus with fitted value to determine the market value is undervaluation or overvaluation of housing price in Malaysia housing market.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

In this section, graphical analysis is first introduced in order to have a clear picture of the moving trends between the independent and dependent variables in a series of time. It is a basic tool to reveal the pattern in data and identify whether any anomalies exist in data. The dependent variable is the annual growth rate of housing price index (HPI) in Malaysia, and independent variables are lending rate (LR), real gross domestic product (RGDP), and unemployment rate (UNEM). The data periods were from 2000 to 2014 in quarterly. All the graphs were shown in Figure 4.1.1, 4.1.2, 4.1.3, 4.1.4 and 4.1.5.The first graph shows the relationship between the lending rate and the changes of annual growth rate in housing price index growth (Figure 4.1.1). Next, is relationship between real gross domestic product and changes of annual growth rate in housing price index (Figure 4.1.2) following with the relationship between unemployment rate and changes of annual growth rate of housing price index (Figure 4.1.3), and the relationship between three independent variables with changes of annual growth rate in housing prices (Figure 4.1.4). The fifth graph is the comparison of the changes of annual growth rate in house price index between Malaysia and United State (Figure 4.1.5).

Next, unit root tests such as Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and Elliot-Rothenberg-Stock Point-Optimal (ERS) were used to test whether the model involves stationary or non – stationary series and the result was showed in Table 4.2. For ADF test and ERS test, we construct a hypothesis testing by setting null hypothesis (H_0) has unit root and alternative hypothesis (H_1) was no unit root. The decision rule for this test was reject null hypothesis when the t-statistics is lower than critical value in left tail test or higher than critical value in right tail test, otherwise do not reject null hypothesis. Inversely, for stationary test which in KPSS test, we set the null hypothesis was stationary and alternative hypothesis was non-stationary. The decision rule for this test is reject the null hypothesis when the t-statistics is higher than critical value in right tail test, otherwise do not reject null hypothesis. The optimal number of lags length was selected based on information criteria such as Schwarz Information Criteria (for ADF test and ERS test) and NewWest Banwidth (for KPSS test) to prevent autocorrelation problem in error term and provide an accurate result in the test. In Elliot-Rothenberg-Stock Point-Optimal (ERS),

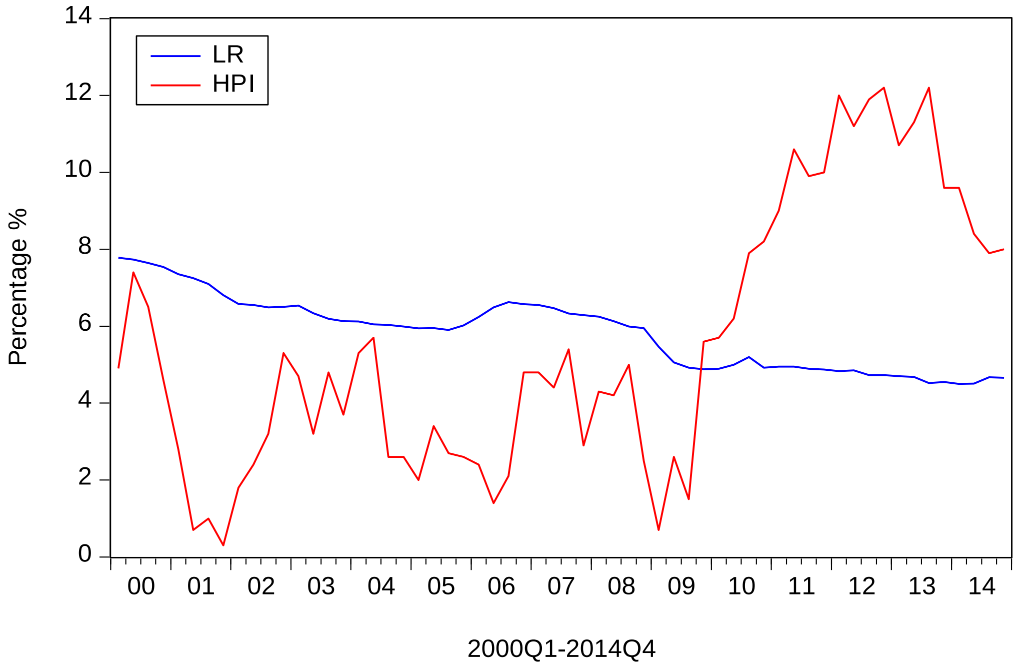
After the unit root test, we proceeded to the Auto Regression Distributed Lag (ARDL) model since there were I(0) and I(1) in our previous test and we used it to examine the long run relationship between the dependent variable and independent variables. The result is shown in Table 4.3 Part I, and a series of diagnosis checking such as Jarque-Bera normality test, Breusch-Godfrey Serial Correlation LM Test, ARCH Test, and Ramsey reset misspecification test were showed in Table 4.3 Part II. In addition, residual testing by using ADF test was applied to confirm the co- integrated in the model so as the residual graph. The result was shown in Table 4.3.1. The residual graph shows that it is stationary. In other words, the model suggests cointegrated between dependent and independent variables and subsequently cointegrating regression was conducted and the estimation was shown in Table 4.4. Three long run estimators such as is Fully Modified Least Squares (FMOLS), Canonical Co-integrating Regression (CCR), and Dynamic Least Square (DOLS) were utilized. In these three test, the long run covariance estimate is based on Bartlett kernel, Newey-West fixed bandwidth=4.0000.

Although we have observed the fundamentals of housing prices in the long run equilibrium, we are also interested to consider the short run evolution of the variables. Therefore, Error Correction Model (ECM) was applied to observe the short run relationship between variables. The result was shown in Table. 4.4. Pairwise Granger Causality Test between dependent and independent variables was shown in Table 4.5. Lastly overvaluation of house price was analyse and shown in Figure 4.6.

4.1 Graphical Analysis

In this section, we analyse all the graphs which can indicate relationship between the variables.

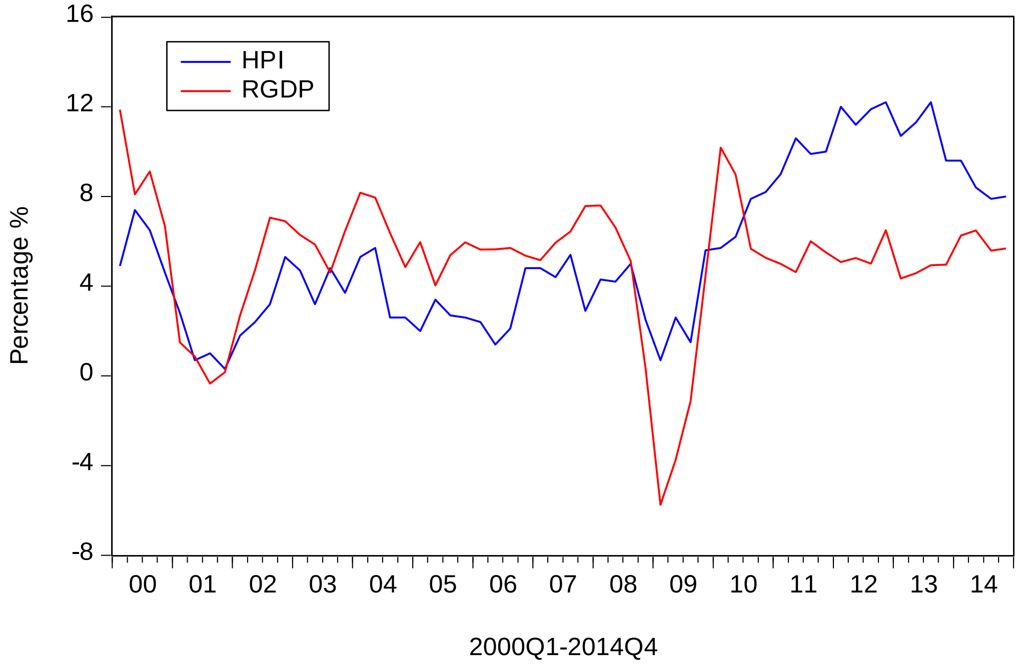
Figure 4.1.1: Relationship between the Lending Rate and the Changes of Annual Growth Rate in Housing Price Index Growth



Source: Jabatan Penilaian Dan Perkhidmatan Harta; International Monetary Fund Data

The graph shows the relationship between lending rate (LR) and annual growth rate of housing price index in Malaysia (HPI) during 2000 to 2014 quarterly. As we can see from the graph, lending rate was maintained in between 4-8 percent, however, the changes of housing price index was fluctuated throughout these 15 years. The two graphs show clearly that housing price decreased when lending rate is high. From 2010 onwards, housing price index keep on fluctuated above the lending rate, while lending rate went slowly in a decreasing trends.

Figure 4.1.2: Relationship between Real Gross Domestic Product and Changes of Annual Growth Rate in Housing Price Index



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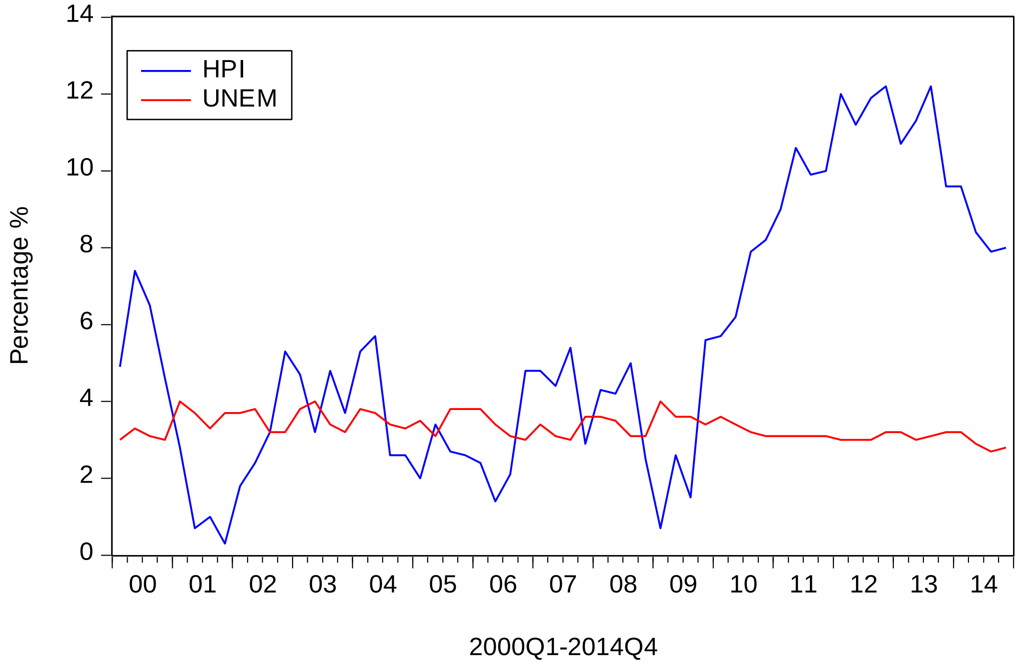
Source: Jabatan Penilaian Dan Perkhidmatan Harta; International Monetary Fund Data

Above is a graph of real gross domestic product (RGDP) with the annual growth rate of housing price index (HPI) in Malaysia over previous four periods during 2000 to 2014 in quarterly. From the graph above, it presents both increased and decreased in both variables. Both of them were almost moving in the same direction. At the outset, real GDP and housing price index were decreased for the first three quarters before having a sharp decrease in the last quarter of 2000 and it shows similar pattern as housing price index. In 2002 onwards, real GDP fluctuated above the housing price index for 7 years while housing price index moving in the same form as real GDP. It was a dramatic dropped in the following years for real GDP compared to housing price index, it can be seen in the dropped of real GDP reached negative rate while housing price index still maintain in the positive rate. A year later, housing price index fluctuated higher than real GDP and it continued until 2014. From the graph above, we can be seen both graph are co-integrated because they are moving together through time.

Figure 4.1:3Relationship between Unemployment Rate and Changes of Annual Growth Rate of House Price Index.



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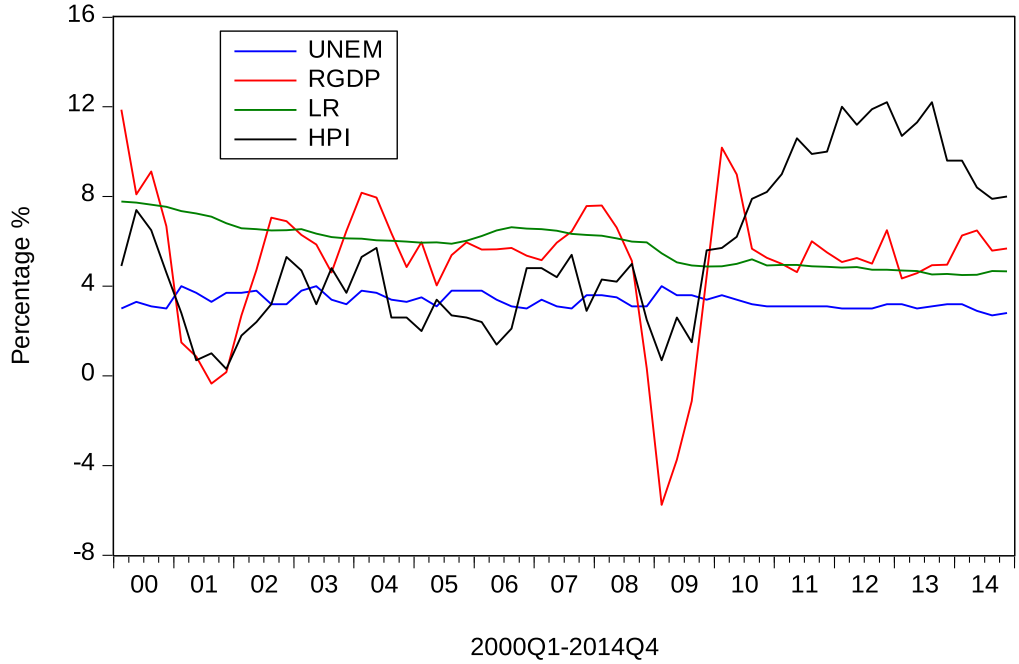
Source: Jabatan Penilaian Dan Perkhidmatan Harta; International Monetary Fund Data

The unemployment rate (UNEM) and annual growth rate of housing price index in Malaysia (HPI) are shown in the graph above in quarterly from 2000 to 2014.It clearly shows the unemployment rate was highly fluctuated throughout these 15 years. As it shown in the graph, the unemployment rate was fluctuated in a stationary which contrary as housing price index went up and down inconsistently. Unemployment rate was moving in a line and passed through the housing price index throughout the years. In year 2009, unemployment rate went along with the lower rate compared to housing price index which moving above unemployment rate in the following years. This is due to increase in income tends to increase the buying power of consumer and lower the unemployment rate. When the unemployment rate is low, hiring cost in construction field become higher and resulted higher housing price.

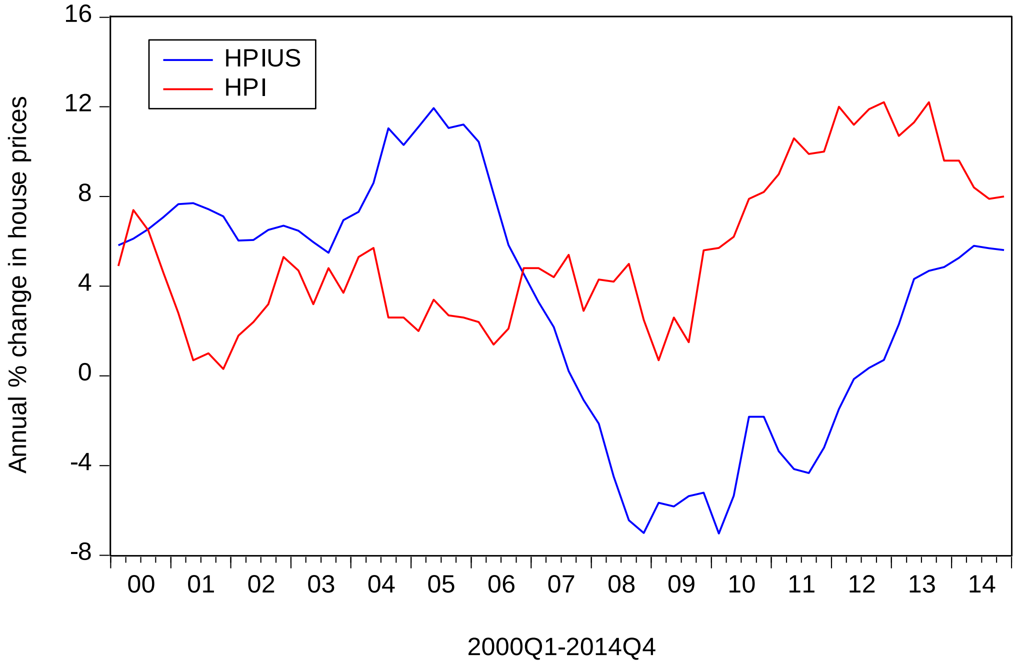
Figure 4.1.4: Relationship between three independent variables (UNEM, RGDP, LR) and Annual Growth Rate of House Prices (HPI).



Source: Jabatan Penilaian Dan Perkhidmatan Harta; International Monetary Fund Data

The graph above indicates the relationship between unemployment rate (UNEM), lending rate (LR), real gross domestic product (RGDP) and annual growth rate of housing price (HPI) in 2000 to 2014 in quarterly. The highlighted point in this graph was the intersection point for the previous three graphs. In the first quarter of 2010, the HPI was increasing and the RGDP was moving together with it, however LR and UNEM were below the (HPI).This phenomena can be investigated by economist yet is consistent with the estimation in this research. Moved to the next quarter, there was anomaly phenomena showed between RGDP and HPI where HPI was moving in opposite direction with RGDP. This is due to the slower improvement in external demand and scatting low base effect recovery of economy after financial crisis in 2008 (Bank Negara Malaysia, 2010).

Figure 4.1.5: Comparison of the Changes of Annual Growth Rate in House Price Index between Malaysia and United State



Source: Jabatan Penilaian Dan Perkhidmatan Harta; Federal Housing Finance Agency

The line graph depicts the comparison of annual growth rate housing price index (HPI) between United State (HPIUS) and Malaysia (HPI) in quarterly from 2000 to 2014. It can be seen from the graph, both countries presents different trend throughout the years In the first three years, the changes of housing price index in United State went up and down within 1 percent but there was approximately 3 percent in Malaysia. Besides this, rate of housing price index in United State was mostly higher than in Malaysia in first three years. It was a hit between Housing price index in United State and Malaysia in the fourth quarter of 2006 while housing price index in US was declining and Malaysia was fluctuating for the remaining years. During 2005 to 2008, there was an increasing trend changed in housing price index in US but fluctuated in Malaysia. The changes of housing price index went up and down in an increasing trend in both countries but the gap between Malaysia and United State were high. The housing price index in US was below Malaysia after the hit in 2006.

4.2 Unit Root Test

The result of unit root test was presented in table 4.2 by using Augmented Dickey – fuller (ADF) test and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) was used as the compliment of ADF test. We test the unit root in level and included trend and intercept in test equation at first. After that, we conducted again the same test by setting the first difference form instead of level form to different the non-stationary and transform to stationary data. The optimal number of lag is based on the minimum SIC (Schwarz Information Criterion). Whereas we were using New-West Banwidth to conduct the KPSS (Kwiatkowski-Phillips-Schmidt-Shin) test.

In Augmented Dickey-Fuller (ADF) test, we set the null hypothesis of a unit root or non-stationary and no unit root or stationary in an alternative hypothesis, we reject null hypothesis when the T-statistics is higher than critical value in right tail test or lower than critical value in left tail test, otherwise do not reject null hypothesis. Based on the result in Table 4.1, there were two variables showing stationary which is real gross domestic product and unemployment rate except lending rate which is not significant in reject null hypothesis in significance level 1 percent, 5 percent and10 percent. Therefore, we conclude that there is one unit root existed in the model. Due to the non- stationary result in lending rate, we proceed to the first difference level form for this variable in ADF test. At this time, lending rate showed stationary and we concluded it there is a unit root in the model.

Whereby KPSS test is intended to compliment, unit root test for ADF test. By testing both the unit root hypothesis one can distinguish series that appear to be stationary, series that occurred unit root and series for which data are not sufficiently informative to be sure whether they are stationary or integrated. The null hypothesis in KPSS test is inversely with ADF test, which is no unit in null hypothesis. The decision rule is rejects when the T-statistics is higher than critical value, otherwise do not reject it. Based on the result showing in the table 4.1, the result showed unanimous as ADF test which do not reject null hypothesis, and concluded it there were almost stationaries in all variables in significance level at 1 percent, 5 percent and 10 percent except unemployment rate which reject null hypothesis at 5 percent and 10 percent significance level.

Since both tests were not consistent, we proceed to the more powerful test which is Elliot-Rothenberg-Stock Point-Optimal (ERS) to confirm with the existing trend components in a model. ERS proposed a modified ADF t-statistic by using GLS detrend data. We fix unit root in the null hypothesis and no unit root in null hypothesis, we reject null hypothesis when the P-statistics is higher than critical value in 1 percent, 5 percent and 10 percent significance level. After conducted the ERS test, we found that the result shows inversely in ADF test and KPSS test. Real gross domestic production and unemployment rate showed significance to reject null hypothesis and we concluded these two variables are consists of unit root or non-stationary. However, it was insignificance to reject null hypothesis in lending rate and concluded it has no unit root.

Table 4.2 Result of Unit Root Test

Please refer to page 91- Appendix 4.23

4.3 Auto -Regressive Distributed Lag

After three methods of unit root checking, we proceeded to the Auto Regression Distributed Lag (ARDL) model to examine the long run relationship between the dependent variable and independent variables. In previous test, real GDP and unemployment are I(1) or unit root, while lending rate is I(0) in Elliot-Rothenberg-Stock Point-Optimal (ERS) unit root test. Since the model comprises I(0) and I(1) variables, we suggested ARDL model to be used in examining the long run relationship between dependent and independent variables. Therefore, we do not need to accurate identification of the underlying data.

Table 4.3, part I shows the result of the long run relationship between housing price index and fundamental of housing prices. We first run the ARDL test by selecting the lag according to Akaike Info Criterion. The null hypothesis was set to reject when the p-value is lower than α=0.05. The result showed all variable were significant in the test, hence we concluded it have co-integrate with housing price. Besides, the result stated that, lending rate and unemployment are negative related to the housing prices due to the negative coefficient in the regression, which is (-0.7898) and (-1.6220), whereas, real GDP showed positive relationship with annual growth rate of housing prices index which can be seen from the positive coefficient (0.1722) in the regression. The adjusted R- square (0.3065) shows the estimated goodness of fit.

To make sure all the variables in ARDL model are valid and accurate, we continue with a series of diagnostic checking which includes Jarque-Bera normality test, Breusch-Godfrey Serial Correlation LM Test, ARCH Test, and Ramsey Reset test are applied in the model. We set no autocorrelation in null hypothesis and autocorrelation in an alternative hypothesis. The decision rule for the test is rejects null hypothesis when the p-value is less than α=0.05, otherwise do not reject null hypothesis. We conducted Breuch-Godfey Serial Correlation LM test for residual checking and it result no autocorrelation happened in the model due to p-value (0.4738) is higher than the α=0.05, therefore we do not reject null hypothesis. To check whether the residual is homo or different, we conducted heteroskedasticity test by using ARCH test to verify it. The ARCH test regresses the squared residuals on lagged squared residuals and a constant. The p-value showed (0.2077) which is higher than α=0.05, therefore we do not reject null hypothesis and concluded the residual is same all the time. Normality test too showing the p-value is (0.6449) which is higher than α=0.05, therefore we do not reject the null hypothesis and conclude the model is normal. Lastly, to check the stability in this model, we have conducted Ramsey –Reset test by setting no specification error in null hypothesis and specification error exist in an alternative hypothesis. The decision rule is same as the autocorrelation test, and concluded the model is stable due to p-value (0.4167) is higher than α=0.05. The result of diagnosis checking for this model also demonstrated in Table 4.3 part II.

To double confirm with the co-integrated occurred in the model, we test the residual from ARDL model. We applied Augmented-Dickey-Fuller (ADF) to test for residual and set the null hypothesis of a unit root or non-stationary and no unit root or stationary in an alternative hypothesis, we reject null hypothesis when the T-statistics higher than critical value in right tail test or lower than critical value in left tail test, otherwise do not reject null hypothesis. The result is shown in Table 4.3.1, we reject the null hypothesis due to the T-statistics is lower than critical value in left tail test and conclude the residual is stationary yet the model is not spurious. The adjusted R-square (0.4895) represent the goodness fit of the model.

After confirmed the residual is stationary, we checked again the residual graph to verify the residual is I(0) variable. The graph is shown in figure 4.3.1 which indicates the residual is stationary when the fitted value and actual value are moving in parallel line, ultimately we can conclude there were co-integrated between dependent and independent variables.

Table: 4.3 ARDL Model Part I

Variables	Coefficient	T-statics	Probability
HPI(-1)	-0.3066	-3.5699	0.0008***
LR(-1)	-0.7898	0.2836	0.0076***
RGDP(-1)	0.1722	1.9685	0.0547*
UNEM(-1)	-1.6220	-2.0838	0.0424**
Adjusted R-squared	0.306541		
Standard Error of Regression	1.187109		
F-statistic	4.149581		
Probability(F-statistic)	0.000763		

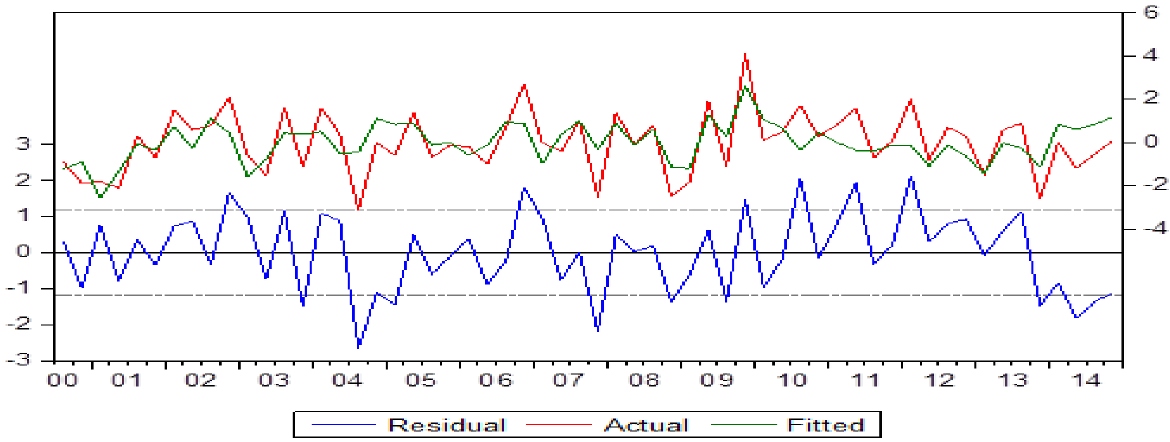
Table: 4.3 ARDL Model Part II

Part II	Diagnosis checking
1) Autocorrelation (Breusch-Godfey Seial Correlation LM Test)	
Prob. Chi-Square(2):	0.4738
2) Jarque-Bera normality test	
Prob.	0.6449
3) ARCH Test	
Prob. Chi-Square(1)	0.2077
4) Stability (Ramsey-Reset test)	
Prob.	0.4167
Note: Figures in parentheses ( ) refer to the selected lag length. The number of lags was selected automatically based on Akaike Info Criterion (AIF) ***, ** and * indicates the significant at 1 percent, 5 percent and 10 percent significance level.	

Table 4.3.1 Unit Root Test for Residual (ADF)

Data period:2000-2014 quarterly, observation (after adjustment)=55	
T-statistics: -7.396303	Prob. : 0.0000
Adjusted R-squared : 0.489542	
S.E. of regression: 1.119718	
Note: In ADF test, null hypothesis was set non stationary series or contains a unit root and alternative hypothesis was a stationary series. The rejection of null hypothesis is based on MacKinnon (1996) one-sided p-values. Reject null hypothesis when the T-statistics is greater than critical value or less than α=0.05	

Figure 4.3.1 ARDL Residual



4.4 Cointegrated regression

After confirmed the long run relationship between annual growth of housing price index and fundamental of housing price by using ARDL test, following with the co-integration regression with three methods which is Fully Modified Least Squares (FMOLS), Canonical Co-integrating Regression (CCR), and Dynamic Least Square (DOLS). FMOLS is attributed to Phillips and Hansen (1990) to give optimal estimates of co-integrating regressions. It modifies least squares to explicate the serial relationship between dependent and independent variables. DOLS is designed by Saikkonen (1991) and Stock and Watson (1993). It used to construct an asymptotically accurate and efficient estimator in the co-integrating system. In these three test, the long run covariance estimate is based on Bartlett kernel, Newey-West fixed bandwidth=4.0000. The null hypothesis is clearly demonstrated in the model which is βLR=βUNEM=βRGDP=β=0 while the alternative hypothesis stated that at least one of the βi is ≠0, where i =LR, UNEM, RGDP. The decision rule is stated reject null hypothesis when the p-value is lower than significant level at 1 percent, 5 percent, and 10 percent, otherwise do not reject null hypothesis. The result is shown in Table 4.4

and three of them showed consistent result which indicated that unemployment rate, real GDP and lending rate were significant in long run relationship with housing prices. Other than that, three long run methods yet showed consistent result in explaining the coefficient between dependent variable and independent variables. Three of them indicated lending rate and unemployment rate have a negative long run relationship towards annual growth rate of housing price index. However, real gross domestic product has a positive relationship with annual growth rate housing price index.

Although we have observed the long run equilibrium in the fundamentals of housing prices, we also interest to consider the short run evolution of the variables. Therefore, Error Correction Model (ECM) was applied to observe the short run relationship between variables. This model allows us to adjust and correct the deviation in short term disequilibrium relationship between the variables to achieve the long run equilibrium. First, we take into the residual into the model and it results negative in the residual and significant in 5 percent significance level due to p-value (0.0015) is lower than α=0.05. Therefore, the null hypothesis of no relationship has been rejected, and thus concluded it that there is significant in the model and co-integrated occurred. Besides, the negative coefficient in residual (-0.2836) showed the whole system is getting adjusted long run equilibrium at the speed up of 28.36 percent. In this model, unemployment rate and real gross domestic product were significance in significance level 5 percent and 10 percent and the null hypothesis of no relationship has been rejected, we concluded it has short run relationship with the housing price. By looking at the independent variables coefficient presented in these three long run method, unemployment showed the highest among the other variables which brought up the great impact to the housing prices. This result was showed up in Table 4.4.1 Part I.

When the ECM was conducted, a series of diagnosis checking such as Jarque-Bera normality test, Breusch-Godfrey Serial Correlation LM Test, ARCH Test, and Ramsey‟s misspecification test are applied in the model and the results showed in Table 4.4.1 part II. At the end of the test, the model showed valid and accurate due to no autocorrelation, stable, residual is normal distributed and same variance over time.

Table 4.4: Long Run Relationship between Dependent and Independent Variables

Variable	FMOLS		CCR		DOLS	
Observation after adjustment	59		59		57	
	Prob.	Coef.	Pro.	Coef.	Pro.	Coef.
LR	0.0000 ***	-2.1685	0.0000 ***	-2.1602	0.0005 ***	-2.0288
UNEM	0.0009 ***	-4.8790	0.0196 **	-5.2228	0.0407 **	-7.5442
RGDP	0.0109 **	0.3827	0.0020 **	0.3787	0.0015 ***	0.5216
Adjusted R-square	0.6318		0.6219		0.7932	

Note: The long run covariance estimate is based on Bartlett kernel, Newey-West fixed bandwidth=4.0000.

***, ** and * indicates the significant at 1 percent, 5 percent and 10 percent significance level.

Table 4.4.1 Error Correction Model

Variable	Coefficient	T-statistics	Probability
D(LR)	-1.2163	-0.9323	0.3554
D(UNEM)	-1.2470	-2.4166	0.0192**
D(RGDP)	0.2487	2.9673	0.0045***
U(-1)	-0.2835	3.3430	0.0015
F-statistic	6.0392		
Prob(F-statistic)	0.0001		
Part II	Diagnosis checking		
Breusch-Godfrey Serial Correlation LM Test			
Prob. Chi-Square(2)	0.3562		
Jarque-Bera normality test			
Prob.	0.7541		
ARCH Test			
Prob. Chi-Square(1)	0.0611		
Ramsey-Reset test			
Prob. F-Test	0.3123		
Note: *, ** and *** indicate significance at 1 percent, 5 percent and 10 percent significance level, respectively.			

4.5 Granger Causality

Granger causality is used to capture the dynamic information the Pairwise Granger Causality Tests between dependent and independent variables. In the simplest terms, it is used to estimate the predictive information contained in independent variables on dependent variable. The Table 4.5 shows the Pairwise Granger Causality Tests between dependent and independent variables. From the result we obtained, lending rate and real gross domestic production were significant granger caused annual growth rate of housing prices index in 10 percent significance level. Meanwhile, real gross domestic product does granger cause lending rate in 10 percent significance level.

When the lending rate is high, the housing price goes low, vice versa. It showed negative relationship between lending rate and housing price. However, real gross domestic showed positive relationship with housing prices. Both moving in the same direction, when the real gross domestic product is high, it means the economic is well performed in a country and as a result, housing price increased too.

Table 4.5 Pairwise Granger Causality Test

	HPI	LR	DUNEM	DRGDP
HPI	--------------	0.3288	0.8700	0.1152
LR	0.0095*	--------------	0.2567	0.1057
DUNEM	0.6273	0.5821	------------	0.5943
DRGDP	0.0840*	0.0007	0.5838	------------
Note: *indicate significance at 10 percent significance level, respectively.				

4.6 Overvaluation of House Price

Lastly, we would like to capture the difference between the actual and the fitted value to examine the overvaluation of housing price. Below are the population regression and the estimated regression. The red colour line represents the actual value while the green line represents the fitted value and the blue line represents the difference between actual and fitted value. Overvaluation of housing prices occurred when the actual value is higher than the fitted value, and it contracted to the

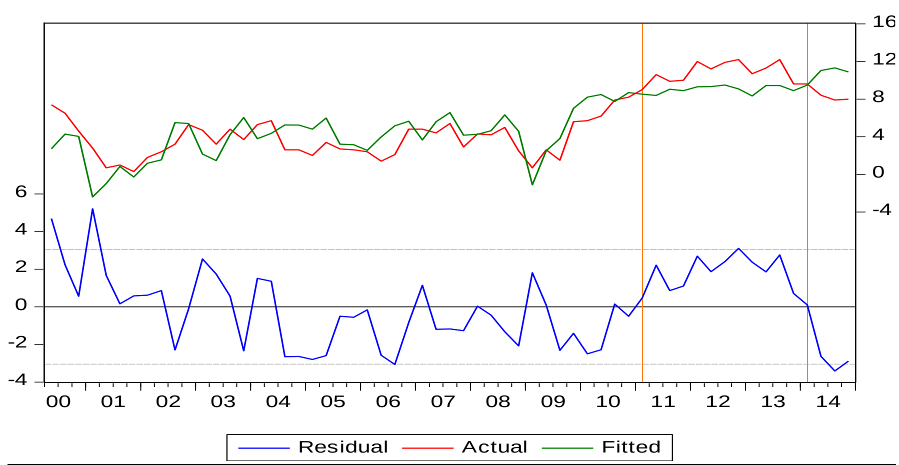
$$HPI_t = 32.47438 - 2.168458LR_t - 4.879037UNEM_t + 0.382698RGDP_t$$

$$\widehat{HPI} = Fitted\ Value$$

$$HPI_t - \widehat{HPI} = Overvaluation$$

From figure 4.6, we will have a positive residual graph when the red actual line was higher than the green fitted line, vice versa. From the graph, actual line and fitted line mostly move together thus we consider there was co-integrate between them. Further look at the blue residual line, it moved within the range thus we consider it was co-integrate and stationary. Overvaluation occurs when the actual value is higher than fitted value, and it did happen between 2011 and 2013 where the actual value was higher than the fitted value.

Figure 4.6 FMOLS Actual, Fitted and Residual Graph



CHAPTER 5: DISCUSSION, POLICY IMPLICATION AND RECOMMENDATION

5.0 Introduction

In this chapter, summary of some major findings in this study and some policy implication is discussed to improve the housing price through different macroeconomic variables such as real gross domestic product, lending rate, and unemployment. Besides, some limitation faced in this study is highlighted and some recommendation is suggested for future study.

5.1 Summary

The housing prices indicate the economic performance in Malaysia because it deals with many significant economic variables. With today economics, the housing prices in Malaysia keep rising and worried many young people with the tremendous increase in housing prices, consequently facing incapable to buy a house for themselves. This issue unconsciously raised Malaysian citizen attention and driven us to find out the real fundamental variables that affect the rising in housing prices and arise of overvaluation of housing prices by using the time series data from 2000-2014 in quarterly for this research.

A series of test have been conducted and the results we obtain are covered in our previous chapter. Based on our result, it clearly showed existed of co-integrated between the dependent variable and independent variables. Real Gross Domestic Product, Unemployment rate and Lending rate are significantly had a long run relationship with housing prices meanwhile Unemployment rate and Real Gross

Domestic Product are significantly affecting housing price in short run. Furthermore, Lending rate and Real Gross Domestic Product are significantly do granger caused housing prices. To capture the overvaluation of house prices in Malaysia, we subject the fundamental house price from real house price, and found overvaluation occurred during 2011-2013.

As the result presented in the early chapter, Lending Rate and Unemployment rate are significantly having negative relationship towards housing prices however Real Gross Domestic Product have a positive relationship with housing price. When the lending rate is high, the housing price goes low, vice versa. Same case applied to the unemployment rate, the housing rate is high when the unemployment rate is low. Lower in unemployment rate indicates the country have high employment rate, citizen are enrolled in contributing output which may enhance the economic growth and hence the living of standard also upgraded. Whereby higher Real Gross Domestic Product represents well performance in a country and hence increased in housing price.

Referring to the result we have obtained, it is consistent with our estimation in this research from the beginning, and we are strongly believed these three variables are the real fundamental variables to affect the movement of housing price. Unemployment rate bring much impact in affecting housing prices due to higher coefficient among the variables.

5.2 Policy Implication

Due to the rapid increase of housing price in Malaysia, the households with the lower-middle income may not afford to own a house. The house price increase above the market price which is called speculative. Under a free market, the government cannot control on the selling price but government can intervene into the market by producing the house at a lower price and sell into the market. This will force the market to reduce the selling price in order to sell off the houses. At the end, the overall house price will be reduced.

Besides, the government can encourage more FDI into our country to create more job opportunity. When the job opportunity increase, the citizen can easily get job. Until the time when the job is more than the unemployment, it will lead to the income increase. When the income increase, the affordability to own a house will be increase.

The government should take more care on the middle-low income households or the first home ownership citizen by giving them a subsidy. According to Malaysia's budget 2015, the government has implement a Youth Housing Scheme for the first-time home ownership for the married youth aged between 25 to 40 years old. This housing scheme provide a 100 percent loan amount of the purchase price and it only open for 20,000 buyers at first come first serve basis. The lending rate for this programme was same with the normal lending rate offer by the banks. When the loan amount increase, the cost of borrowing will be increase and the monthly repayment will also increase. Government may offer a lower mortgage rate compare to the normal rate in order for them to reduce the burden on the cost of borrowing and it may also reduce the default risk for loan repayment.

5.3 Limitation and Recommendation

Along the study of examine the fundamental determinants of Malaysia house price, we found several limitations.

- Lack of data is one of the limitation we faced. We had difficulties on getting quarterly data from 1988-1999. Thus, it forced us to shorten the time period to 15 years 2000-2014 for 60 observations. Due to this problem we are also forced to give up some variable with research value, for example, Real interest rate and households' income.
- Housing Price is not only affected by macroeconomic/fundamental factors, but it also can be affect by microeconomic factors, for example: household's income and education level. Besides, our research just focus on the demand side factors since the supply factors are normally difficult to control and contain many of uncertainty. Future researchers are encouraged to examine on microeconomic factors.
- Residential properties are the only type of real estate we examine in our research. Other types of property like industrial property and commercial property may have a different impact with macroeconomic variables in Malaysia. So, future researchers are encouraged to investigate on more types of real estate.

REFERENCES

Adams, Z., & Füss, R. (2008). Macroeconomic Determinants of International Housing Markets. *Journal of Housing Economics, 19*(1), 38-50.

Amarawickrama, H. A., & Hunt , L. C. (2007). Electricity demand forSri Lanka: a time series analysis. *Energy, Elsevier*, *33*(5), 724-739.

Andres, J., & Arce, O. (2012). Banking competition, housing prices and macroeconomic stability. *The Economic Journal*, *122*(565), 1346-1372.

Arrazola, M., Hevia , J., Romero-Jordan, D., & Sanz-Sanz, J. (2015). Long run supply and demand elasticities in the spanish housing market. *Journal of Real Estate Research, 37*(3), 371-404.

Bordo, M. D. (1998). Commentary. *Review*, 77-82.

Callen, T. (2008). What Is Gross Domestic Product? *Finance and Development*, *45*(4).

Central Intellingence Agency. (n.d.). *The World Factbook*. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/fields/2147.html

Chin, T.-L., Ng, F., & Chau, K. (2004). The impact of the Asian Financial Crisis on the pricing of condominiums in Malaysia. *Journal of Real Estate Literature*, *12*(1), 33-39.

Chong , P. K., & Ramasamy, M. (2016). *Malaysia Trims 2016 Growth Forecast to 4%-4.5%*. Retrieved from Bloomberg: http://www.bloomberg.com/news/articles/2016-01-28/malaysia-trims-growth-expectations-as-oil-drop-weighs-on-economy

Chui, L., & Chau, K. (2005). An Empirical Study of The Relationship Between Economic Growth, Real Estate Prices and Real Estate Investments in Hong Kong. *Surveying and Built Environment, 16*(2), 19-32.

Clark, A., & Daniel, T. (2006). Forecasting South African house prices. *Investment Analysts Journal*, *64*, 27-34.

Department of Statistics and Ministry of Finance, Malaysia. (2015, April). *Gross Domestic Product By Kind Of Economic Activity At Constant 2005 Prices (RM million)2005-2015.* Ministry of Finance, Malaysia. Retrieved from Kementerian Kewangan Malaysia: http://www.treasury.gov.my/index.php?option=com_content&view=article&id=2702&Itemid=2481&lang=ms

Depertment of Statistic Malaysia. (2015). *Population statistics.* Retrieved from https://www.statistics.gov.my/index.php?r=column/ctimeseries&menu_id=NHJlaGc2Rlg4ZXlGTjh1SU1kaWY5UT09#

Dietz, R. (2015, January 14). *Good Signs for Housing in 2015*. Retrieved from US News: http://www.usnews.com/opinion/economic-intelligence/2015/01/14/housing-market-showing-signs-of-a-good-2015

Duke, J. (2015, June 2). *Three things that could trigger a house price crash: interest rates, unemployment, the dollar*. Retrieved from Domain: http://www.domain.com.au/news/three-things-that-could-trigger-a-house-price-crash-interest-rates-unemployment-the-dollar-20150604-ghes4d/

Fang , W. S., Wang, K. M., & Nguyen, T.-B. (2008). Is real estate really an inflation hedge? Evidence from Taiwan. *Asian Economic Journal, 22*(2), 209-224.

Flavin, M., & Yamashita, T. (2002). Owner-occupied housing and the composition of the household portfolio. *The American Economic Review, 92*(1), 345-362.

Fox, R., & Tulip, P. (2014). *Is Housing Overvalued?* Reserve Bank Of Australia.

Fry, R. A., Martin, V. L., & Voukelatos, N. (2010). Overvaluation in Australian housing and equity market: wealth effects or monetary policy? *The Economic Record, 86*(275), 465-485.

Gallin, J. (2003). *The Long-Run Relationship between House Price & Rentals Washington: Federal Reserve.*

Geerolf, F., & Grjebine, T. (2014). Assessing house price effects on unemployment dynamics. *CEII Working Paper*, 1-55.

Geffner, M. (2014, January 21). *Do rising rates trigger lower house prices?* Retrieved from Bankrate: http://www.bankrate.com/finance/mortgages/rising-rates-lower-house-prices.aspx

Glindro, E. T., Subhanij, T., Szeto, J., & Zhu, H. (2011). Determinants of house prices in nine Asia Pacific economies. *International Journal of Central Banking*, 163-204.

Gujarati, D. N. (2008). *Basic Econometric.* New York: McGraw-Hill Irwin.

Guo, M., & Wu, Q. (2013). The empirical analysis of affecting factors of Shanghai housing prices. *International Journal Of Business And Social Science, 4*(14), 218-223.

Harris, R., & Sollis, R. (2003). *Applied time series modeling and forecasting.* West Sessex: Jony Wiley and Sons, Inc.

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

Himmelberg, C., Mayer, C., & Sinai, T. (2005). *Assessing High House Prices: Bubbles, Fundamentals, and Misperceptions.* New York: Federal Reserve Bank of New York.

Holgersson, H., & Shukur, G. (2004). Testing for multivariate heteroscedasticity. *Journal of Statistical Computation and Simulation, 74*(12), 879-896.

Hood, J. k. (1999). The determinants of homeownership: an application of the human capital investment theory to the home ownership decision. *The Park Place Economist, 7*(1), 40-50.

Hubbard, R. G., & Mayer, C. J. (2009). The morgage market meltdown and house prices. *The B.E. Journal Of Economic Analysis & Policy, 9*(3), 1-45.

Ibrahim, M. H., & Law, S. H. (2014). House prices and bank credits in Malaysia: An aggregate and disaggregate analysis. *Habitat International, 42*, 111-120.

Inoguchi, M. (2011). Influence of real estate prices on domestic bank loans in Southeast Asia. *Asian-Pacific Economic Literature*, *25*(2), 151-164.

Jacobsen, D. H., & Naug, B. E. (2005). What drives house prices? *Economic Bullentin*, 29-41.

Kirby, A. M. (1976). Housing market studies: a critical review. *Houses and People in the City*, *1*(1), 2-9.

LaCour-Little, M., Yu, W., & Sun, L. (2014). The role of home equity lending in the recent mortgage crisis. *Real Estate Economics*, *42*(1), 153-189.

Lam, B. (2015). *U.S. Housing: An Economic Bright Spot After a Wobbly Week.* Retrieved from The Atlantic: http://www.theatlantic.com/business/archive/2015/08/us-housing-prices/402544/

Larock, D. (n.d.). *Do Higher Interest Rates Cause Lower House Prices?* Retrieved from Dave The Mortagage Planner: https://www.integratedmortgageplanners.com/blog/mortgage-market-updates/do-higher-interest-rates-cause-lower-house-prices/

Leslie, S. (2016). *Citi: Risk of global recession rising.* Retrieved from CNBC: http://www.cnbc.com/2016/02/25/citi-risk-of-global-recession-rising.html

Liew, C., & Haron, N. A. (2013). Factors influencing the rise of house price in Klang Valley. *International Journal Of Research In Engineering And Technology*, *2*(10), 216-272.

Lum, S. K. (2004). Property price indicates in the commonwealth. *Hournal of Property Investment & Finance*, *2*(1), 25-54.

Mahon, J. (2015, March 4). *The relationship between unemployment and property prices*. Retrieved from Investors Edge: http://www.investorsedge.com.au/property-resources/investment-tips/the-relationship-between-unemployment-and-property-prices/

Mar Iman , A. H. (2012). *Basic aspects of property market research (revised edition).* Malaysia: Penerbit UTM Press.

Mayer, C. (2011). *Housing Bubble: A Survey*. Columbia: Federal Reserve Bank of New York.

Mcquinn, K., & O'Reilly, G. (2006). *Assessing the role of income and interest rates in determining house prices.* Central Bank and Financial Services authority of Ireland: Financial Stability Report.

Minstry of Finance Malaysia. (2013). *Financial Budget 2014.* Minstry of Finance Malaysia. Retrieved from http://www.treasury.gov.my/pdf/budget/speech/bs14.pdf

Meidani, N. A., Zabihi, M., & Ashena, M. (2011). House prices, economic output, and inflation interactions in Iran. *Research In Applied Economics, 3*(1), 1-13.

Mernagh, M. (2014, January 28). *House prices and unemployment: a story of linked fortunes*. Retrieved from Significance: https://www.statslife.org.uk/economics-and-business/1339-house-prices-and-unemployment-a-story-of-linked-fortunes-ireland

Numbeo. (2015). *Asia: Property prices index by country 2015 mid-year.* Retrieved from Numbeo: http://www.numbeo.com/property-investment/rankings_by_country.jsp?title=2015-mid&region=142

Ogaki, M., & Park, J. Y. (1997). A cointegration approach to estimating preference parameters. *Journal of Econometrics, 82*(1), 107-134.

Ong , T. S. (2013). Factors affecting the price of housing in Malaysia. *An Online International Monthly Journal, 1*(5), 414-428.

Ong, T. S. (2013). Factors affecting the price of housing in Malaysia. *Journal Of Emerging Issues In Economics, Finance and Banking, 1*(5), 414-429.

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

Pesaran, M. H., & Pesaran, B. (1997). *Working with Microsoft 4.0: Interactive econometric analysis.* London: Oxford University Press.

Pesaran, M. H., & Shin, Y. (1999). *An autoregressive distributed lag modeling approach to cointegration analysis.* Cambridge: Cambridge University Press.

Pinter, G. (2015). House prices and job losses. *Bank Underground*, 1-65.

Posedel, P., & Vizek, M. (2009). House price determinants in transition and EU-15 countries. *Post-Communist Economies*, *21*(3), 327-343.

Pour, M. S., Khani, P. N., Zamanian, C., & Barghandan, K. (2013). Specifying the effective determinants of housing price volatilities in Iran. *Journal of Economics and Business, 6*(2), 15-20.

Pour, M., Khani, P., Zamanian, G., & Barghandan, K. (2013). Specifying the effective determinants of house price volatilities in Iran. *Journal of Economics and Business, 11*(2), 15-20.

Qingyu, Z. (2010). Regional unemployment and house price determination. *MPRA*, 1-20.

Ramazan, S., Bradley, T., & Bahadir, A. (2007). Marcoeconomic variables and the housing market in Turkey. *Emerging Markets Finance & Trade, 43*(5), 5-19.

Rebi, E. (2014). Mortgage lending and house prices in Albania - a co-integrated analysis based on VECM. *Eastern Journal Of European Studies, 5*(1), 79-98.

Sa, F., Towbin, P., & Wieladek, T. (2010). Low interest rate and housing booms: the role of capital inflows, monetary policy and financial innovation. *Bank Of England*, 1-26.

Selim, H. (2009). Determinants of house prices in Turkey: Hedonic regression versus artificial neural network. *Expert Systems With Applications, 36*(2), 2843-2852.

Shiller, R. (2005). *Irrational Exuberance (2nd ed).* Princeton: Princeton University Press.

Sin Chiew Daily. (2015). *The right timing to buy house*. Retrieved from Sin Chiew Daily: http://property.sinchew.com.my/node/3299

Snowdon, B., & Vane, H. (2002). An Encyclopedia of Macroeconomics. Cheltenham, UK: Edward Elgar Publishing.

Svedberg, C., & Trygger, E. (2008). Swedish house prices and fundamentals: a study of the price development of small houses from 1986-2005. *Stockholm School of Economics*, 1-45.

Trading Economics. (n.d.). *Malaysia bank lending rate*. Retrieved from Trading Economics: http://www.tradingeconomics.com/malaysia/bank-lending-rate

The Star. (2015). *Malaysian banks reducing staff*. Retrieved from The Star Online: http://www.thestar.com.my/business/business-news/2015/09/17/banks-rightsizing-staff/

The Star. (2016). *Oil price slump continues to spook investors in Malaysia*. Retrieved from The Star Online: http://www.thestar.com.my/business/business-news/2016/02/04/oil-price-slump-continues-to-spook-investors/

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

Valuation Property Services Department and MOF Malaysia. (2015). *Property market report first half 2015.*

Vermeulen, W., & Ommeren, J. V. (2009). Compensation of regional unemployment in housing markets. *Economica, 76*, 71-88.

Xu, L., & Tang, B. (2014). On the determinants of UK house prices. *International Journal Of Economic And Research, 5*(2), 57-64.

Yan , S., & Ge , J. (2014). Direct Government Control Over Residential Land Supply and Its Impact on Real Estate Market: Evidence from Major Chinese Market. 20th Annual PRRES conference. Christchurch, New Zealand. *20th Annual PRRES conference.* . Christchurch, New Zealand.

Yip , C. Y., Wong, W. C., & Woo, K. H. (2016). Detecting Malaysian Housing Bubbles. *American Journal of Applied Sciences*.

Zhu, Q. (2010). Regional Unemployment and House Price. *Munich Personal RePEc Archive*, 1-20.

Zou, G. L., & Chau , K. W. (2015). Determinants and sustanability of house prices: The case of Shanghai, China. *sustainability, 7*, 4525-4548.

Appendix 2.1: Table 2.1: Summary Table for Literature Review

Title	Authors	Date	Data	Methodology	Conclusion
House Price and Job Loses	Gabor Pinter	2015	Consumption, output, house price index, consumer price index, population, credit and unemployment from year 1983Q3-2014Q2 in UK	Bayesian VAR model, DSGE model, regional static panel model	House price shock cause by 10-20% of output fluctuations and about 20-30% of fluctuations unemployment and job separation rates. (-ve relationship)
On the determinant of UK House Prices	Lu Xu, Bo Tang	2014	Nominal house prices as dependent variable, construction cost, credit, GDP, household disposal income, interest rate, money supply and unemployment rate as independent variable. Data range is from 1971-2012 quarterly basis.	Cointegration approach, error correction model, The EG two step method, ADF test, PP test, KPSS test.	Positive long run relationship existence between house prices and construction cost, credit, GDP, interest rate and unemployment rate, whereas disposal income and money supply has a negative impact to the house prices.
What drives house prices?	Jacobsen D.G. & Naug B.E.		Household's total wage income, CPI, unemployment rate, household debt, total population, interest rate from 1990Q1-2004Q1	Graphical analysis	Interest rates, housing construction, unemployment and household income are the most important explanatory for house price. (-ve relationship)

Regional Unemployment and House Price Determination	Zhu Qingyu	2010	UK panel data of house prices, unemployment, income, interest rate and housing starts from 1997Q1-2011Q3	Panel fixed effect, pool panel, OLS	Richer region have house prices which are more sensitive to unemployment compare with poorer regions. Falling unemployment will raising house price.
Compensation of Regional Unemployment in Housing Markets	Vermeulen W. & Ommeren J.V.	2007	The average house price per square meter, unemployment rate, income (measured by either GDP per capita or median disposal household income) from period of 1999 to 2003	Survey from 142 cities in 12 countries.	Strong negative correlation between unemployment and house prices.
Assessing House price Effects on Unemployment Dynamics	Geerolf F. & Grjebine T.	2014	House price data from 1970-2010 (annual data for 34 countries), unemployment, percentage of active population, percentage of total employment.	ADF test, PP test, OLS, 2SLS	A 10% depreciation in house prices yields to a 3.4% increase in the unemployment rate.
The empirical analysis affects factors of Shang Hai housing price.	Mingzhen Guo & Qing Wu	2013	CPI, GDP, population, commercial housing, disposable income, annual disposal income per capita, lending rates	Regression model, breusch-godfrey serial correlation LM test	-it shows that housing prices are inversely related with loan interest rates, and have a positive relationship with GDP, and both of these two factors have a great impact on housing prices.

Determinants of House Prices in Nine Asia-Pacific Economies	Eloisa T. Glindro, Tientip Subhanij, Jessica Szeto & Haibin Zhud	2011	Resident property prices, real GDP, population, construction cost index, land supply index, mortgage credit-to-GDP ratios, real mortgage rates, real effective exchange rate, stock price index. Quarterly data from 1993-2006		Patterns of national house price dynamics exhibit significant cross-country heterogeneity.(differences in land supply and business environments.) -national house price movements before the onset of the global financial crisis mainly reflected changes in fundamental value so cyclical adjustments towards fundamentals.
Factors influencing the rise of house price in Klang Valley	Cindy Liew & Nurul Azam Haron	2013	Urban migration, foreign immigrant and labour, inflation rate, GDP	survey	Fluctuation in housing market, increasing in construction cost, population growth and increasing demand are factors which give major influence to rise of house price. -44% respondents in opinion, gross domestic product highly increase house price so that it maintains stable and high condition.

House prices, Economic Output, and Inflation Interactions in Iran	Ali A. Naji Meidani, Maryam Zabihi, Malihe Ashena	2011	CPI, real GDP, real house prices and exchange rate	VAR, OLS, Toda-Yamamoto causality procedure, unit root test, ADF test	there is evidence of a significant multidirectional link between house prices, and the macroeconomic factors -The causality tests confirm that GDP and CPI Granger cause house prices, and feedback effects are observed for house prices and GDP
Factor affecting the price of housing in Malaysia	Tze San Ong	2013	GDP, interest rate, inflation, labour force, RPGT and population and housing prices	simple regression model	Empirical results that the gross domestic product (GDP), population and RPGT are the key determinants of housing prices. However, changes in housing prices may not necessarily be influenced by the gross domestic products (GDP), population and RPGT in Malaysia
Specifying the effective Determinants of house price volatilities in iran	Murteza Sanjarani Pour, Parviz Nasir Khani, Gholamreza Zamanian, Kamran Barghandan	2013	Volume of money, CPI, GDP, exchange rate	Engel Granger Co-integration Approach, ADF	The relationship between this alternative market and volatilities proxy was negative and significant(because instability of alternative markets) - pertaining to the gross domestic products variable symptom, it can be said that increase in the GDP means grater supply of the commodity and therefore lower price. As a result, uncertainty in lower.

Forecasting South African House Prices	Clark A.E. & Daniel T.	2006	South African house price, All share index, number of building plans passed, rand merchant bank/bureau for economic research business confidence index, ratio of household debt to disposable income, real GDP, real gold price, number of motor vehicles sales, real oil price, real prime rate of interest, real exchange rate and real transfer const.	ADF test, regression analysis	positive relationship exists between the lagged stock market returns, GDP, transfer costs and house price growth rates; a negative relationship exists between interest rates, exchange rate movements and house price growth rates.
Mortgage lending and house prices in Albania- a co-integrated analysis based on VECM	Rebi E.		Housing price index, mortgage loans provided by the banks, disposal income, interest rate. Range of data from 1998-2012 quarterly basis.	VECM, VAR model	Negative long term relationship between interest rates and house prices however, statistically insignificant.

House prices and bank credits in Malaysia: An aggregate and disaggregate analysis	Ibrahim M.H. & Law S.H.	2013	House price, bank creidit, CPI, real GDP, real bank loan, money market rate(interest rat) data range from 1999Q1-2011Q4	Cointegration test, VECM, granger causality test, ADF, PP test	A negative long run relationship between house price and interest rate and negative responses of both aggregate house price and bank loan to positive interest.
Influence of real Estate Prices on Domestic Bank Loans in Southeast Asia	Inoguchi M.	2011	Resident property price index (Singapore), house price index (Malaysia), real estate price indices (Thailand), bank loan data. data range from 1992-2006	Dynamic panel regression, graphical analysis	Malaysia: the coefficient of the house price index insignificant. The coefficient on the lagged valued is positively significant after the crisis. However, the over-identifying restriction is not satisfied for the regression after crisis. Therefore, result suggest that real estate price did not affect lending pattern of the domestic banks. Singapore & Thailand: the real estate price affected the lending pattern of domestic banks after the crisis.

Low Interest Rates and Housing Booms: The role of Capital Inflow, Monetary and Financial Innovation	Sa F., Towbin P. & Wieladek T.	2011	Nominal interest rateon government debt, real GDP, CPI, current balance to GDP ratio, trade weighted real exchange rate, commodity price index, real credit to private sector, real residential investment, real house prices for 18 OECD countries.	VAR, Bayesian error bands,	If household are highly indebted, risk premia and lending rate are more sensitive to change in the risk free rate, small change in interest rate can have a large effect on their ability to serve the debt. Housing demand become more sensitive to interest rates.
The Mortgage Meltdown, The Economy, and Public Policy	Hunnard R.G. and Mayer C.J.	2009	Percentage change of house price for various countries from 1997 to 2007, real house price, real mortgage rates, house price index, real interest rate, rent , income for various country	Graphical analysis	Real interest rate have a very important impact on housing and real estate prices. Higher mortgage rate will reduce the house price.

Forecasting South African House Prices	AE Clark & T Daniel	2006	Actuaries All Share Index, Number of building plans passed, ratio of household debt to disposable income, GDP, real Gold price, number of motor vehicle sales, real oil price, real prime rate of interest, real land/dollar exchange rate and real transfer costs.	ADF, test statistic, forecasting	Positive relationship exists between the lagged stock market returns, GDP, transfer costs and house price growth rates; a negative relationship exists between interest rates, exchange rate movements and house price growth rates.

Appendix 4.1 Lending Rate Augmented Dickey-Fuller in level test

Null Hypothesis: LR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.554250	0.3022
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LR)
Method: Least Squares
Date: 03/15/16 Time: 19:19
Sample (adjusted): 2000Q3 2014Q4
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LR(-1)	-0.113741	0.044530	-2.554250	0.0135
D(LR(-1))	0.476843	0.117633	4.053651	0.0002
C	0.784781	0.330694	2.373134	0.0212
@TREND("2000Q1")	-0.004902	0.002424	-2.022256	0.0481

R-squared	0.295251	Mean dependent var	-0.052931
Adjusted R-squared	0.256098	S.D. dependent var	0.131590
S.E. of regression	0.113496	Akaike info criterion	-1.447632
Sum squared resid	0.695588	Schwarz criterion	-1.305533
Log likelihood	45.98133	Hannan-Quinn criter.	-1.392281
F-statistic	7.541012	Durbin-Watson stat	2.109223
Prob(F-statistic)	0.000265		

Appendix 4.2 Real Gross Domestic Product Augmented Dickey-Fuller in level test

Null Hypothesis: RGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.676414	0.0020
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP)
Method: Least Squares
Date: 03/15/16 Time: 19:08
Sample (adjusted): 2000Q3 2014Q4
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	-0.369070	0.078922	-4.676414	0.0000
D(RGDP(-1))	0.509571	0.109243	4.664563	0.0000
C	1.839415	0.608592	3.022412	0.0038
@TREND("2000Q1")	0.000738	0.012972	0.056879	0.9549

R-squared	0.385713	Mean dependent var	-0.041724
Adjusted R-squared	0.351586	S.D. dependent var	2.041965
S.E. of regression	1.644276	Akaike info criterion	3.898949
Sum squared resid	145.9967	Schwarz criterion	4.041049
Log likelihood	-109.0695	Hannan-Quinn criter.	3.954300
F-statistic	11.30225	Durbin-Watson stat	1.979033
Prob(F-statistic)	0.000007		

Appendix 4.3 Unemployment Rate Augmented Dickey-Fuller in level test

Null Hypothesis: UNEM has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.509414	0.0001
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UNEM)
Method: Least Squares
Date: 03/16/16 Time: 01:50
Sample (adjusted): 2000Q3 2014Q4
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UNEM(-1)	-0.857499	0.155643	-5.509414	0.0000
D(UNEM(-1))	0.207762	0.130200	1.595709	0.1164
C	3.127486	0.566185	5.523789	0.0000
@TREND("2000Q1")	-0.008604	0.002462	-3.494543	0.0010

R-squared	0.389618	Mean dependent var	-0.008621
Adjusted R-squared	0.355708	S.D. dependent var	0.330488
S.E. of regression	0.265276	Akaike info criterion	0.250379
Sum squared resid	3.800047	Schwarz criterion	0.392478
Log likelihood	-3.260978	Hannan-Quinn criter.	0.305729
F-statistic	11.48974	Durbin-Watson stat	1.894762
Prob(F-statistic)	0.000006		

Appendix 4.4 Lending Rate Augmented Dickey-Fuller in first level test

Null Hypothesis: D(LR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.700788	0.0019
Test critical values:	1% level	-4.124265	
	5% level	-3.489228	
	10% level	-3.173114	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LR,2)
Method: Least Squares
Date: 03/15/16 Time: 19:12
Sample (adjusted): 2000Q3 2014Q4
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LR(-1))	-0.572271	0.121739	-4.700788	0.0000
C	-0.055718	0.034453	-1.617233	0.1115
@TREND("2000Q1")	0.000843	0.000948	0.889843	0.3774

R-squared	0.286690	Mean dependent var	0.000690
Adjusted R-squared	0.260751	S.D. dependent var	0.138474
S.E. of regression	0.119059	Akaike info criterion	-1.368056
Sum squared resid	0.779628	Schwarz criterion	-1.261481
Log likelihood	42.67362	Hannan-Quinn criter.	-1.326543
F-statistic	11.05266	Durbin-Watson stat	2.000803
Prob(F-statistic)	0.000092		

Appendix 4.5 Lending Rate Kwiatkowski-Phillips-Schmidt-Shin test- LEVEL

Null Hypothesis: LR is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.073196
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.116473
HAC corrected variance (Bartlett kernel)	0.517571

KPSS Test Equation
Dependent Variable: LR
Method: Least Squares
Date: 03/15/16 Time: 19:14
Sample: 2000Q1 2014Q4
Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.320525	0.088516	82.70288	0.0000
@TREND("2000Q1")	-0.050221	0.002588	-19.40837	0.0000

R-squared	0.866570	Mean dependent var	5.839000
Adjusted R-squared	0.864270	S.D. dependent var	0.942182
S.E. of regression	0.347115	Akaike info criterion	0.754445
Sum squared resid	6.988360	Schwarz criterion	0.824257
Log likelihood	-20.63335	Hannan-Quinn criter.	0.781752
F-statistic	376.6850	Durbin-Watson stat	0.141296
Prob(F-statistic)	0.000000		

Appendix 4.6 Real Gross Domestic Product Kwiatkowski-Phillips-Schmidt-Shin test- level

Null Hypothesis: RGDP is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.045564
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	8.690597
HAC corrected variance (Bartlett kernel)	20.24047

KPSS Test Equation
Dependent Variable: RGDP
Method: Least Squares
Date: 03/15/16 Time: 19:23
Sample: 2000Q1 2014Q4
Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.388738	0.764600	7.047785	0.0000
@TREND("2000Q1")	-0.008635	0.022352	-0.386332	0.7007

R-squared	0.002567	Mean dependent var	5.134000
Adjusted R-squared	-0.014630	S.D. dependent var	2.976682
S.E. of regression	2.998378	Akaike info criterion	5.066785
Sum squared resid	521.4358	Schwarz criterion	5.136597
Log likelihood	-150.0036	Hannan-Quinn criter.	5.094092
F-statistic	0.149252	Durbin-Watson stat	0.483050
Prob(F-statistic)	0.700664		

Appendix 4.7 Unemployment Rate Kwiatkowski-Phillips-Schmidt-Shin test-level

Null Hypothesis: UNEM is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.149816
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.080388
HAC corrected variance (Bartlett kernel)	0.104542

KPSS Test Equation
Dependent Variable: UNEM
Method: Least Squares
Date: 03/15/16 Time: 19:23
Sample: 2000Q1 2014Q4
Included observations: 60

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.590820	0.073537	48.83031	0.0000
@TREND("2000Q1")	-0.008672	0.002150	-4.033960	0.0002

R-squared	0.219095	Mean dependent var	3.335000
Adjusted R-squared	0.205632	S.D. dependent var	0.323553
S.E. of regression	0.288374	Akaike info criterion	0.383649
Sum squared resid	4.823257	Schwarz criterion	0.453460
Log likelihood	-9.509460	Hannan-Quinn criter.	0.410956
F-statistic	16.27284	Durbin-Watson stat	1.310519
Prob(F-statistic)	0.000162		

Appendix 4.8 Lending Rate Kwiatkowski-Phillips-Schmidt-Shin test- first level

Null Hypothesis: D(LR) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.074907
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.016211
HAC corrected variance (Bartlett kernel)	0.032102

KPSS Test Equation
Dependent Variable: D(LR)
Method: Least Squares
Date: 03/15/16 Time: 19:26
Sample (adjusted): 2000Q2 2014Q4
Included observations: 59 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.092963	0.034162	-2.721227	0.0086
@TREND("2000Q1")	0.001336	0.000990	1.349129	0.1826

R-squared	0.030944	Mean dependent var	-0.052881
Adjusted R-squared	0.013943	S.D. dependent var	0.130451
S.E. of regression	0.129538	Akaike info criterion	-1.216372
Sum squared resid	0.956468	Schwarz criterion	-1.145947
Log likelihood	37.88297	Hannan-Quinn criter.	-1.188881
F-statistic	1.820149	Durbin-Watson stat	1.142743
Prob(F-statistic)	0.182631		

Appendix 4.9 Lending Rate Elliott-Rothenberg-Stock test

Null Hypothesis: LR has a unit root
Exogenous: Constant, Linear Trend
Lag length: 1 (Spectral OLS AR based on SIC, maxlag=10)
Sample: 2000Q1 2014Q4
Included observations: 60

		P-Statistic
Elliott-Rothenberg-Stock test statistic		10.51802
Test critical values:	1% level	4.228000
	5% level	5.704000
	10% level	6.774000

*Elliott-Rothenberg-Stock (1996, Table 1)

HAC corrected variance (Spectral OLS autoregression)	0.043819

Appendix 4.10 Unemployment Rate Elliott-Rothenberg-Stock test

Null Hypothesis: RGDP has a unit root
Exogenous: Constant, Linear Trend
Lag length: 1 (Spectral OLS AR based on SIC, maxlag=10)
Sample: 2000Q1 2014Q4
Included observations: 60

		P-Statistic
Elliott-Rothenberg-Stock test statistic		4.162103
Test critical values:	1% level	4.228000
	5% level	5.704000
	10% level	6.774000

*Elliott-Rothenberg-Stock (1996, Table 1)

HAC corrected variance (Spectral OLS autoregression)	10.46557

Appendix 4.11 Real Gross Domestic Product Elliott-Rothenberg-Stock test

Null Hypothesis: UNEM has a unit root
Exogenous: Constant, Linear Trend
Lag length: 1 (Spectral OLS AR based on SIC, maxlag=10)
Sample: 2000Q1 2014Q4
Included observations: 60

		P-Statistic
Elliott-Rothenberg-Stock test statistic		3.887448
Test critical values:	1% level	4.228000
	5% level	5.704000
	10% level	6.774000

*Elliott-Rothenberg-Stock (1996, Table 1)

HAC corrected variance (Spectral OLS autoregression)	0.104388

Appendix 4.12 Autoregressive Distributor Lag Model (ARDL)

Dependent Variable: DHPI
Method: ARDL
Date: 03/13/16 Time: 22:38
Sample (adjusted): 2000Q3 2014Q4
Included observations: 58 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): DLR DRGDP DUNEM
Fixed regressors: HPI(-1) LR(-1) RGDP(-1) UNEM(-1) C
Number of models evalulated: 8
Selected Model: ARDL(1, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DHPI(-1)	-0.175718	0.125737	-1.397508	0.1686
DLR	-2.545316	1.672148	-1.522184	0.1344
DRGDP	0.296033	0.099281	2.981770	0.0045
DUNEM	-1.507062	0.612558	-2.460276	0.0175
HPI(-1)	-0.306674	0.085904	-3.569965	0.0008
LR(-1)	-0.789843	0.283653	-2.784543	0.0076
RGDP(-1)	0.172264	0.087508	1.968554	0.0547
UNEM(-1)	-1.622012	0.778378	-2.083834	0.0424
C	10.74009	3.313192	3.241613	0.0021

R-squared	0.403869	Mean dependent var	0.010345
Adjusted R-squared	0.306541	S.D. dependent var	1.425543
S.E. of regression	1.187109	Akaike info criterion	3.322641
Sum squared resid	69.05215	Schwarz criterion	3.642365
Log likelihood	-87.35659	Hannan-Quinn criter.	3.447180
F-statistic	4.149581	Durbin-Watson stat	1.992399
Prob(F-statistic)	0.000763		

*Note: p-values and any subsequent tests do not account for model selection.

Appendix 4.13 ARDL Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.621270	Prob. F(2,47)	0.5416
Obs*R-squared	1.493855	Prob. Chi-Square(2)	0.4738

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 03/16/16 Time: 00:45
Sample: 2000Q3 2014Q4
Included observations: 58
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DHPI(-1)	0.135046	0.256253	0.527001	0.6007
DLR	0.032187	1.685788	0.019093	0.9848
DRGDP	-0.024009	0.105397	-0.227797	0.8208
DUNEM	0.023879	0.620725	0.038469	0.9695
HPI(-1)	-0.002351	0.120501	-0.019509	0.9845
LR(-1)	0.005004	0.328740	0.015222	0.9879
RGDP(-1)	-0.022967	0.100338	-0.228900	0.8199
UNEM(-1)	0.081141	0.920098	0.088188	0.9301
C	-0.184906	4.349848	-0.042509	0.9663
RESID(-1)	-0.126695	0.346222	-0.365934	0.7161
RESID(-2)	0.193476	0.174154	1.110946	0.2722

R-squared	0.025756	Mean dependent var	1.68E-15
Adjusted R-squared	-0.181530	S.D. dependent var	1.100655
S.E. of regression	1.196392	Akaike info criterion	3.365513
Sum squared resid	67.27364	Schwarz criterion	3.756287
Log likelihood	-86.59987	Hannan-Quinn criter.	3.517727
F-statistic	0.124254	Durbin-Watson stat	2.080274
Prob(F-statistic)	0.999378		

Appendix 4.14 ARDL ARCH test

Heteroskedasticity Test: ARCH

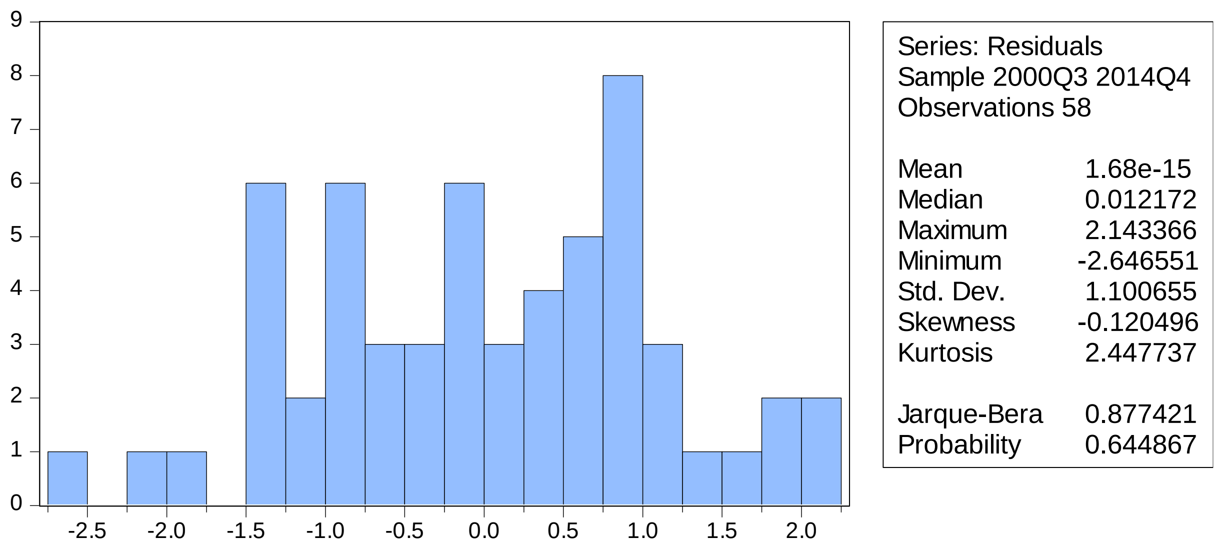
F-statistic	1.575658	Prob. F(1,55)	0.2147
Obs*R-squared	1.587476	Prob. Chi-Square(1)	0.2077

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/16/16 Time: 00:49
Sample (adjusted): 2000Q4 2014Q4
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.407432	0.247596	5.684384	0.0000
RESID^2(-1)	-0.166020	0.132261	-1.255252	0.2147

R-squared	0.027850	Mean dependent var	1.209842
Adjusted R-squared	0.010175	S.D. dependent var	1.450302
S.E. of regression	1.442905	Akaike info criterion	3.605651
Sum squared resid	114.5086	Schwarz criterion	3.677337
Log likelihood	-100.7611	Hannan-Quinn criter.	3.633511
F-statistic	1.575658	Durbin-Watson stat	2.039130
Prob(F-statistic)	0.214694		

Appendix 4.15 ARDL Normality Test (Jarque- Bera)



Appendix 4.16 ARDL Ramsey RESET Test

Ramsey RESET Test
Equation: ARDL
Specification: DHPI DHPI(-1) DLR DRGDP DUNEM HPI(-1) LR(-1) RGDP(-1) UNEM(-1) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.819254	48	0.4167
F-statistic	0.671177	(1, 48)	0.4167

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.952232	1	0.952232
Restricted SSR	69.05215	49	1.409228
Unrestricted SSR	68.09992	48	1.418748

Unrestricted Test Equation:
Dependent Variable: DHPI
Method: ARDL
Date: 03/16/16 Time: 00:51
Sample: 2000Q3 2014Q4
Included observations: 58
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic):
Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DHPI(-1)	-0.153447	0.129056	-1.188991	0.2403
DLR	-2.637046	1.681518	-1.568253	0.1234
DRGDP	0.292509	0.099709	2.933642	0.0051
DUNEM	-1.615035	0.628595	-2.569275	0.0134
HPI(-1)	-0.308359	0.086218	-3.576493	0.0008
LR(-1)	-0.814921	0.286251	-2.846878	0.0065
RGDP(-1)	0.181151	0.088471	2.047583	0.0461
UNEM(-1)	-1.601431	0.781407	-2.049419	0.0459
C	10.68636	3.325012	3.213931	0.0023
FITTED^2	0.109753	0.133967	0.819254	0.4167

R-squared	0.412089	Mean dependent var	0.010345
Adjusted R-squared	0.301856	S.D. dependent var	1.425543
S.E. of regression	1.191112	Akaike info criterion	3.343238
Sum squared resid	68.09992	Schwarz criterion	3.698487
Log likelihood	-86.95389	Hannan-Quinn criter.	3.481614
F-statistic	3.738340	Durbin-Watson stat	1.919994
Prob(F-statistic)	0.001276		

*Note: p-values and any subsequent tests do not account for model selection.

Appendix 4.17 ARDL Residual Unit Root Test (ADF)

Null Hypothesis: ARDLRESIDUAL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.396303	0.0000
Test critical values:	1% level	-3.550396	
	5% level	-2.913549	
	10% level	-2.594521	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ARDLRESIDUAL)
Method: Least Squares
Date: 03/16/16 Time: 00:53
Sample (adjusted): 2000Q4 2014Q4
Included observations: 57 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ARDLRESIDUAL(-1)	-1.005663	0.135968	-7.396303	0.0000
C	-0.005187	0.148334	-0.034968	0.9722

R-squared	0.498657	Mean dependent var	-0.024622
Adjusted R-squared	0.489542	S.D. dependent var	1.567214
S.E. of regression	1.119718	Akaike info criterion	3.098488
Sum squared resid	68.95723	Schwarz criterion	3.170174
Log likelihood	-86.30690	Hannan-Quinn criter.	3.126347
F-statistic	54.70530	Durbin-Watson stat	1.957917
Prob(F-statistic)	0.000000		

Appendix 4.18 Fully Modified Ordinary Least Squares

Dependent Variable: HPI
Method: Fully Modified Least Squares (FMOLS)
Date: 03/16/16 Time: 00:30
Sample (adjusted): 2000Q2 2014Q4
Included observations: 59 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LR	-2.168458	0.474194	-4.572931	0.0000
UNEM	-4.879037	1.385473	-3.521569	0.0009
RGDP	0.382698	0.145137	2.636803	0.0109
C	32.47438	4.593259	7.070009	0.0000

R-squared	0.650793	Mean dependent var	5.532203
Adjusted R-squared	0.631745	S.D. dependent var	3.447910
S.E. of regression	2.092329	Sum squared resid	240.7813
Long-run variance	9.245537		

Appendix 4.19 Dynamic Ordinary Least Squares

Dependent Variable: HPI
Method: Dynamic Least Squares (DOLS)
Date: 03/16/16 Time: 00:31
Sample (adjusted): 2000Q3 2014Q3
Included observations: 57 after adjustments
Cointegrating equation deterministics: C
Fixed leads and lags specification (lead=1, lag=1)
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LR	-2.028769	0.541235	-3.748406	0.0005
UNEM	-7.544168	2.228833	-3.384806	0.0015
RGDP	0.521628	0.247326	2.109071	0.0407
C	39.68996	6.423563	6.178809	0.0000

R-squared	0.837519	Mean dependent var	5.456140
Adjusted R-squared	0.793206	S.D. dependent var	3.483636
S.E. of regression	1.584170	Sum squared resid	110.4222
Long-run variance	6.174653		

Appendix 4.20 Canonical Cointegrating Regression (CCR)

Dependent Variable: HPI
Method: Canonical Cointegrating Regression (CCR)
Date: 03/16/16 Time: 00:32
Sample (adjusted): 2000Q2 2014Q4
Included observations: 59 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LR	-2.160226	0.475318	-4.544801	0.0000
UNEM	-5.222823	1.607417	-3.249203	0.0020
RGDP	0.378723	0.157496	2.404646	0.0196
C	33.55391	5.144116	6.522774	0.0000

R-squared	0.641449	Mean dependent var	5.532203
Adjusted R-squared	0.621892	S.D. dependent var	3.447910
S.E. of regression	2.120136	Sum squared resid	247.2238
Long-run variance	9.245537		

Appendix 4.21 Error Correction Model

Dependent Variable: DHPI
Method: Least Squares
Date: 03/13/16 Time: 22:48
Sample (adjusted): 2000Q3 2014Q4
Included observations: 58 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.036551	0.171660	-0.212925	0.8322
DHPI(-1)	-0.139717	0.121789	-1.147201	0.2565
DLR	-1.216346	1.304554	-0.932384	0.3554
DRGDP	0.248746	0.083827	2.967380	0.0045
DUNEM	-1.247084	0.516044	-2.416623	0.0192
ECT(-1)	-0.283566	0.084822	-3.343052	0.0015

R-squared	0.367368	Mean dependent var	0.010345
Adjusted R-squared	0.306537	S.D. dependent var	1.425543
S.E. of regression	1.187112	Akaike info criterion	3.278621
Sum squared resid	73.28022	Schwarz criterion	3.491771
Log likelihood	-89.08002	Hannan-Quinn criter.	3.361647
F-statistic	6.039244	Durbin-Watson stat	1.999790
Prob(F-statistic)	0.000177		

Appendix 4.22 Pairwise Granger Causality Test

Pairwise Granger Causality Tests
Date: 03/16/16 Time: 00:59
Sample: 2000Q1 2014Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LR does not Granger Cause HPI	58	5.09605	0.0095
HPI does not Granger Cause LR		1.13586	0.3288
DRGDP does not Granger Cause HPI	57	2.59861	0.0840
HPI does not Granger Cause DRGDP		2.25304	0.1152
DUNEM does not Granger Cause HPI	57	0.47057	0.6273
HPI does not Granger Cause DUNEM		0.13966	0.8700
DRGDP does not Granger Cause LR	57	8.34828	0.0007
LR does not Granger Cause DRGDP		2.34665	0.1057
DUNEM does not Granger Cause LR	57	0.54676	0.5821
LR does not Granger Cause DUNEM		1.39607	0.2567
DUNEM does not Granger Cause DRGDP	57	0.52562	0.5943
DRGDP does not Granger Cause DUNEM		0.54389	0.5838

Appendix 4.23 Result of Unit Root Test

Table 4.2 Result of Unit Root Test

Variables	ADF Test		KPSS Test		ERS Test
Data period:2000-2014 quarterly, observation:60 T-statistics					
	level	First difference	level	First difference	Level
Lending rate(LR)	-2.5543(1)	4.7008(1)	0.0732(3) ***	0.07491(3) ***	10.5180(1) ***
Real Gross Domestic Products (RGDP)	-4.6764(1) ***	-------------	0.0456(3) ***	------------	4.1621 (1)
Unemployment rate (UN)	-5.5094 (1) ***	-------------	0.1498(1) **	-------------	3.8875 (1)

Notes: In ADF test, null hypothesis was set non stationary series or contains a unit root and alternative hypothesis was a stationary series. The rejection of null hypothesis is based on MacKinnon (1996) one-sided p-values.

In KPSS test, null hypothesis was set stationary series and alternative hypothesis was non-stationary series. The rejection of null hypothesis is based on Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

In ERS test, null hypothesis was set non stationary and alternative hypothesis was stationary series. The rejection of null hypothesis is based on Elliot-Rothenberg-Stock (1996,Table 1)

Figures in parentheses ( ) refer to the selected lag length. The number of lags was selected based on Schwarz Information Criteria (for ADF test and ERS test)) and New-West Banwidth (for KPSS test): This modus is use to prevent autocorrelation in error term and result with an accurate data.

***, ** and * indicates the rejection of the null hypothesis of non-stationary at 1 percent, 5 percent and 10 percent significance level respectively.