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Empirical Analysis of House Price Bubble: A Case Study on Malaysia

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Abstract

The main objective of this research is to investigate the relationship between house price with macroeconomics variables - Gross Domestic Product per capita, inflation rate, Base Lending Rate and amount of household loan disbursed for purchase of residential properties. We try to use these variables to examine if they could trigger a housing bubble to burst in Malaysia. Granger Causality results show that there is univariate relationship from house price to Gross Domestic Product per capita. Though house price and other macroeconomics variables do not Granger–cause each other in short run, but these variables are cointegrated in the long run, i.e. there is no evidence of house price bubble in Malaysia. We suggest that soaring house prices in Malaysia is being supported by the large inflow of foreign funds into the housing sector and the unresponsive supply of houses.

Keywords: causality, cointegration, house price bubble, macroeconomics

1. Introduction

Housing is an important element in Maslow's Hierarchy of needs. Homeownership is always used as a tool to eliminate poverty and increase human well-being. Housing is not only the most long-lasting asset of household, but also plays an important role in a country's monetary channel and economic growth. Since housing industry connects with many other industries, a collapse in housing market will bring enormous effect to a country's economy, as what we have seen from the Subprime Mortgage Crisis in year 2008.

House price in Malaysia has been growing rapidly for the past decades. Malaysian Annual Property Market Report 2013 shows that average value of property in Kuala Lumpur within a year had increased 37.66% from 2012 to 2013. The drastic raise of house price in Malaysia has made many not being able to afford in owning their dream house. States such as Pulau Pinang, Kuala Lumpur and Johor Bharu have been identified as areas where houses are unaffordable. A research from Khazanah Research Institute shows in year 2014, the Median Multiple (Note 1) affordability in Malaysia at national level is 4.4 times, which has exceeded the global standard of 3.0 times. Houses in areas such as Kuala Lumpur and Pulau Pinang recorded 'severely unaffordable' level of 5.4 times and 5.2 times respectively (Suraya et al., 2015). Although Malaysia experiences economic growth, buying a house has become a 'dream' for many Malaysians.

Theoretically, when demand for house increases, this will hike up the house prices. If producers are able to produce more houses to accommodate with the demand raise, house prices therefore would not increase much. However, according to Suraya et al. (2015), in the case of Malaysia, supply of housing is unresponsive to meet the effective demand due to the facts that long period of time is needed for new houses to be built. Besides that, when new houses are built in the same area where existing houses are located, they will be priced according to the market price of the latter. The price of existing houses can be said as a determinant of the price for new houses that are being sold in the market. When demand increases, there are not enough new houses yet limited supply of existing houses will push up the housing price. More worryingly, as Lind (2009) stated, excess volatility in house price is often related to housing bubble. Hence, the main objective of this research is to investigate the relationship between house price with macroeconomics variables-Gross Domestic Product per capita, inflation rate, Base Lending Rate, and amount of household loan disbursed for purchase of residential properties. We try to use these variables to examine if they could trigger a housing bubble in Malaysia

To study the house price bubble, one should first understand the concept of bubble. Some researchers, such as Case and Shiller (2003), believe that expectation of the future price will elevate the price today. On the other hand, Brunnermeier (2008) defined bubbles as the prices of the assets go beyond the fundamental value of the assets.

Recent studies pointed out that income is one of the most important factors that influences house price. Nyakabawo et al. (2013) showed that house price Granger–cause output per capita in U.S. during the studied period. This result confirmed the claim that the subprime mortgage crisis was one of the main reasons that caused the subsequent recession in U.S. Based on the findings, they proposed that policy makers should amend the housing policy in order to stimulate economy growth. Li and Chiang (2012) pointed out that house price does not Granger–cause national income by showing that houses in China are mostly under self–ownership rather than speculative purposes, as the increase in house price does not generate capital gain. Real estate is always believed to be an effective hedge of inflation, as pointed out by Yongqiang and Tien (2004) whose results showed that inflation Granger–cause real estate price. The results of Granger Causality Test from Stevenson (2000) proved that housing market Granger–cause inflation, while McDonald and Stokes (2013) coincided with their postulation that the monetary policy on the interest rate is one of the major causes of the house price bubble. Besides the demand of house, researchers also found that supply of house plays an important role in determining house price bubble. Glaeser et al. (2008) showed that during the period of bubble, house price increased more in the location where supply of housing is inelastic relative to demand.

A general way to confirm the occurrence of a house price bubble is to relate the house price and the fundamental factors in the housing sector. House price bubble can be measured by two main categories of fundamentals. First, fundamental value or intrinsic value for the housing market is the present value obtained by the sum of discounted future revenue produced by the asset. Second, macroeconomics variable such as household income that determines the house price. However, as pointed out by Flood and Hodrick (1990), the fundamental value of the assets is not easy to be verified due to the difficulty in obtaining the data and calculating the values. Various studies tried to measure a bubble by using indirect way, i.e., whether the variations in house price can be well justified by macroeconomics variables through using empirical approaches. Clark and Coggin (2011) applied Cointegration Test and found out that house price and the macroeconomics variables they selected did not cointegrate, which means they did not converge to a stable equilibrium relationship in long run. Thus, they confirmed the presence of a U.S. house price bubble during the period. Since there is no cointegration found in the model they established, they did not apply Error Correction Model in the paper.

The rest of the paper is organised as follow: Section 2 presents the process of the research in methodology, which included the data sources and the details of each test that is carried out in the study; Section 3 discusses the empirical results; and Section 4 concludes the paper.

2. Method

Secondary quarterly time series data from 2005Q1 to 2014Q2 with 38 observations is used in this study. Regression will be carried out on macroeconomic variables that represent the demand elements of housing and house price in Malaysia. House price is defined as a function of macroeconomic variables as below:

$$HPI = f\ (GDPPC,\ INF,\ BLR,\ LOAN) \tag{1}$$

The variable *HPI*, House Price Index is obtained from the National Property Information Center (NAPIC) under the Valuation and Property Services Department. The base year of the *HPI* is converted from year 2000 to 2005Q1 to ensure that the base year used is consistent with Gross Domestic Product per capita.

The *GDPPC* variable denotes Gross Domestic Product per capita. It is used to measure the average income of house buyers in Malaysia. Both gross domestic product and population statistics can be obtained from the Department of Statistic Malaysia. Income is considered the most important variable when house buyers intend to buy a house. Per capita income is considered in this study as it manages to capture both effects of income and population on house price. When per capita income increases, the purchasing power of house buyers and demand of houses will be increased as well. House price will be pushed up. Thus, income per capita is useful to justify the direction of house price.

The data of *INF*, *BLR* and *LOAN* can be obtained from the Bank Negara Malaysia Report. The *INF* variable denotes inflation rate, which is measured using the changes of consumer price index. Inflation rate is used to confirm the movement of house price and other merchandises and services in the market. When prices of merchandises and services increase, the cost of housing will be pushed up and so does the price of houses. Thus, inflation rate can be used as a tool to explain the movement of house price.

Base Lending Rate, which is represented by the variable *BLR*, is the interest rate paid by the house buyers when they purchase a house. It is considered part of the cost of buying a house. When interest rate increase, cost of buying a house will increase, while demand of houses will decrease and so do the house price. Thus, Base Lending Rate can be used as a proxy for monetary policy in explaining house price.

The variable *LOAN* is amount of household loan disbursed for purchase of residential properties. It is used in the study to check whether monetary policy applied by the central bank affect the house price, as shown by the Austrian business cycle theory (Thornton, 2009). The amount of household loan disbursed for purchase of residential properties is anticipated to link positively with house price.

The statistic software Eviews 8 will be used to conduct the study. The tests will be carried out by using 95% confidence interval.

2.1 Unit Root Test

The Unit Root Test is conducted to test whether the data is stationary. This is to avoid spurious results in the regression. The Unit Root Test is applied on all variables House Price Index (*HPI*), Gross Domestic Product Per Capita (*GDPPC*), Inflation Rate (*INF*), Base Lending Rate (*BLR*), and Amount of Household Loan Disbursed for Purchase of Residential Properties (*LOAN*) to make sure the data is stationary before using it for empirical analysis.

2.2 Granger Causality Test

Granger (1969) suggested the knowledge of Granger Causality Test to show the variables' level of prediction power. In the author's view, only the past value of B can Granger-cause current A, but current A definitely cannot Granger-cause the past value of B. Likewise, the past value of A can Granger-cause current B but current B definitely cannot Granger-cause the past value of A. Granger (1969) pointed out that if variables A and B are not able to Granger–cause each other, the variables are independent.

Granger Causality Test is useful to examine whether past values of the variables *GDPPC*, *INF*, *BLR* and *LOAN* will change *HPI*, and vice versa. We can write the test of each variable as follow:

$$\Delta HPI_t = c + \sum_{i=1}^{n} \alpha_i \, \Delta HPI_{t-i} + \sum_{j=1}^{n} \beta_j \, \Delta GDPPC_{t-j} + \varepsilon_{1t} \quad (2)$$

$$\Delta GDPPC_t = c + \sum_{i=1}^{n} \gamma_i \, \Delta GDPPC_{t-i} + \sum_{j=1}^{n} \delta_j \, \Delta HPI_{t-j} + \varepsilon_{2t} \quad (3)$$

$$\Delta HPI_t = c + \sum_{i=1}^{n} \sigma_i \, \Delta HPI_{t-i} + \sum_{j=1}^{n} \psi_j \, \Delta INF_{t-j} + \varepsilon_{1t} \quad (4)$$

$$\Delta INF_t = c + \sum_{i=1}^{n} \tau_i \Delta \, INF_{t-i} + \sum_{j=1}^{n} \varphi_j \, \Delta HPI_{t-j} + \varepsilon_{2t} \quad (5)$$

$$\Delta HPI_t = c + \sum_{i=1}^{n} \emptyset_i \, \Delta HPI_{t-i} + \sum_{j=1}^{n} \theta_j \, \Delta BLR_{t-j} + \varepsilon_{1t} \quad (6)$$

$$\Delta BLR_t = c + \sum_{i=1}^{n} \pi_i \, \Delta BLR_{t-i} + \sum_{j=1}^{n} \rho_j \, \Delta HPI_{t-j} + \varepsilon_{2t} \quad (7)$$

$$\Delta HPI_t = c + \sum_{i=1}^{n} \lambda_i \, \Delta HPI_{t-i} + \sum_{j=1}^{n} \nu_j \, \Delta LOAN_{t-j} + \varepsilon_{1t} \quad (8)$$

$$\Delta LOAN_t = c + \sum_{i=1}^{n} \varsigma_i \, \Delta LOAN_{t-i} + \sum_{j=1}^{n} \varrho_j \, \Delta HPI_{t-j} + \varepsilon_{2t} \quad (9)$$

Where ε_{1t} and ε_{2t} refer to the residuals in the projected model respectively; the coefficient of each model is represented by *c*; the coefficient on the lagged value of *HPI* represented by α, δ, σ, φ, ϕ, ρ , λ and ϱ respectively; β and γ denote the coefficient on the lagged *GDPPC* values; ψ and τ denote the coefficient on the lagged *INF* values; θ and π denotes the coefficient on the lagged *BLR* values; ν and ς denote the coefficient on the lagged *LOAN* values.

Before the regressions are estimated, the maximum lag length should be determined in order to obtain the best results. Degree of freedom will be consumed if there are too many lagged terms included, while specification errors will occur if too little lagged terms are included. Trial and error process cannot be avoided while selecting the lag length. The Eviews software provided several lag length criteria. The minimum values of the criterions will be used as guidelines to select the length of lag.

The Granger Causality Test will be performed by testing the null hypothesis that the variables do not Granger–cause *HPI* or vice versa, versus the alternative hypothesis of the variables Granger–cause *HPI* or vice versa. The *Chi*–square statistic will be used to compare with the τ critical value. The null hypothesis will be rejected if the coefficients of the lagged variable values do not equal to zero.

2.3 Cointegration Test

Johansen Cointegration Test will be carried out in this study to test for house price bubble in Malaysia. Cointegration Test is applied to confirm the long term relationship among the variables. To start the Cointegration Test, *HPI* will be regressed on the variables *GDPPC*, *INF*, *BLR*, and *LOAN*, as shown in the following equation:

$$\Delta LOGHPI_t = \beta_0 + \beta_1 \Delta LOGGDPPC_t + \beta_2 \Delta LOGINF_t + \beta_3 \Delta LOGBLR_t + \beta_4 \Delta LOGLOAN_t + \mu_t \quad (10)$$

All variables, *HPI*, *GDPPC*, *INF*, *BLR* and *LOAN*, are first differences of the time series. Trace Test and Maximal Eigenvalue Test statistics will be used to determine whether the variables are in a long run relationship. If the null hypothesis of none cointegrated equation ($r = 0$) is rejected, the variables of *HPI*, *GDPPC*, *INF*, *BLR* and *LOAN* are in long run relationship and there is no evidence of house price bubble in Malaysia.

3. Results

The null hypothesis of the test is the variable that has unit root versus the alternative hypothesis that the variable does not have unit root. The summary of the Unit Root Test results is shown in Table 1.

Table 1. Summary of unit root tests

Variable	Augmented Dickey –Fuller Test H_1: *I*(0)	 H_1:*I*(1)
HPI	5.1779	-6.2061*
GDPPC	- 0.9193	-6.3304*
INF	-3.9586*	-
BLR	-3.0521*	-
LOAN	-0.3617	-5.4518*

Note. * Denotes significant at 5% level.

The results of Unit Root Test showed that data of house price index, Gross Domestic Product per capita and amount of household loan disbursed for purchase of residential properties contain unit root and are not stationary, while the data of inflation rate and Base Lending Rate do not contain unit root, which means that they are stationary. Thus, the non–stationary data need to be transformed into stationary data using first differences to avoid getting spurious results. The data of house price index, Gross Domestic Product per capita and amount of household loan disbursed for purchase of residential properties become stationary after first differencing.

Table 2 presents the results of Granger Causality Test. The study involves 38 observations, from 2005Q1 to 2014Q2. Lag length is determined by the statistical software, Eviews. For *HPI–GDPPC*, *HPI–INF* and *HPI–BLR*, the best results produced is to select lag 2, and for *HPI–LOAN* is lag 1. There will be eight pairs of regressions to be run for testing Granger Causality. The null hypothesis is to be rejected if the coefficients of the lagged variable values do not equal to zero at 5% significant level.

Table 2. Summary of granger causality test

Estimated Regression	Null Hypothesis	Coefficient Number of lags (*t*–statistics) 0	 1	 2	Chi-square statistics/ *t*–statistics
$\Delta HPI_t = c + \sum_{i=1}^{n} \alpha_i \Delta HPI_{t-i} + \sum_{j=1}^{n} \beta_j \Delta GDPPC_{t-j} + \varepsilon_{1t}$	H_0: $\alpha_i = 0$	-	0.7759 (4.2149)*	0.2183 (1.1815)	982.0155*
	H_0: $\beta_j = 0$	0.1008 (2.0963)	-0.0941 (1.5503)	0.0579 (1.3372)	5.2262
$\Delta GDPPC_t = c + \sum_{i=1}^{n} \gamma_i \Delta GDPPC_{t-i} + \sum_{j=1}^{n} \delta_j \Delta HPI_{t-j} + \varepsilon_{2t}$	H_0: $\gamma_i = 0$	-	0.8859 (5.7427)*	-0.3213 (-2.1914)*	41.0827*
	H_0: $\delta_j = 0$	1.2669 (2.0963)*	0.2991 (0.3641)	-1.3173 (-2.1063)*	19.3846*
$\Delta HPI_t = c + \sum_{i=1}^{n} \sigma_i \Delta HPI_{t-i} + \sum_{j=1}^{n} \psi_j \Delta INF_{t-j} + \varepsilon_{1t}$	H_0: $\sigma_i = 0$	-	0.8634 (4.4344)*	0.1719 (0.8602)	6823.017*
	H_0: $\psi_j = 0$	-0.0054 (-0.5539)	-0.0061 (-0.3764)	-0.0001 (-0.0086)	4.2899
$\Delta INF_t = c + \sum_{i=1}^{n} \tau_i \Delta INF_{t-i} + \sum_{j=1}^{n} \varphi_j \Delta HPI_{t-j} + \varepsilon_{2t}$	H_0: $\tau_i = 0$	-	1.3973 (8.1792)*	-0.8911 (-5.4471)*	67.8498*
	H_0: $\varphi_j = 0$	-2.1498 (-0.5539)	-0.9193 (-0.1791)	2.9393 (0.7357)	2.1391

$\Delta HPI_t = c + \sum_{i=1}^{n} \emptyset_i \Delta HPI_{t-i} + \sum_{j=1}^{n} \theta_j \Delta BLR_{t-j} + \varepsilon_{1t}$	H_0: $\emptyset_i = 0$	-	0.8372 (4.5124)*	0.2098 (1.0878)	8854.806*
	H_0: $\theta_j = 0$	0.1147 (1.2103)	-0.1515 (-0.9946)	0.0356 (0.3965)	2.0753

Table 2. Summary of granger causality test (continued)

Estimated Regression	Null Hypothesis	Number of lags t–statistics 0	1	2	Chi-square statistics/ *t*–statistics
$\Delta BLR_t = c + \sum_{i=1}^{n} \pi_i \Delta BLR_{t-i} + \sum_{j=1}^{n} \rho_j \Delta HPI_{t-j} + \varepsilon_{2t}$	H_0: $\pi_i = 0$	-	1.4303 (11.1226)*	-0.6029 (-4.6812)*	255.0156*
	H_0: $\rho_j = 0$	0.4058 (1.2103)	0.2101 (0.4664)	-0.6504 (-1.8571)	4.5350
$\Delta HPI_t = c + \sum_{i=1}^{n} \lambda_i \Delta HPI_{t-i} + \sum_{j=1}^{n} \nu_j \Delta LOAN_{t-j} + \varepsilon_{1t}$	H_0: $\lambda_i = 0$	-	1.0181 (37.8401)*	-	37.8401*
	H_0: $\nu_j = 0$	-0.0052 (-0.1948)	0.0190 (0.7138)	-	0.7826
$\Delta LOAN_t = c + \sum_{i=1}^{n} \varsigma_i \Delta LOAN_{t-i} + \sum_{j=1}^{n} \varrho_j \Delta HPI_{t-j} + \varepsilon_{2t}$	H_0: $\varsigma_i = 0$	-	0.7589 (6.5509)*	-	6.5509*
	H_0: $\varrho_j = 0$	-0.2215 (-0.1948)	0.5595 (0.4792)	-	4.0990

Note. * Denotes significant at 5% level.

From Table 2, the Granger Causality Test results show none of the variables Granger–caused house price in Malaysia, and house price only Granger–causes Gross Domestic Product per capita. This means the changes in previous value of house price influence present value of Gross Domestic Product per capita. House price Granger–cause Gross Domestic Product per capita may be a result of capital gain in continuing escalation of house price, as suggested by Shen, Hui, and Liu (2005), and this implies that Malaysian house owners obtain capital gain from owning a house. Nyakabawo et al. (2013) pointed out that, if this happens, it is effective to use policies that stimulate housing market in Malaysia as a tool to increase the national income. Housing market should be prioritized in any policy implementation. In addition, house price Granger–cause Gross Domestic Product per capita also shows that the collapse in housing market may bring huge disaster to the economy of the country. This is shown in the history that subprime mortgage crisis in year 2008 was one of the main reasons that caused the subsequent recession in U.S. and the global economy.

Gross Domestic Product per capita is found that it does not Granger–cause the house price in Malaysia. As explained by Shen, Hui, and Liu (2005), the growth in house price does not depend on the growth in income. The results also show that there is no evidence of the existence of house price bubble in Malaysia market, as economic growth is unlikely to escalate the house price.

House price and inflation rate do not Granger–cause each other; the appreciation in house price is not the cause of inflation in Malaysia, as in line with the findings by Dreger and Zhang (2013). Zhang (2013) argued if house price Granger–cause inflation rate, policy makers should be cautious when implementing monetary policy in housing sector, as it will push up the consumer price as well. However, this is not the case in Malaysia.

Inflation rate does not Granger–cause house price. We suggest that buying houses is an effective hedge for inflation in Malaysia. Malaysians invest in housing market as a means to protect the true value of money, as house prices increase faster than inflation. The results also can be a useful guideline for policy makers that deflationary policies are not significant to control house prices (Zhang, 2013).

Base Lending Rate and amount of loan disbursed are considered as proxies of monetary policy in this study. These two variables do not Granger–cause house price as well. Èadil (2009) pointed out that if house price Granger–cause mortgage, it can be considered as an indicator of speculative bubble. But the results show that house price does not Granger–cause the amount of loan disbursed, and we suggest there is no speculative bubble in Malaysian's housing market. However, most of the previous literatures show there is causal relationship between monetary policy and housing market. The results in this study contradict with most of the previous literatures. Credit expansion and low interest rate are always argued to be the main reasons of the 2008 Global

Financial Crisis and the subsequent global recession. Lax monetary expansion and low interest rate can be harmful to the housing sector, and the economy of the country. As explained by Belke and Wiedmann (2005), credit and assets price are always connected and influenced each other. Our results suggest that exercising vigilance monetary policy as a means to control house price in Malaysia is insignificant.

Based on the literature review, if house price and its rudiments are cointegrated, it means that the variables converge to a stable equilibrium relationship, i.e. absence of house price bubble. Engle and Granger (1987) pointed out that the linear combination of non–stationary variable will be stationary if the variables are cointegrated. According to the results in Unit Root Test, only *INF* and *BLR* are stationary among the variables. However, the Cointegration Test is still applied in this study by assuming that all the variables have a unit root. (Clark & Coggin, 2011; Ibrahim & Law, 2014).

Table 3. Summary of cointegration test

H_0	H_1	Trace Test	95% critical values	Maximal Eigenvalue	95% critical values
$r = 0$	$r = 1$	99.70933*	69.81889	45.49865*	33.87687
$r \leq 0$	$r = 1$	54.21068	47.85613	30.45310	27.58434
$r \leq 0$	$r = 1$	23.75757	29.79707	12.65018	21.13162
$r \leq 0$	$r = 1$	11.10739	15.49471	11.07380	14.26460
$r \leq 0$	$r = 1$	0.033589	3.841466	0.033589	3.841466

Note. * Denotes significant at 5% level.

The results of Johansen Cointegration Test are presented at Table 3. The lag length selected is 2. The null hypothesis of no cointegration among the variables, which is $r = 0$, can be rejected as Trace Test and Maximal Eigenvalue Test values are significant at 5% level. Hence, we conclude that there is no evidence of house price bubble in Malaysia.

4. Discussion

The empirical results proved that only unilateral relationship from house price to Gross Domestic Product per capita—the only macroeconomic variable—is affected by changes in house price. Yet the other variables do not Granger-cause house price. House price Granger–causes Gross Domestic Product per capita implies that dropping in house price will affect national income in Malaysia. The findings send an important message to the policymakers, i.e. any policy tries to subside the overheating housing market, will at the same time affect the national income.

Under the Cointegration Test, the results showed that house price index, Gross Domestic Product per capita, inflation rate, Base Lending Rate, and amount of household loan disbursed for purchase of residential properties possess a long run relationship among the variables. Based on these results, we suggest that there is no evidence of house price bubble in Malaysia. However, it is undeniable that supply of houses would also affect the house price. Hence, the study of house price bubble from the supply-side should not be neglected.

Malaysia housing is among the cheapest in the region in terms of capital city pricing. Soaring house price in Malaysia could be contributed by the large inflow of foreign investment especially from Singapore, as the houses in Malaysia are relatively cheaper than houses in Singapore.

Supply of housing is less elastic compared to demand, as the scarce of land resources especially in Kuala Lumpur and Pulau Pinang and the time taken for construction. As pointed out by Barker (2008), the relatively low supply of elasticity may be due to the delays in land purchasing, planning, and building. Suraya et al. (2015) showed that inelastic in supply to the changes of demand contributed to unaffordable housing in Malaysia. Thus, intervention of government in the housing market is vital to ensure the house price is at its affordable level. Well and forethoughtful housing policy and development projects are needed to regulate the overheating housing market. To alleviate the heated housing market, Bank Negara Malaysia has applied more stringent lending policy; loans are not easily to be approved for house buyers who are less qualified. Likewise, loans approval depends on buyers' commitments and net income, but not based on their gross income. At the same time, government should fight against the speculative activities in the housing market.

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Note

Note 1. Median multiple: the ratio of median prices for the housing market to the median gross annual household income. This formula was developed by the United Nations Centre for Human Settlement (1988).