Expect the unexpected: housing price bubble on the horizon in Malaysia

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Abstract

The growth of financial market has taken centre stage in today's world economy. It takes a quarter of a second to change the whole dynamics of an economy. The moment an asset price bubble and burst occurs, the whole economy may collapse. This paper makes an attempt to investigate the existence of housing price bubble by taking Malaysia as a case study. In Malaysia, the housing market is in its boom, naturally housing prices are sky high. There is no consensus in the literature about what is a housing price bubble. The method applied in this study are the standard time series techniques of cointegration, long-run structural modelling, vector error correction, variance decomposition method. To our knowledge, this is the first study on housing bubble based on demand and supply side variables, for a period of 17 years of data. Our findings tend to indicate that variables are cointegrated and market tends to correct any disequilibrium that exists over time. The results also imply that house prices are on the rise. The policy implications are that, though housing prices bubble and burst are not imminent, the upward pressures on housing prices, might require more sustainable measures within the current housing boom period.

Key Words: housing bubble, error-correction model, variance decompositions, Malaysia

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I. Introduction

The impact of globalization has been tested more than once in the world history. The growth of financial market has taken centre stage in today's world economy. The movement of money around the globe is unimaginable. It takes a quarter of a second to change the whole dynamics of an economy. The moment an asset price bubble and burst occurs, euphoria, profit taking and panic would collapse whole economy. Without doubt, any 'expected' house price bubble needs to be addressed pro-actively.

The demand for housing market does not stem from country's domestic demand alone. The foreign players are playing a key role in channelling the funds through the global housing markets. The average real house prices across global are now back to the level before 2008 financial crisis. Malaysia is among the 21 economies who are experiencing a housing price boom around the world.

In recent years, demand for residential housing in Malaysia has been phenomenal. The housing prices in Malaysia has appreciated dramatically. The rise in the house prices, has widened the gap between demand and supply side for residential properties. The call for more affordable housing has been on the track for quite some time. The stagnant income level of the households has far crying effect on the house prices. Thus, so far no one could explain the sky high housing prices in Malaysia. Some analysist have argued that, lack of affordable housing as one of the root causes of the problem. Economic theories suggest that, movement of house price are inherent to its regional and demographic economics, such as population growth, Gross Domestic Product, lending rate, inflation, tax and cost of supply of housing. The questions remains, as to the fundamental housing prices in Malaysia. This paper makes an attempt to investigate the existence of housing price bubble by taking Malaysia as a case study.

There exists disperse of authority on assessing housing price bubble. The most common understanding is that the house price bubbles are situations in which the price for houses exceeds their fundamental value. This study applied time series techniques of cointegration, long-run structural modelling, vector error correction, variance decomposition method. However, the questions of what accounts for housing bubble still remains unresolved.

In this paper, we will address the following research questions;

(i) Firstly, whether a housing price bubble exists in the Malaysian housing market from 2013 to 2015 using economic fundamentals.

(ii) Secondly, what are the effects of macroeconomic fundamentals on housing prices in Malaysia?

In the past, Zainuddin, (2010) investigated existence of housing price bubble using switching and not-switching model, Yusoff Hussain et al., (2012) investigated presence of housing bubble in Klang Valley, Malaysia, using Fama-French Three Factors model, and more recently, Yin, Chyuan, & Hoong, (2016) used Fundamental house prices and price stability model to identify housing bubble in Malaysia during 2001 to 2012. This study is certainly the most recent work on the subject, as one can presume the issue persists in a real sense at the present time. Furthermore, this study is based on 17 years of data observation, unlike other past research work. Finally, the use of time series techniques of cointegration, LRSM, VECM and VDC make this work different from that of the past research papers.

The debate on existence of housing bubble may continue until it bursts. Our findings tend to suggest that Gross-domestic product (GDP), personal consumption and KLCI have significant impact on the long-run housing price index of Malaysia. Also, our forecast equilibrium housing prices shows, market tends to correct the equilibrium imbalances that exists in the past. Which means, a housing price bubble does not exist in Malaysia's housing market till 2015.

The findings of this paper would be of particular interest to policy makers and investors in the housing market. It would help the investor make dynamic investment decisions in the Malaysia's property market.

Section II gives the theoretical framework of Malaysian Housing market on the subject of the study and reviews of empirical studies are given in section III. It is followed by Methodology of the Study in Section IV. Data, empirical results and discussions are in detailed within Section V. Finally, this paper ends with the major conclusion and the policy implications of the study in Section VI.

II. Theoretical Framework: Malaysian Housing Market

The growth of Malaysia's housing market embarked after its independence in 1957. Since then, housing market has grown in parallel to its economy. In the past, Malaysia has experienced strong growth in residential properties with short periods of downturn.

As with most of the nations, the housing market in Malaysia is an important part of the domestic economy. For businesses, local people and also for foreigners, residential properties have

become an attractive form of investment. This can be evidenced from the household balance sheet in Malaysia.

Malaysia household Balance Sheets and private consumption

The household balance Sheet provides a summary of assets and liabilities of the locals. The Balance sheets also shows the financial health of the overall economy. The asset side indicates resources for future spending. The liabilities reflects household debts that need to be repaid in the future (Figure 1).

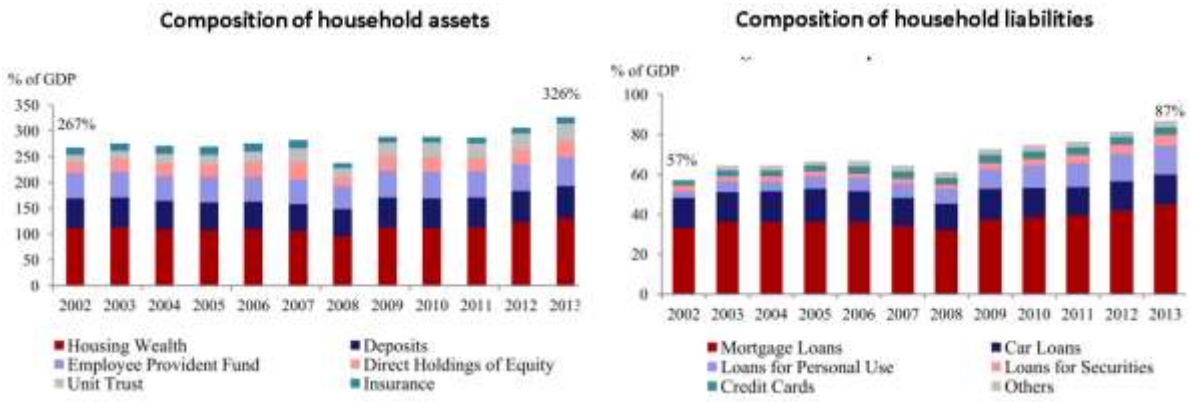


Figure 1: Household consumption ***(Source: Bank Negara Malaysia estimate)***

The size of the Malaysian household balance sheet has grown since 2002. Total household assets grew at an average annual rate of 10.5% from 2003-2013 to 325.5 of GDP at end of 2013. The household debt grew annually by 12.7% to 86.8% of GDP at the end of 2013. The household assets continued to exceed debt by 3.8 times. This trend is attributable to rising household income. The property related asset and liabilities are the largest component on both side of the balance sheet. At the end of 2013, property assets accounted for 40.6% of total assets, while property loans accounted for largest share of total liabilities at 51.8% (Murugasu, Huei, & Hwa, 2015).

Most Malaysian's household spend a large proportion of savings or spending to acquire a house. Most households are reported to allocate one third of income for housing investments, such as payment of rents or loan repayment (Zainuddin, 2010).

On the issue of consumption and housing wealth, Muellbauer and Murphy (1990) and Dvornak and Kohler (2007) argued that house price increases stimulated growth in consumption in U.K. and Australia, respectively. These studies reflect the situation prevalent in sub-prime crisis,

where the investors and speculators found the housing market to be more attractive than the financial market (Wang-Li, Hook, Said, & Chin, 2015).

However, Wang-Li et al., (2015) found that, house market in Malaysia still remains a market that provides housing service more than wealth gain. Thus, price effect will take place to affect consumption in a negative way. Hence, higher house prices will lead to lower consumption, followed by economic stagnation.

The Housing Price Index in Malaysia

The housing Price Index (HPI) is an index that used to measure the prevailing trends of the residential house price based on the hedonic approach. HPI represents the overall housing prices, including thirteen States and two federal territories. The HPI acts as a national price index for the performance of Malaysian housing market.

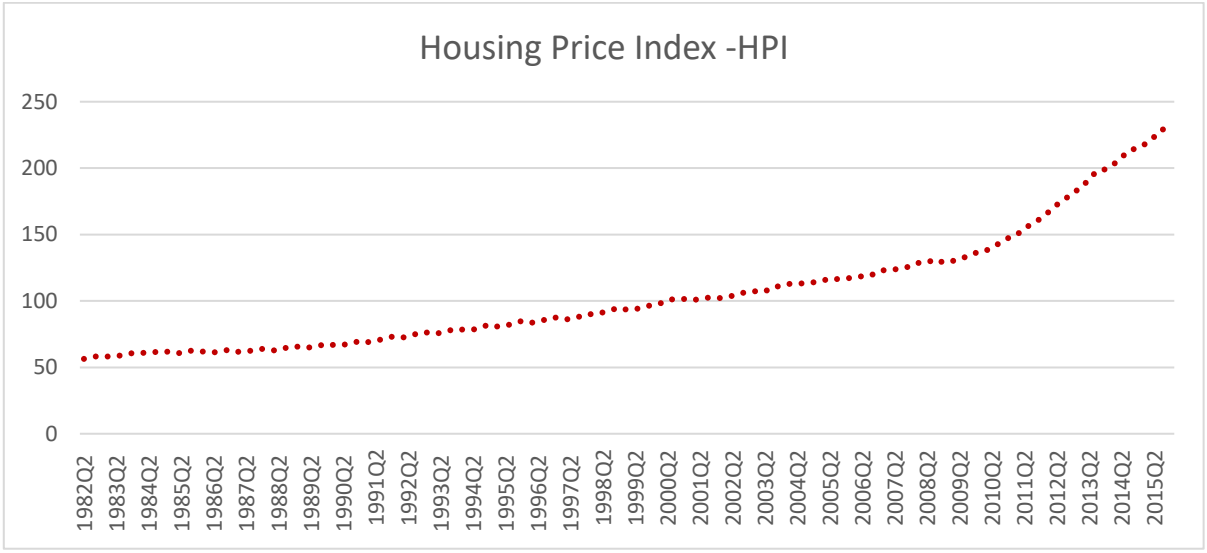


Figure 2: House price movements in Malaysia (Source: DataStream)

Housing affordability and Housing Prices

The Malaysian housing market is characterised by many ups and downs. The HPI (Figure 2) shows the house prices in Malaysia has continuous increasing trend. Especially, during 2009 to 2012, house prices has seen dramatic run-ups. In those years, the average house prices in Malaysia increased 20% per year after 2007. This means household income level should raise at a same level to keep up the market demand in equilibrium.

However, rapid increase in the housing prices, particularly in major urban centres, has called for supply of affordable housing. Since, 2005, Malaysia's housing market has increased by 35%. The gap between housing stocks and number of households widened to 2.5 million units in 2015 from 2.1 million units in 2005(Bank Negara Malaysia, 2015).

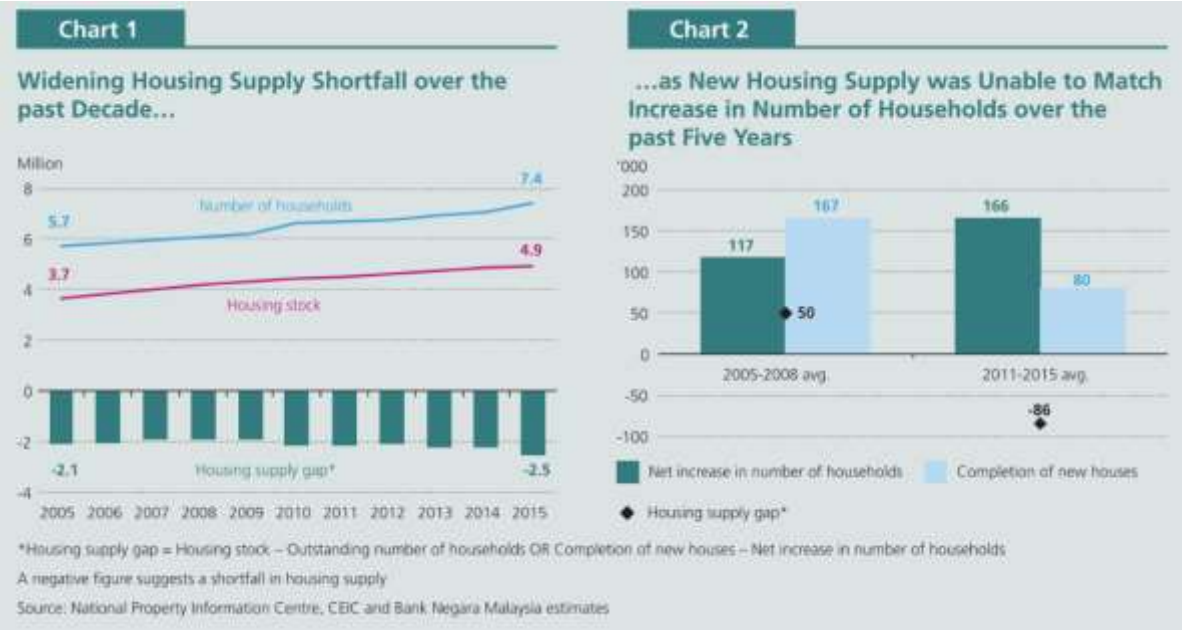


Figure 3: Demand and supply of Housing in Malaysia *(Source: Bank Negara Malaysia)*

In 2014, half of Malaysian households earned a monthly income of RM 4,585 and below. According to "*Median Multiple*" methodology developed by Demographia International and recommended by the World Band and United Nations to evaluate urban hosing market, house price to income ratio should be 3.0 and below. This suggest that, houses priced up to RM 165,060 are considered affordable to the median Malaysian Household. However, only 21% of new housing launches were below 250,000 in 2015 (Bank Negara Malaysia, 2015)

Does the imbalance between the demand and supply of housing, has contributed to rapid increase in house prices? On the other hand, many analysts suggest that, marketing tools used by developers has influenced upward pressure on the housing prices artificially in Malaysia.

III. Literature review

Until today, no doctor (economist/analysts) had being able to diagnose the housing bubble before they take off. Hence, it is difficult to give a single definition for housing bubble. Over the past decades, economists have identified diverging rationales for housing bubbles. Some

economists have found that the rampant growth in international housing prices is rational when supported by fundamentals of supply and demand, while others described these price rises merely as booms and were careful not to define them as bubbles (Yin et al., 2016).

Case and Shiller (2003) explained an asset bubble as a price increase that cannot be explained by the underlying economic fundamentals such as income, inflation and interest rates. Some argues that, housing bubble can help the development of an economy during a booming time. On the other hand, when the housing bubble burst, the likely panic sale will negatively impact the real economic activities.

Dong Chen, n.d. (2012) provided that, the speculation part is the key reason why asset price bubbles has been studied by many researches such as case and Shiller (1989), Levin and Wright (1997), Muelbaur and Murphy (1997) and Roche (2000).

In U.S, before the 2008 sub-prime crisis, researchers intrigue whether a house price bubble exists in U.S. housing market. After studying the U.S. housing market McCarthy and Peach (2004) concluded that rapid increase in house price is attributed by rising income and decline in interest rate. On the other hand, most of the researchers (Clithero & Pealer, 2005; Goodman & Thhibodeau, 2008; and U.S, Capozza 2004) believe that the increase in house price indeed is a bubble that cause by irrational expectations (Dong Chen, n.d.).

In Western countries, Levin and Wright (1997) found out that in England, house price bubbles were caused by speculation, Roehner (1999) found out that in France housing bubble were caused by speculation, Roche (2000) found out that in Ireland, house price bubble were caused by speculation, Fraser, Hoesli and McAlevey (2008) found out that in New Zealand, house price bubble were caused by price dynamics, Hatzi & Otto, (2008) found out that, in Australia, Housing price bubble was caused by speculation.

In Asian Countries, test of house price bubble by Calhoun (2003) in Thailand, found strong link between HPI and real economy, Kim and Suh (1993) in tested in South Korea and Japan caused by large price to value ratio, Chan (2001) tested in Hong Kong, house price bubble caused by huge variation in the price index, Hou (2009) in China, caused by relative growth rate of house prices that is fundamental variations.

In Malaysia, Jeni (2010) provided that, housing bubble exist when there is excessive bank-lending and low borrowing cost. Hussain (2012) argued existence of housing price bubble in Malaysia, after measuring the difference between house price and the intrinsic value. Yin et

al., (2016) argued that, housing bubble in not imminent based on price trend in the Malaysian property market.

In the context of Malaysia, we take the definition given by Yin, Chuyan and Hoong (2016), housing bubble represent when the housing prices are over and above the fundamental housing prices. In view of controversies over diagnosis for the existence of house price bubble, this paper offers an alternative approach to investigate whether bubble exists in the Malaysian housing market.

IV. The Methodology used

There is no consensus with regards what actually constitutes a housing price bubble in the literature. The most common understanding is that the house price bubbles are situations in which the price for houses exceeds their fundamental value. If the reason is that, the housing price is high today only because house buyer believes that the selling price will be high tomorrow, then a bubble exit (Joebges, Dullien, & Márquez-Velázquez, 2015).

Most of the literatures does not test on "fundamental value" of housing prices to detect housing bubbles. Instead, some look at rapid raise in nominal or real house prices (Mayer, 2011). Some researchers used ratio approach, which is deviation from price to rent to house ratio or house price to income ratio (McCarthy and Peach (2004), some used cost approach, asset market approach model (Levin & Wright, 1997) and others used Vector Error Correction Model (VECM) (Case & Shiller, 1989, Quigley, 1999; Sing et al., 2006) (Dong Chen, n.d.).

This study employs, time series technique of VECM model to estimate housing prices relationship in both short run and long run. Sing et al. (2006) employed the VECM model to test the long-run relationship between house prices in the Singapore. The authors found that the error term and lagged house price in VECM model can significantly explained the house price dynamics in Singapore housing market. Gallin (2006) examined the relationship between house prices and interest rates from 1978 to 2000 in 300 metropolitan areas in the U.S. housing market by using VECM model.

This study employs, Vector Error Correction Model (VECM) to estimate both short run and long run housing prices relationship in Malaysia. Most of the literatures on time series which are based on cointegration have applied either vector error correction and/or variance decompositions method for testing Granger-causality. Since, variance decompositions method

is based on estimates of the cointegrating vectors, we use Long-run Structural Modelling (LRSM) technique to take care of such limitations.

To test the stationarity of variables, all the 'level' form variables were transformed into logarithms to achieve stationarity in variance. We test the unit root of the all the variables, using Augmented Dickey fuller, Phillips Peron and KPSS test. We test each variables to determine whether they are integrated series of order 1 that is I(I) on the basis of ADF, PP and KPSS test.

Before we proceed to cointegration analysis, we determined order of VAR based on AIC and SBC results. The results of AIC and SBC differs sharply. As AIC offer maximum likelihood, less concerned with over parameters, SBS gives the lowest likelihood and more concerned with over-parameters. The choice of lag is determined after we test on the autocorrelation problem, the number of lags which brings lesser autocorrelation problem within the variables.

The long-term theoretical relationship is tested based on Engle-granger and Johansen cointegration test. The test of cointegration is to understand the long-run equilibrium relationship among the variables. It will rule out any spurious or accidental relationship between the variables. After getting the cointegration vectors, we then proceed to Long Run Structuring Modelling.

The existence of long term theoretical expectations are tested by normalising on the coefficient of the focused variable (Housing Price Index) by exact identifications. Further restrictions are imposed in over identifications at the LRSM stage, to test statistically significance of the variable. The restrictions are tested on each variable, to check the statistical significance. Those variables which are statistically significant, are used to determine the fundamental house prices in the preceding analysis.

The test of endogeneity and exogeneity is done by the test of vector error correction model (VECM). VECM shows which variables leads on its own and extent if its dependence on other variables. The long term and short term granger-causality can be established through VECM. Since, VECM does not give relative exogeneity and endogeneity of the variables, we use variance decomposition technique. The variance decomposition technique determine which variables are relatively exogenous and endogenous. The proportion of the variance explained by its own past shocks determine the level of exogeneity or weak follower. The variable specific shock is tested in Impulse response function with a graphical way. Finally, we examine the speed it takes to recover back to the level of equilibrium if there is a system wide shock.

Lastly, based on the multivariate forecasting technique, we determine the forecast values to compare with the actual HPI value.

Source of Data and Variables

This study is based on the secondary data that are collected from DataStream. All the variables are quarterly data taken from year 1978 until 2015.

The proposed VECM model is based on underlying economic fundamentals. Where housing prices are determined by both demand and supply side factors. As Levin and Wright (1997) suggest, demand side factors of income, inflation and interest rate should be used to study house prices. As for the supply side, most literatures used inflation to capture the cost of supply. Thus, this paper uses both demand side (Gross Domestic Product, based lending rate, exchange rate) and supply side factors (Consumer Price Index- CPI) to capture the housing price movements in the short run and long run in Malaysia. The inclusion of FTSE Bursa Malaysia stock index is based on it's a strong wealth effect between KLSE and overall house price in Malaysia (Lean, 2012). The exchange rate is used because foreign ownership do plays a key role in the Malaysian Housing market.

Model

The housing price equation can be defined as;

$$HPI \sim \alpha_t + \beta_1 GDP_1 + \beta_2 KLCI_2 + \beta_3 RM_3 + \beta_4 LR_4 + \beta_5 PC_5 + \beta_{6t} CPI_6 + \in_t$$

Where,

HPI	=	House Price Index
GDP	=	*Gross Domestic Product*
KLCI	=	*FTSE Bursa Malaysia KLCI*
CPI	=	*Consumer Price Index as a proxy for Inflation rate*
RM	=	*Exchange Rate of Malaysian Ringgit against USD*
LR	=	*Base Lending Rate*
PC	=	*Household Consumption*

α_t = intercept $\in_t$ = error terms β = Coefficient Beta value

V. Empirical Results and Discussion

Unit root test

As discussed earlier, we use the above mentioned variables to test the long-term equilibrium housing prices in Malaysia. We started with the unit root test of all the variables. We need to test whether the variables are non-stationary in the level form. The variables should be stationary after the first difference. The Augmented Dickey-Fuller (ADF) and Phillips Peron (PP) tests are used to test on stationarity of the variables. Both test uses variables on log forms to test non-stationarity and difference form to check stationarity. The table 1A& 1B, 2A & 2B below summarises the results (Appendix 1A TO 1N)

We found that all the variables are I (1) on the basis of PP test. However, ADF test shows, KLCI variable is stationary in level form and in difference form. Also, the exchange rate variables shows non-stationary in difference form. However, we decided to proceed with the test result of PP, since, it takes care of problem of both autocorrelation and heteroscedasticity.

Table 1A- Augmented Dickey-Fuller ADF test

Variables in Level FORM

Variables	T- Statistics	Critical Value	Implication
LHPI	0.36999	-3.4749	Non-Stationary
LKLCI	-4.0531	-3.4749	Stationary
LCPI	-2.7178	-3.4749	Non-Stationary
LLR	-2.7635	-3.4749	Non-Stationary
LPC	-2.9482	-3.4749	Non-Stationary
LGDP	-2.3916	-3.4749	Non-Stationary
LRM	1.2289	-3.4749	Non-Stationary

Table 1B- Augmented Dickey-Fuller ADF test

Variables in Difference FORM

Variables	T- Statistics	Critical Value	Implication
DHPI	-3.269	-2.9042	Stationary
DKLCI	-5.9157	-2.9042	Stationary
DCPI	-5.5127	-2.9042	Stationary
DLR	-4.7301	-2.9042	Stationary
DPC	-4.9394	-2.9042	Stationary
DGDP	-6.2121	-2.9042	Stationary
DRM	-2.1497	-2.9042	Non-Stationary

Notes: The ADF is used to test the stationarity of the variables both in level form and difference form. The null hypothesis in level form is, variables are non-stationary. Hence, when Test statistics (95% confidence level) is less than the critical value (in absolute terms), we conclude the variable is non-stationary. In the difference form, when the t-statistics are more than the critical value, we reject the null hypothesis and concludes the variable is stationary 1(I) variable. (Appendix 1A to 1N)

Table 2A-Phillips Peron (PP) test

Variables in Level FORM

Variables	T- Statistics	Critical Value	Implication
LHPI	-0.32168	-3.5351	Non-Stationary
LKLCI	-3.0845	-3.5351	Non-Stationary
LCPI	-2.3746	-3.5351	Non-Stationary
LLR	-3.356	-3.5351	Non-Stationary
LPC	-3.2081	-3.5351	Non-Stationary
LGDP	-3.1794	-3.5351	Non-Stationary
LRM	0.19626	-3.5351	Non-Stationary

Table 2B-Phillips Peron (PP) test

Variables in Difference FORM

Variables	T- Statistics	Critical Value	Implication
DHPI	-8.2623	-2.9435	Stationary
DKLCI	-13.1395	-2.9435	Stationary
DCPI	-7.5244	-2.9435	Stationary
DLR	-5.6675	-2.9435	Stationary
DPC	-6.7726	-2.9435	Stationary
DGDP	-9.0438	-2.9435	Stationary
DRM	-3.846	-2.9435	Stationary

Notes: The Phillips Peron (PP) is used to test the stationarity of the variables both in level form and difference form. The null hypothesis in level form is, variables are non-stationary. Hence, when Test statistics (95% confidence level) is less than the critical value, we conclude the variable is non-stationary. In the difference form, when the t-statistics is more than the critical value, we reject the null hypothesis and conclude the variable is stationary 1(I) variable. (Appendix 2A to 2N)

Lag order selection

The test of lag order was made using Unrestricted VAR post estimation. Testing and selection criteria for order (lag length) of the VAR showed mixed results. AIC showed maximum of five lags and SBC showed minimum of two lags. Since, the data in the observations are quarterly data, taking maximum lag could limit the observation within our sample period. Hence, we decided to proceed with, minimum lag of two on the basis of SBS criteria and based on the test of Autocorrelation diagnostic test (Appendix 4A to 4K).

Cointegration

We tested the long-term theoretical relationship based on Engle-granger test of cointegration. When the variance of error terms are stationary, it would mean the variables have some cointegrating vectors. For this study, when we applied Engle-Granger cointegration test, we did not find any cointegration (**Table 3**. Results of Engle-Granger cointegration test- Appendix 5A to 5G).

We then applied Johansen cointegration test, and found them to have two cointegration based maximum Eigen value and terrace test ***(Table 3B).***

This implies that, the relationship between the variables are cointegrated and it's not accidental (spurious). The variables within our sample are inclusive of demand, supply side and financial side variables. Hence, finding two cointegration factors are not without expectations. The existence of stock market variables and housing price variable within our model, two cointegrating vectors are possible based on fact that, both the variables have some controlled variables which has long term relationship. For this project paper, we decided to

Table 3A. Results of Engle-Granger cointegration test

Variables	T-statistics	DF statistics 95%
CPI	3.1856	4.9553
LKLCI	4.42679	4.9553
LHPI	1.914	4.9553
LRM	1.1152	4.9553
LGDP	3.39	4.9553
LLR	3.3375	4.9553
LPC	3.7781	4.9553

Notes: The cointegration test , test the stationarity of error term of the variables. The error term would be stationary, when its test statistic is greater than the critical value at 95% confidence level.

proceed with ***one cointegration vectors***, since our purposes is to determine the long term equilibrium housing price movements.

This conclusion has an important implications. Since, the housing prices and other variables are cointegrated, though in short term there exist equilibrium imbalances, the market would re-align themselves into a long-term (theoretical) relationship with one another.

***Table 3B*- Johansen ML results for cointegrating vectors – HPI, GDP, RM,LR, KLCI, CPI, and personal consumption, (1978 – 2015)**

Criteria	H Null	H - Alternative	Statistics	95% Critical Value	Number of cointegration vectors
Maximal Eigen value	r=0	r=1	89.2797	49.32	2
	r<= 1	r = 2	60.5954	43.61	
Trace statistics	r=0	r=1	269.2434	147.27	2
	r<= 1	r = 2	179.9637	115.85	
				AIC	7
				SBC	0
				HQC	1

Notes: The Johansen's cointegration test is based on unrestricted intercept and restricted trends in the VAR. From the above results, the cointegration is determined by comparing the statistical value with critical value at 95% confidence level. When r=0, statistical value is greater than critical value, hence, we reject null hypothesis and accept the alternative, which suggests an existence of cointegrating vectors. The underlying VAR model of order 2 and is computed using 68 quarterly observations. (Appendix 6)

Long-run structural modelling

To test the coefficient of the cointegrating vectors, we applied, exact identifications in 'Long run structural modelling' procedure. We imposed exact identifying restrictions on the coefficient of HPI (Table 4A). We found coefficient of KLCI, GDP, CPI and PC as highly significant. Based on our theoretical

Table 4A. Exact identifying on the cointegrating vector

Variable	Coefficient	Standard Error	t-ratio	implication
LRM	0.27243	0.17612	1.546843	insignificant
LLR	-0.207	0.1443	-1.43451	insignificant
LKLCI	-0.3715	0.091456	-4.06206	significant *
LHPI	1	NONE	NONE	NONE
LGDP	2.688	0.43274	6.211582	significant *
LCPI	1.9256	0.86167	2.23473	significant *
LPC	-2.5772	0.75717	-3.40373	significant *

Table 4B. Over identifying on the cointegrating vector

Variable	Coefficient	Standard Error	t-ratio	implication
LRM	0	NONE	NONE	NONE
LLR	0	NONE	NONE	NONE
LKLCI	-0.32111	0.091885	-3.49469	significant **
LHPI	1	NONE	NONE	NONE
LGDP	2.9135	0.42385	6.873894	significant **
LCPI	0	NONE	NONE	NONE
LPC	-2.6532	0.78902	-3.36265	significant **

****LR Test of Restrictions CHSQ(3)= 4.9346[.177]**

expectations, we imposed over-identifying restrictions on those variables which were insignificant (Appendix 7A to 7I).

Notes: The result above shows the maximum likelihood estimates subject to exactly identifying (Table 4A) and over identifying (Table 4B) restrictions. The significant results are given in the implication column in the table. Though CPI was significant initially, when we put restrictions, CPI became insignificant. Hence, when we run the restrictions, the restrictions (**) was accepted (P-value (0.177). ** indicates significant at 5%.

We imposed, over-identifying restrictions of zero on the coefficient of RM, CPI and LR. The restriction was accepted by the chi-square statistics (Table 4B). Even though, we found that all of the variables are theoretically cointegrated, for the purpose of this study, we decided to proceed keeping the restrictions. Hence, we proceed with 'Table 6' for the remainder of this study.

From table 4B, it is apparent that, the GDP is found to be significantly and positively correlated with HPI. The result is consistent with research by Ong (2013), showing housing investment is part of the GDP(Ong, 2013). The household consumption is negatively correlated with the house price, which is in line with the study by Wong (2015). Where he found that, higher house price lead to lower consumptions in case of Malaysia, unlike other advanced economies (Wang-Li et al., 2015). Furthermore, KLCI results is significant, suggesting to be it's a long-term driver of Housing price in Malaysia, which in support of Lean (2012) who found a strong wealth effect between KLSE and overall house price in Malaysia (Pillaiyan, 2015).

Vector Error Correction Model (VECM)

We applied VECM technique, to test which variable is leading (exogenous) and which variable is lagging (endogenous). The error correction coefficients showed, RM, LLR, KLCI, CPI, PC variables are exogenous. Only, HPI and GDP variables are endogenous (Table 5). That tends to indicate that HPI variables responds to exchange rate, lending rate, KLCI, inflation rate and personal consumption of the households. The error-correction term in the HPI equation is significant. This implies that the deviation of the variables has a significant feedback effect on the HPI variables that bears the burden of short run adjustment to bring about

Table 5: VECM result

Variable	ECM-1 (p-value)	implication
LRM	0.491	**Exogenous**
LLR	0.582	**Exogenous**
LKLCI	0.084	**Exogenous**
LHPI	0.036	Endogenous
LGDP	0	Endogenous
LCPI	0.331	**Exogenous**
LPC	0.357	**Exogenous**

Notes: The result of Error Correction model is shown above, ECM-1 dictates p-value. The significant of p-value at 95% confidence level are given in the implication (Appendix 8A to 8G).

the long-term equilibrium. Furthermore, error-correction term stands for the long-term relations and short term Granger-causality among the variables.

From the above analysis, the following cointegrating equation holds,

$$HPI - 0.32111KLCI + 2.9135GDP - 2.6532PC - 0.020705\ Trend$$

Variance Decomposition (VDC)

To determine the relative exogeneity and endogeneity of a variable, we had applied orthogonalized and generalized variance decomposition technique. The relative exogeneity or endogeneity of a variable can be ascertained by proportion of the variance explained by its own past. The most exogenous variable is explained mostly by its own shocks (and not by others). However, the result of orthogonalized and generalized tend to differ. In orthogonalized, VAR order of variables are biased against the first order variable, it assumes in the model are switched of.

The forecast horizons are 4, 8, 12, 16 and 20 Quarters. The results of orthogonalized results are summarised in table 6A, 6B and C (Appendix 9A to 9N).

Table 6A: Orthogonalized VDC Forecast Horizon = 4 Quarters (1 year)

Variable	RM	LR	KLCI	HPI	GDP	CPI	PC
RM	**94.70%**	0.09%	0.03%	0.07%	0.59%	0.15%	4.36%
LR	0.05%	**98.68%**	0.31%	0.25%	0.26%	0.42%	0.03%
KLCI	19.27%	34.87%	**37.85%**	0.20%	0.12%	0.41%	7.28%
HPI	0.28%	1.44%	1.37%	**90.50%**	4.38%	1.38%	0.64%
GDP	13.61%	19.82%	13.36%	0.49%	**22.16%**	1.38%	29.18%
CPI	1.04%	22.13%	0.33%	2.49%	0.86%	**71.53%**	1.61%
PC	7.07%	11.43%	2.43%	2.69%	18.00%	1.29%	**57.10%**

Table 6B: Orthogonalized VDC Forecast Horizon = 20 Quarters (5 year)

Variable	RM	LR	KLCI	HPI	GDP	CPI	PC
RM	**92.99%**	0.15%	0.04%	0.05%	0.74%	0.28%	5.74%
LR	0.05%	**98.51%**	0.38%	0.35%	0.24%	0.46%	0.01%
KLCI	19.42%	40.95%	**30.34%**	0.23%	0.16%	0.58%	8.32%
HPI	0.09%	1.62%	1.13%	**90.30%**	4.71%	1.72%	0.43%
GDP	14.51%	27.15%	11.49%	0.74%	**12.30%**	1.12%	32.68%
CPI	1.19%	25.96%	0.33%	2.82%	0.69%	**67.08%**	1.92%
PC	7.45%	15.90%	2.10%	2.53%	15.39%	1.93%	**54.71%**

Notes: Table 6A & 6B, row read as the percentage of the variance of forecast error of each variable into proportions attributable to shocks from other variables, including its own. The Column read as percentage in which variable contributes to other variables in explaining observed changes. The diagonal line of box (highlighted) shows the relative exogeneity.

The results of orthogonalized are summarized in table 6C. The result shows variable LLR is most exogenous variable throughout the forecast horizon. This is because, it assumed when one variables is shocked, all other variables are switched off in the model. Therefore, it's biased towards the order of variables in the VAR.

Table 6 C: Variables relative Exogeneity based on Orthogonalized

No.	4 Quarters	12 Quarters	20 Quarters
1	LLR	LLR	LLR
2	LRM	LRM	LRM
3	LHPI	LHPI	LHPI
4	LCPI	LCPI	LCPI
5	LPC	LPC	LPC
6	LKLCI	LKLCI	LKLCI
7	LGDP	LGDP	LGDP

The results of generalized forecast error variance is shown in the table 7A & 7B. Throughout the five horizon, HPI is the most exogenous variable (Table 7C). At the end of forecast horizon number 20, forecast error variance of HPI variable explained by its own shock of 86.52%, exchange rate 79.36%, Lending rate 78.13%, consumer Price Index 71.67%, Personal consumption of 61.45%, KLCI of 42.33% and GDP of 6.81. The results tend to indicate that, HPI variable has a significant role in explaining the forecast error variance of the rest of the variables. This shows, if the prices are to go on increasing on a similar way, it may be the deterministic variable in the economy.

Table 7 A - Generalized VDC Forecast Horizon = 4 Quarters (1 year)

Variable	RM	LR	KLCI	HPI	GDP	CPI	PC
RM	**82.66%**	0.23%	5.88%	0.97%	0.38%	0.13%	9.75%
LR	0.04%	**77.83%**	8.01%	0.10%	1.32%	11.23%	1.46%
KLCI	12.15%	23.32%	**46.83%**	0.07%	0.03%	2.45%	15.15%
HPI	0.27%	1.39%	1.94%	**86.94%**	7.34%	0.86%	1.24%

GDP	9.34%	14.41%	20.43%	0.09%	**15.01%**	3.70%	37.02%
CPI	0.84%	18.15%	1.85%	1.48%	1.22%	**75.04%**	1.40%
PC	4.94%	8.50%	7.53%	2.93%	10.27%	1.52%	**64.32%**

Table 7B- Generalized VDC Forecast Horizon = 20 Quarters (5 year)

Variable	RM	LR	KLCI	HPI	GDP	CPI	PC
RM	**79.36%**	0.49%	6.37%	0.92%	0.43%	0.30%	12.12%
LR	0.04%	**78.13%**	7.45%	0.15%	1.32%	11.72%	1.18%
KLCI	11.80%	26.27%	**42.33%**	0.05%	0.01%	3.20%	16.35%
HPI	0.09%	1.56%	1.81%	**86.52%**	8.05%	0.90%	1.08%
GDP	9.30%	18.43%	21.63%	0.05%	**6.81%**	3.16%	40.62%
CPI	0.94%	20.80%	2.13%	1.63%	1.07%	**71.67%**	1.76%
PC	5.15%	11.60%	8.19%	2.82%	8.25%	2.54%	**61.45%**

Notes: Table 7A & 7B, row read as the percentage of the variance of forecast error of each variable into proportions attributable to shocks from other variables, including its own. The Column read as percentage in which variable contributes to other variables in explaining observed changes. The diagonal line of box (highlighted) shows the relative exogeneity. (Appendix 10A to 10N)

From the above results, it can be seen that, VECM and VDC results contradicts. The VECM results shows, HPI variable as an endogenous variable. However, VDC show, HPI is most exogenous variable. This difference could be due to the fact that, VDC is a forecast/estimation based on the past results. The results also implies that, house prices are on the rise. The upward price movements are expected. Hence, it might be realistic to expect the house prices are moving upward, and authorities may need to take some measures to address this problem as soon as possible.

Table 7 C - Generalized VDC Variables relative Exogeneity

No.	4 Quarters	12 Quarters	20 Quarters
1	HPI	HPI	HPI
2	RM	RM	RM
3	LR	LR	HPI
4	CPI	CPI	CPI
5	PC	PC	PC
6	KLCI	KLCI	KLCI
7	GDP	GDP	GDP

Notes: Summary of table 7A & 7B.

Impulse Response Function

We then applied the generalised impulse response functions (IRF) and found that rest of the variables do respond well to one percent standard variation shock to the rest of the variables in the present model. (Appendix 10- O)

Persistence Profile

The application of persistence profile analysis was done to test the system wide shock on how long cointegrating relationship take to restore to its equilibrium level. Figure: 4 indicate, it takes 8 quarters or 2 years for equilibrium to be restored.

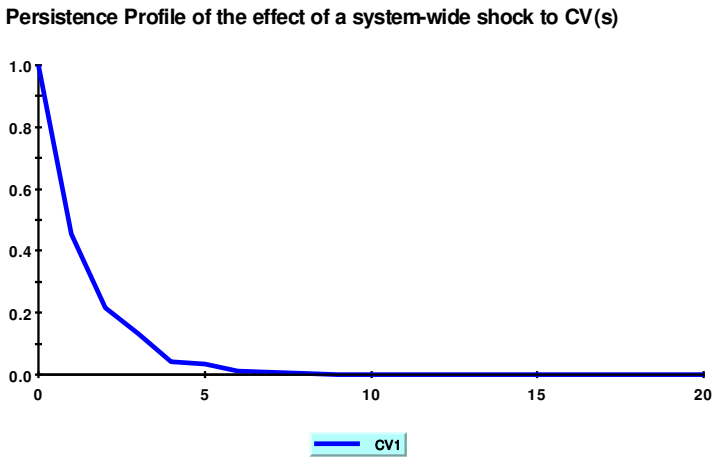


Figure: 4: Persistence profile of the effect of a system wide shock (Appendix 11)

Housing Bubble in Malaysian Housing market

The existence of housing bubble is to address the gap between the real house price and its fundamental prices. Therefore, to compare the movement of house price index and equilibrium house price index based on the variables in this study, we used multivariate dynamic forecast technique. The red colour line represent the equilibrium house price index in Malaysian housing market based on the gross domestic product, inflation, lending rate, exchange rate, Kuala lumper composite index and house hold consumption. The blue line represent house prices as per House price index.

The Figure 5, shows the descriptive evidence of the price movements in Malaysian housing market. Our results shows three similar trend in first three quarter of 2013, 2014 and second quarter of 2015. Theoretically, a house price bubble exists when the real house price index is greater than the equilibrium house prices for a long period. Therefore, the result shows a

housing bubble does not exist in the Malaysian housing market until 2015. The market tend move towards equilibrium when an imbalance exist.

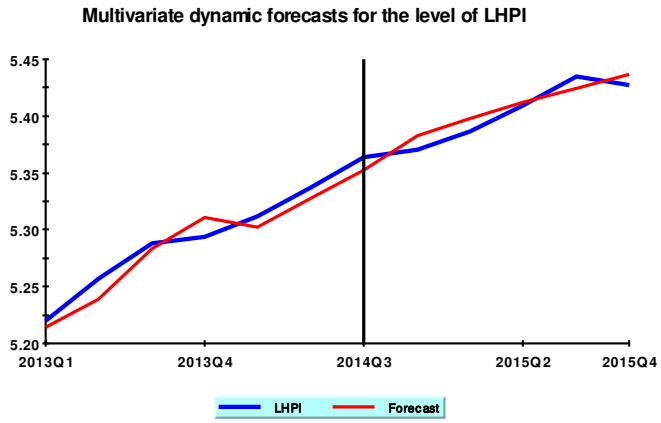


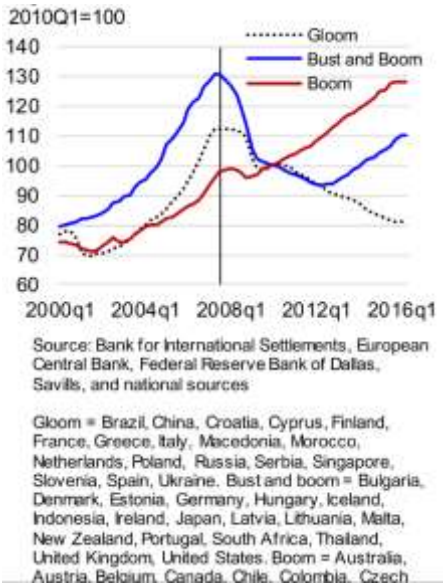
Figure 5: Results of multivariate forecast of HPI

The debate on existence of housing bubble may continue until it burst. As per last year, it has recorded slower housing transactions. This was mainly due to higher housing prices. The existence of wide gap between demand and supply of affordable housing, puts little hope for mere correction in house prices. As such, an increase in the supply of affordable housing remain key to bringing about a further easing of upward pressure on house prices (IMF Country Report, 2016).

Furthermore, IMF's Global Housing Watch reported that house prices are still growing but prices of high end properties in Kuala Lumpur have declined slightly. Among the world countries, Malaysia is among the few housing price boom economies (Figure 6). As such, IMF highlighted more concerns about the sustainability of Malaysian economy. Hence, IMF assessment state that, Malaysia may needs additional macro prudential measures, if housing market vulnerabilities intensifies. (IMF, 2016)

Furthermore, Hou (2009) suggested that existence of housing price bubble can be known through analysing relationship among house prices and income (the house price to income ratio (P-I ratio). Also, house price and rent (the house price rent ratio (P-R ratio). The figure 7 show, in Malaysia, house price increases have outpaced income and rents. Additionally, though population growth is strong in Malaysia, increase in house prices compared with other countries is difficult to comprehend (Figure 8). Further research may be done using these alternative techniques based on the current economic situation.

Figure 6: House price Boom



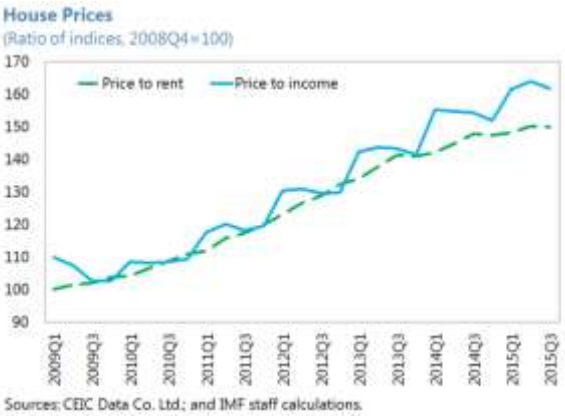
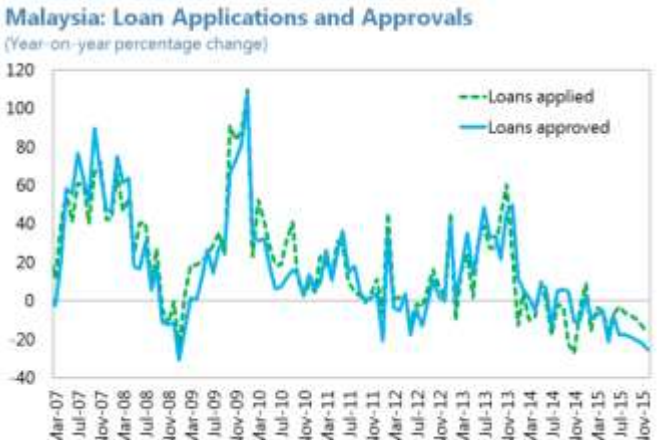


Figure 7: house prices to income

Figure 8: House price and population growth

The above facts can be pooled to conclude an evidence of existence of housing price bubble on the horizon. This can be further supported by the fact that, in Malaysia once in every five loan application is rejected at the current economic turmoil. The IMF country report highlighted its worrying trend on loan approval and applications continue to decline as the financial cycle begins to turn Figure 9 (IMF Country Report, 2016).

Figure 9: Loan application and approval



As part of ongoing fiscal reforms by Malaysian government, introduction of Goods and services tax (GST) in 2015 has increased cost of living of the household. This was further hit by government decision to raise the toll rates and public transport fares. Not to mention, depreciation of ringgit has added more heat to the economy. As such, in Malaysia, the private consumption of growth declined in 2015 from 6.0% to 7.0% that of 2014. In addition, weaker sentiments due to uncertainty in global and domestic market, further weighed down private consumption (Akhtar, n.d.,2015).

In 2016, Malaysian government has taken drastic measures to boost the people's spending. The Statutory Reserve Requirement (SRR) ratio was reduced by 0.5% (to 3.5%) in January 2016. The Employment Provident Fund (EPF) contributions were given the option to reduction from 12% to 8% in February 2016. The Overnight Policy Rate (OPR) was reduced by 0.25% in July 2016. This means, reduced SRR rates are to encourage financial institutions to lend more, reduced EPD rates are to encourage public to spend more and OPR reflects lower monthly mortgage payments for existing housing facility holders.

The proposed Malaysia Budget 2017 is expected to address the issues in the property market.. Perhaps, housing price bubble is not far away in the Malaysia Housing market.

V. Conclusions & Policy Implications

The debate over existence of housing bubble will continue until it burst. This paper investigates this particular issue in the context of Malaysian housing market. This study applied time series techniques of cointegration, Long-Run structural Modelling (LRSM), VECM, variance decomposition, impulse response and persistence profile. Using, vector error correction approach, this paper make an initial attempt to examine the long run equilibrium housing prices in Malaysia, using GDP, lending rate, inflation, exchange rate, KLCI and household consumptions as variables..

Furthermore, the impact of macroeconomic fundamentals on housing prices were studied in the cause of this research. Our findings tends to suggest that Gross-domestic product (GDP),

personal consumption and KLCI have significant impact on the long-run housing price index of Malaysia. Also, our forecast equilibrium housing prices shows, in the past market tend to correct the equilibrium imbalances which exist. Which means, a housing price bubble does not exist in Malaysia's housing market till 2015. However, the house prices are in its boom. Hence, the existence of wide gap between demand and supply of affordable housing and upward pressure on housing prices are very much realistic. The findings also implies that, house prices are on the rise. The upward price movements are expected. Hence, it might be realistic to expect the house prices are moving upward. Our findings, have strong policy implications in the sense that, if the housing price intensifies, additional macro prudential measures are required to avoid any possible house price bubble in Malaysia. It's time to expect the unexpected.

Limitation and Future research

The choice of single model to ascertain the existence of a housing price bubble may not bring a conclusive evidence. Hence, with this limitation, in future studies, it is desirable to take one or two models. Hence, future research may be conducted using alternative methods of identify housing bubbles, such as house price to income ratio (P-I ratio) or house price, rent (the house price rent ratio (P-R ratio) and house prices to population growth techniques based on the current economic landscape of Malaysia.

In addition to this, lack of monthly or daily data (especially housing price index are published quarterly), makes it challenging to analyse the true impact of price movements. Also, lack of data with regards to cost of supply as a proxy for Constructions cost in Malaysia, also limits the scope of these studies. Hence, in future research, it is hoped that researchers will take into consideration the above mentioned limitations.

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