

Housing Bubble in Penang: Prediction and Determinants

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Graphical abstract



Abstract

House prices in Malaysian cities increased drastically in the past few years, notably in the state of Penang. The existence of a housing bubble is speculated by major property players. This paper ascertains whether a housing bubble exists in Penang and explores the long-run and short-run determinants of Penang residential prices. Quarterly data (2000Q1 to 2012Q2) of House Price Index is the dependent variable and Gross Domestic Product, Consumer Price Index (CPI), Base Lending Rate (BLR) and Housing Supply as independent variables. Econometric model together with fully modified Ordinary Least Squares regression were used to detect the presence of housing bubble in Penang. The determinants of Penang house prices are based on Granger causality and variance decomposition analysis using the vector autoregressive (VAR) model. The results show no evidence of housing bubble in Penang housing market. CPI has both long-run and short run causality relationship with house prices while CPI and BLR explain a large part of housing price variance. Results show changes in inflation and cost of borrowing will greatly affect Penang house prices.

Keywords: Housing bubble; housing price determinants; housing price variance

Abstrak

Harga rumah di bandar-bandar Malaysia meningkat secara mendadak kebelakangan ini, terutamanya di negeri Pulau Pinang. Pihak-pihak harta tanah menspekulasi tentang kewujudan gelembung perumahan. Kajian ini menentukan sama ada gelembung perumahan wujud di Pulau Pinang dan faktor-faktor penentu jangka panjang dan jangka pendek harga kediaman Pulau Pinang. Data suku tahunan (untuk 2000Q1 hingga 2012Q2) Indeks Harga Rumah ialah pemboleh ubah bersandar dan Keluaran Dalam Negara Kasar, Indeks Harga Pengguna (IHP), Kadar Pinjaman Asas (BLR) dan Bekalan Perumahan adalah pembolehubah bebas. Model ekonometrik bersama-sama dengan regresi *Ordinary Least Squares* diubahsuai sepenuhnya telah digunakan untuk mengesan kehadiran gelembung perumahan di Pulau Pinang. Penentu harga rumah di Pulau Pinang adalah berdasarkan pada *Granger causality* dan varians penguraian analisis menggunakan model autoregresif vector (VAR). Keputusan menunjukkan tiada bukti gelembung perumahan dalam pasaran perumahan Pulau Pinang. IHP mempunyai kedua-dua hubungan *causality* jangka panjang dan jangka pendek dengan harga rumah manakala IHP dan BLR menjelaskan sebahagian besar varians harga perumahan. Keputusan menunjukkan perubahan inflasi dan kos pinjaman akan memberi kesan kepada harga rumah di Pulau Pinang.

Kata kunci: Gelembung perumahan; penentu harga perumahan; varians harga perumahan

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1.0 INTRODUCTION

Housing bubble can be described as situations where house prices rise rapidly due to expectation and then decline due to reversal of prospect¹. House prices are a major concern in every country, particularly if it results in housing bubbles which may push the whole economy into recession.

Recent researches on housing bubble e.g. on China housing market where²⁻³ found evidence of bubble but⁴ determined otherwise.⁵ conducted their study in India and found that no housing bubble exists. In Australia,⁶ claimed that Australia is not facing a housing bubble as the factors that contributed to the US housing bubble were not evident in the Australia housing market.

The increase in house prices in the state of Penang is the highest among all the states in Malaysia, giving rise to whether a housing bubble exists.⁷ spelled out that the house prices in Penang in 2010 had far exceeded the prices projected for 2014. However, real estate players voiced out that the housing bubble is a myth because it is not backed by reasonable evidence⁸. In contrast, other real estate players disagreed by declaring the drastic rises in the house prices is a characteristic of housing bubble which is happening in the Penang housing market⁹. This had led to the importance of this study to be conducted to determine the existence of housing bubble in Penang.

In addition, there are only a handful of researches conducted in Malaysia, including¹⁰⁻¹¹. Both these studies are confined to the

general house prices of Malaysia as a whole and did not focus on particular geographical areas such as Penang. Based on the above, three research questions arise. First, what are the measures to detect housing bubble? Second, whether housing bubble exists in Penang? Third, what are the long run and short run factors that affect Penang house prices?

The findings of this study is beneficial to several parties such house buyers and investors in providing information on Penang housing market and also developers and governments in supplying information for regulating proper policy and laws regarding housing price. This paper is divided into several sections. Section I introduces the background, problem statement, objectives and implication of the study. Section II provides theory of housing bubble. Section III discusses data and methodology. Sections IV and V include empirical findings and concluding.

■ 2.0 HOUSING BUBBLE

Housing bubble can be described as situations where the prices of housing rise rapidly due to expectation and then decline due to the reversal of prospect¹. There are numerous methods used to detect housing bubble and each of them has its advantages and disadvantages. Fundamental price approach uses the long-term mean price and long-term price trend as the fundamental price used to benchmark against market prices. This method is the simplest method but cannot be used alone to support the result achieved. For example,¹⁰ also utilised dating algorithm to enhance the accuracy of his findings.

Dating algorithm recognizes the turning points in the log-level of real estate prices by determining the maximum and minimum in five-year data windows. According to¹² the problems with this approach is the accuracy of determining the turning points, difficulties arising from incomplete phases, censoring rules to restricts the minimal lengths of phase and modifications to precisely recognize the pattern of the cycle.

Markov switching regime approach was proposed by¹³ to analyze time series data in detecting housing bubble. This method consists of multiple equations that can distinguish the time series behaviours in different regimes¹⁴. The weakness of this approach is in precisely estimating the regime shifts.

Several scholars like^{11,15-18} used econometric models to capture the fundamental price with housing prices as dependant variables and a mixture of macroeconomic factors as independent variables. The equilibrium housing prices can be calculated and comparison will be made with actual price movement to determine any deviations. The major difficulty in performing this method is that using different variables and different model structures would generate dissimilar sets of fundamental housing prices series. Thus, there should be proper selection of variables that can accurately reflect the housing market.

A bubble exists when there is a movement of market prices at a magnitude of at least 20-25 per cent from the fundamental price¹². Thus, indirect evidence such as macro factors and a 20 per cent measurement line from fundamental price will be used in this study to investigate whether bubble occurred in the Penang housing market

■ 3.0 DATA AND EMPIRICAL METHODOLOGY

3.1 Data Collection

Housing Price Index (HPI) for Penang residential properties, Gross Domestic Product (GDP), Consumer Price Index (CPI), Malaysian Base Lending Rate (BLR) and Penang Housing Supply (HS) are

the variables of this study. The sample period covered 2000Q1 to 2012Q2. HPI and HS were downloaded from NAPIC website, GDP and CPI were collected from Department of Statistics, Malaysia while BLR from the Central Bank of Malaysia. All the variables were transformed into natural logarithms except BLR.

3.2 Estimation Procedure

Fundamental house price model¹⁹ will be used to determine the fundamental house prices in Penang and estimated by utilizing fully modified OLS. Fully modified OLS is used since it could correct for endogeneity and serial correlation effects, eliminates sample bias and able to accelerate the convergence rate of the coefficient estimator²⁰. Once the model is estimated, the fundamental house price will be compared with the real house price to detect the bubble. Any price misalignments exceeding 20 per cent from the fundamental house price based on¹² will be considered as housing bubble.

Next, vector autoregressive (VAR) model will be performed to test for cointegration and to find the major determinants of housing price in Penang. The Augmented Dickey-Fuller (ADF) unit root test is used to determine the stationarity of the data. Then, Johansen-Juselius cointegration test is conducted to determine whether variables were integrated of the same order. Vector error correction (VEC) model would be estimated to model the short-run dynamics if the variables were found to be cointegrated. Next, the granger causality test is conducted based on the VEC to verify whether macroeconomic variables (independent variables) do Granger cause the house price index followed by variance decomposition.

3.3 Fundamental House Price Model

There are many models used to derive the fundamental house price but in this study, the model from¹⁹ will be utilized. This model was chosen due to its simplicity in empirical investigation on the structure of housing supply which had been tested in Malaysia by^{19,11}. The model is as follow:

$$P_h = \gamma_0 + \gamma_1 Y + \gamma_2 P_0 + \gamma_3 P_c \quad (1)$$

where P_h is house price, Y is income, P_0 is price of other goods and P_c is cost of construction. Furthermore, first time buyers usually obtain mortgages from financial institutions to buy houses. The credit constraints on house buyers are not taken into account. Therefore, in this research, interest rate had been added to confine the credit channel as suggested by^{21,11}. Then, equation (1) now can be rewritten as Equation (2) where IR is the base lending rate of commercial banks.

$$P_h = \gamma_0 + \gamma_1 Y + \gamma_2 P_0 + \gamma_3 P_c + \gamma_4 IR \quad (2)$$

In this study, P_h represents Penang House Price Index (HPI), Y represents Gross Domestic Product (GDP), P_0 represents Consumer Price Index (CPI), P_c represents Housing Supply (HS) and IR represents Base Lending Rate (BLR).

²²proposed that GDP can be measured in term of income as it works on the principle that the incomes of the productive factors must equal to the value of their product, and GDP can be determined by finding the sum of all producers' income. Besides,¹⁵ employed GDP as income factor. Hence, GDP can represent income and used to substitute income in Equation (2).¹⁹ had substituted CPI as price of other goods in Equation (2). This is because CPI can be defined as the cost of purchasing. Moreover,²³ mentioned cost of construction and housing supply are equivalent to the supply side of housing. Thus, due to limitation of data in

cost of construction, housing supply is used to substitute construction cost in Equation (2).

3.4 Vector Autoregressive (VAR) Model

VAR model was used to test for cointegration and determine the major determinants of housing price in Penang. VAR is famous for its excellent forecasting performance as VAR is shown to have better forecasting ability than sophisticated macroeconomic variables²⁴. Besides, VAR is also used for analyzing the dynamic impact of random disturbances on the system of variables.

The model has five variables namely House Price Index (HPI), Gross Domestic Product (GDP), Consumer Price Index (CPI), Base Lending Rate (BLR) and Housing Supply (HS). Housing price index will be the dependents variable and the rest as independent variables. The model is as below:

$$\log HPI_t = \alpha + \beta_1 \log GDP_t + \beta_2 \log CPI_t + \beta_3 BLR_t + \beta_4 \log HS_t + \varepsilon_t \quad (3)$$

where α is the intercept, $\beta_1, \beta_2, \beta_3$ and β_4 are the coefficients of the model. $\log HPI$ is the log of housing price index, $\log GDP$ is the log of gross domestic product, BLR is the base lending rate, $\log HS$ is the log of housing supply and ε_t is the error term.

4.0 EMPIRICAL FINDINGS

4.1 Detection of Housing Bubble

The fundamental equilibrium house prices of Penang can be generated from the coefficients obtained from fully modified OLS as reported in Table 1.

$$LHPI = -4.491 + 0.441(LGDP) + 1.141(LCPI) - 0.017(BLR) - 0.073(LHS)$$

The coefficient of GDP indicates that 1 per cent increase in GDP will increase the HPI by 0.441 per cent. The positive relationship is comparable with¹⁷ where they found that house price is sensitive towards GDP performance. In addition, a 1 per cent in CPI will increase the HPI by 1.141 per cent. CPI has a positive effect on HPI which is similar with¹⁹ findings because the increase in domestic price level will increase the cost of construction causing an increase in housing price.

The effect of BLR on HPI is not significant and supports¹¹ findings. This is likely due to financial innovation which created flexible housing loans and interest payment structures²⁵ thus dampening the effect of fluctuating BLR.²⁶ suggest that housing supply together with demand factors are likely to play an equally important role in affecting house prices. Housing demand and supply in Penang are moving in parallel with high trading activities in real estate and supply in housing, thus, housing supply would not significantly affect the housing price as it had been balanced with the housing demand.

Table 1 Coefficients of fundamental house price model

Dependent Variable: LHPI				
Variables	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.441	0.173	2.55	0.014
LCPI	1.141	0.369	3.091	0.004
BLR	-0.017	0.023	-0.739	0.464
LHS	-0.073	0.225	-0.325	0.747
C	-4.491	0.959	-4.684	0.000
R-squared	0.951			
Adjusted R-squared	0.947			

From the equation obtained, Penang housing bubble can be examined by comparing the fundamental and actual house price with a bubble limit. The comparison can be seen in Figure 1 below. Although there is a price misalignment starting from first quarter of 2011 until second quarter of 2012 but the misalignment had not exceeded the bubble limit. Hence, no bubble was detected in Penang housing market. The analysis continues with identifying the determinants of housing price in Penang even though there is no housing bubble occurred since Penang housing price is far above to other states.

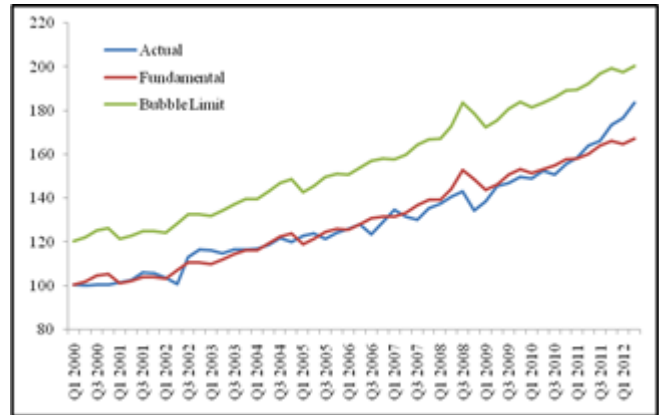


Figure 1 Actual and Fundamental House Price Index from Quarter 1 2000 to Quarter 2 2012

4.2 Long Run and Short Run Housing Price Determinants

This study uses Augmented Dickey-Fuller (ADF) unit root test to test the integration of the variables as it is important to test the stationarity of variables in analyzing time series data and the result are presented in Table 2. Results shows that all the variables were not stationary at level but were significant at the first difference thus; the null hypothesis that the variables contain a unit root can be rejected. Therefore it can be concluded that all the variables were stationary.

Given that the variables are stationary at the first difference, the Johansen cointegration test can be performed to identify the existence of any cointegration or long run relationship among the variables. Table 3 and Table 4 review the Johansen cointegration test result for trace and maximum eigen-value for the model of this study. The result reveals that there were 2 cointegration equations for the trace and 1 cointegration equation for the maximum eigen-value indicating that the variables were cointegrated concluding a long run relationship exist between the dependent and independent variables.

Table 2 Augmented Dickey-Fuller (ADF) Unit Root Test

Variable	Level		First Difference	
	Intercept	Intercept and trend	Intercept	Intercept and trend
Log HPI	1.210	-2.738	-6.877***	-7.088***
Log GDP	-0.528	-3.147	-4.291***	-3.731**
Log CPI	0.337	-2.865	-5.515***	-5.489***
BLR	-2.565	-2.442	-5.282***	-5.288***
Log HS	-2.213	-2.088	-1.408	-5.384***

Note: *** Denotes significance at 1 per cent level and ** at the 5 per cent level.

Table 3 Johansen cointegration test results based on trace statistic

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized	Trace	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.758	119.926	76.973	0.000
At most 1 *	0.415	54.625	54.079	0.045
At most 2	0.288	29.951	35.193	0.165
At most 3	0.174	14.361	20.262	0.265
At most 4	0.114	5.575	9.165	0.226

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

Table 4 Johansen cointegration test results based on maximum eigenvalue statistic

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized	Max-Eigen	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.758	65.301	34.806	0.000
At most 1	0.415	24.674	28.588	0.146
At most 2	0.287	15.589	22.299	0.328
At most 3	0.174	8.786	15.892	0.457
At most 4	0.114	5.575	9.165	0.226

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

Since the variables are cointegrated, the Granger causality based on the vector error correction (VEC) model is utilized for the model to determine the long run and short run causality relationship among the variables as presented in Table 5. Result shows CPI has significant short run causal effects on house price at 5 per cent level. The ect(-1) term is significance at the 10 per cent level which indicates long run causality running from GDP, CPI, BLR and HS to HPI. This result is consistent to ¹⁵ assertions that housing prices are affected in long run by GDP, CPI and lending rate. Besides, CPI is the only variable that has short run and long run causal effects on house price; this mean inflation rate has immediate and continuing effects on house price since it is a weighted average of sub-indices for different components of consumer expenditure like housing, food and clothing. Thus, when there is a change in CPI, housing price will follow the same trend and it shall be pay proper attention in controlling house price.

Table 5 Granger Causality with LHPI as the dependent variables

	Σ DLGDP	Σ DLCP	Σ DBLR	Σ DLHS	ect(-1)
F-stats.	0.414353	4.402692	0.057153	1.477422	-1.745847*
	(2)	(1)**	(1)	(1)	

Notes: ect(-1) represents the error correction term lagged one period. The numbers in three brackets show the optimal lag based on the AIC. D represents the first difference. Only F-statistics for the explanatory lagged variables in first differences are reported here. For the ect(-1) the t-statistic is reported instead. ** denotes significance at the 5 per cent level and * indicates significance at the 10 per cent level.

The research continues with variance decomposition analysis because it provides information about the relative strength of random shock in system²⁷. Table 6 reveals the results of the variance decomposition up to 10 periods. In the short run (period 2), CPI is dominating the variance as compared to other independent variables and in the long run (period 10), all independent variables have increase their contribution towards house price's movement. This is consistent with the finding of Granger causality results presented in Table 5. Another notable finding is a large portion of housing price is explained by itself

where this is similar to the stylised feature of housing markets in other parts of the world where housing prices display strong persistence because of the time taken in clearing the market in the aftermath of a shock. Higher persistence means that the risk of relatively quicker reversal in housing price in the event of a shock can be ruled out. The results of variance decomposition also indicate that monetary conditions (CPI and BLR) have a huge part of the variance and considered as primary drivers of growth. Therefore, there is a need to carefully evaluate the consequences of monetary policy actions as it has large impact on housing sector. However, it is alarming to find that income growth played only a minor role in determining housing prices; this reflects an extent of adverse selection in overall bank financing.

Table 6 Variance decomposition

Period	S.E.	LHPI	LGDP	LCPI	BLR	LHS
1	0.027	100.000	0.000	0.000	0.000	0.000
2	0.033	93.671	1.198	3.822	0.967	0.342
3	0.037	84.938	1.248	7.068	1.465	5.281
4	0.040	83.476	1.293	5.983	2.078	7.169
5	0.043	83.513	1.819	5.319	2.751	6.598
6	0.046	83.733	2.076	4.734	3.445	6.012
7	0.048	83.907	2.091	4.271	3.968	5.763
8	0.051	83.717	2.079	4.033	4.459	5.710
9	0.052	83.170	2.167	4.093	5.053	5.516
10	0.054	82.536	2.289	4.218	5.758	5.199

Cholesky Ordering: LHPI LGDP LCPI BLR LHS

4.0 EMPIRICAL FINDINGS

The study has discussed several methods in detecting housing bubble namely fundamental price approach, dating algorithm, Markov switching regime and econometric models. Besides, the study also proved that there was no housing bubble occurs in Penang housing market and Consumer Price Index is the major determinants of Penang housing price in the short run and long run periods. This research would be able to help researcher to fill the gap in literature regarding methods that can be utilized in analyzing housing. Not only that, this research also served as information provider to investor and developer regarding housing market in Penang which would enable them to do proper investment in Penang since there is no housing bubble detected. It will be a good guideline or reference for them in investing in Penang housing market as they can track the trend of market price movement and subsequently forecast the future price movements and to identify the investment opportunity appears. Thus, they can make wise decision on investing in Penang. Taken together the key implication of the findings is monetary policy is expected to exert a significant impact on housing price as CPI has a large impact on housing price in the short and long runs and monetary conditions (CPI and BLR) explain a huge part of the variance of housing price. Hence, it is essential that measured policy adjustments are taken by government to avoid adverse effects on housing sector

For future recommendation, it is suggested to apply another approach in detecting housing bubble and the scope of study can be enlarged to other types of properties or other states in Malaysia to improve the results.

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