MJBE Malaysian Journal of Business and Economics

Liberalization and its Impact Based on House Types

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Received: 3 January 2019

Accepted: 27 May 2019

Keywords: *house price, Johansen test, liberalisation, macroeconomics, real estate*

ABSTRACT

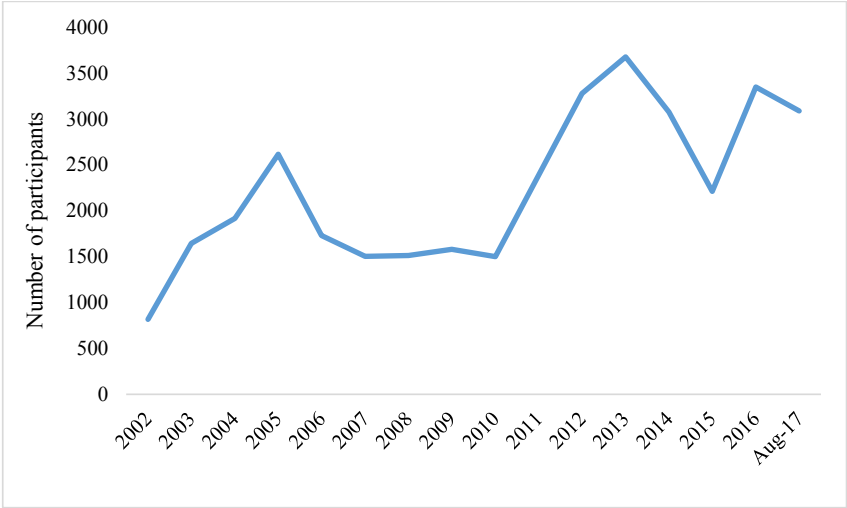
The purpose of the research is to examine the long-term relationship between house price in Malaysia and housing related macroeconomic variables. The secondary aim is to compare the macroeconomic variables' impact on different house types in order to observe which residential types are affected the most during post-liberalisation period. Time-series analysis was used based on data span between 1999 and 2012. This study employed three unit root tests (ADF, PP, and KPSS), Johansen cointegration test, and VECM. Findings suggest that liberalisation poses similar impacts on the prices of high-rise, terrace, and semi-detached houses. The high impact on high-rise's price is expected as demand for houses is focused on the urban and economically active areas. Although the terrace type is not a goal of foreign buyers, high liberalisation through low interest rates has 'trapped' potential terrace owners. It was suggested that terrace prices are affected by the same magnitude as high-rise prices, although the potential buyer groups are different. Therefore, liberalisation policy needs to be reviewed, as the openness has affected even the residential market for the bottom billion population.

INTRODUCTION

House prices in Malaysia have been increasing since 2009 when the government liberalised the housing sector. Liberalisation of the sector includes the abolishment of the Foreign

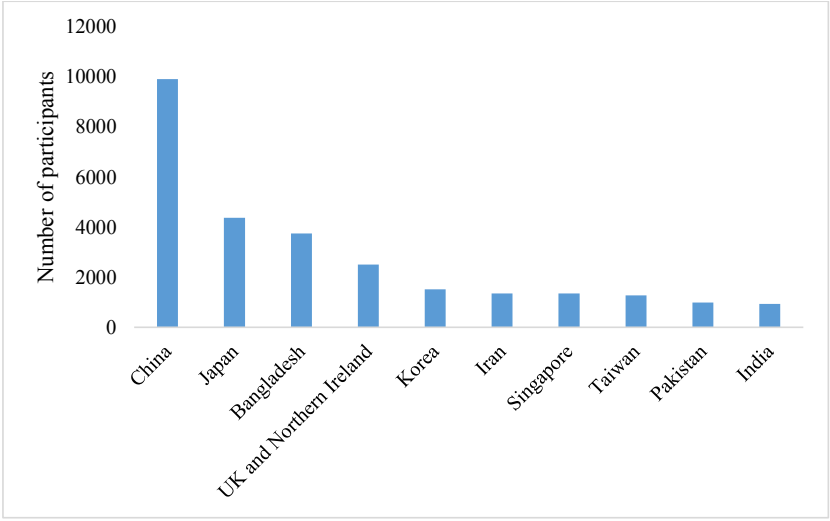
Investment Committee's approval, which previously must be met if a foreigner wanted to purchase a home in Malaysia. Further, the liberalisation includes relaxing the purchase price cap, meaning that a foreigner is no longer restricted to buy a property at certain minimum prices (the cap however was reinstalled in 2015). Due to the liberalisation, properties in Malaysia are being hunted by foreigners especially from the neighbouring countries.

Since Malaysia introduced the Malaysia My Second Home Programme (MM2H) in 2002, the number of participants has been increasing. The number went down between 2005 and 2009, however parallel with the announcement of liberating the residential property policies, the number of participants jumped drastically in 2010. Based on MM2H statistic, a total of 3,084 participants have joined the programme since it was introduced in 2002 (Figure 1). The highest participants came from China, followed by the Japanese and interestingly, Bangladesh (Figure 2). Since MM2H programme allows participants to stay and purchase residential property easily, it is fair to say that properties that are most sought after by the foreigners are from the residential type.



Source: MM2H (http://www.mm2h.gov.my/index.php/en/home/programme/statistics)

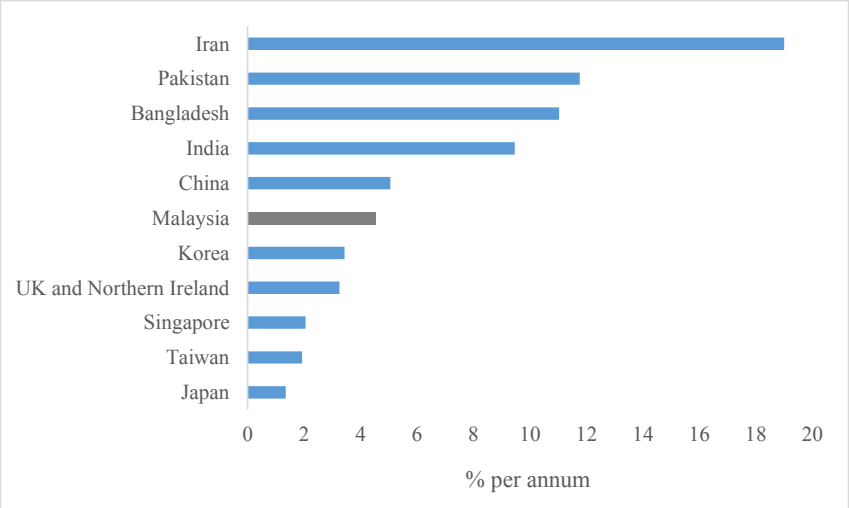
Figure 1 Number of MM2H participants (2002 – August 2017)



Source: MM2H (http://www.mm2h.gov.my/index.php/en/home/programme/statistics)

Figure 2 Top 10 participating countries from 2002 – August 2017 in Malaysia My Second Home Programme

Loan facilities could be an attractive factor to foreign investors, unfortunately data on how foreigners bought property in Malaysia (either through local loans, cash, mortgage, etc.) is publicly unavailable. However, mortgage comparison (Figure 3) among top participants of MM2H may provide reason for residential buyers or investors coming to Malaysia. Based on the figure, five out of 10 top MM2H participant countries have mortgage interest higher than Malaysia; Iran (19%), Pakistan (11.8%), Bangladesh (11%), India (9.5%) and China (5%). Thus, there is a possibility that foreigners from these countries took advantage of relatively lower financing cost in Malaysia. While mortgage interest rates are relatively lower in Korea, UK, Singapore, Taiwan and Japan, Malaysia is considered the best property investment destination due to several property-related factors such as having the cheapest buying price per square meter and the lowest buying and selling cost (Table 1).



Source: www.numbeo.com

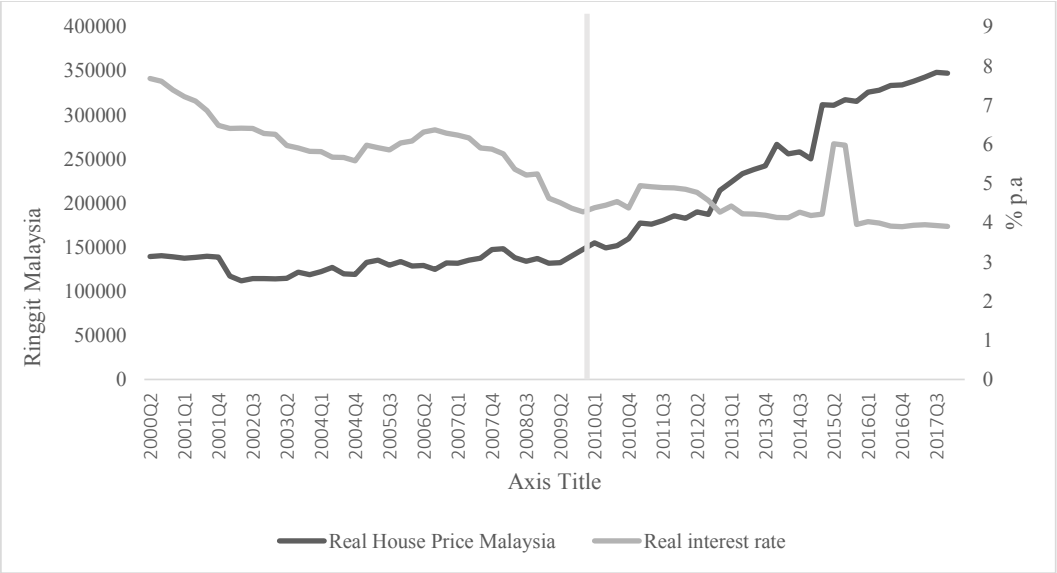
Figure 3 Mortgage interest rate in % yearly for 20 years with fixed rate, salaries and financing

Table 1 Buying price per square metre and buying and selling cost among selected cities

	Buying price per square metre (USD)	Buying and selling cost (%)
Kuala Lumpur	3,441	5.18
Taipei	10,373	9.93
Mumbai	10,932	11.88
Shanghai	11,829	7.35
Singapore	13,748	23.95
Tokyo	16,322	13.36
London	29,676	10.03

Source: Global Property Guide (2018)

Figure 4 shows the trend of real lending interest rate and real house price in Malaysia. Grey line shows the period where property liberalization announcement was made. Lending interest rate shown a downward trend since 2006, while the increase in house price was little. When liberalization was announced, interest rate was at its lowest point (later continued its downward trend) but house price growth jump drastically. This indicate that the liberalization measure which focused on the non-monetary and monetary policies may have a significant influence in the raising price of property market.



Source: Bank Negara Malaysia

Figure 4 Real house price and real interest rate Malaysia (2000 – 2017)

Malaysia, through the Valuation and Property Service Department under the Ministry of Finance, has classified residential properties in Malaysia into four types. The first type is terrace, which is popular among Malaysians. The terrace has a minimum of three bedrooms, however, could also be in of the form of a double storey that has four bedrooms. The terrace type is normally sought after by the low- and middle- income earners. Semi-detached (semi-D) and detached types are normally expensive for the average Malaysians but not to foreigners. Since the liberalisation, the housing projects of these types have increased due to high demand for them. The high demand has pushed up the prices of the semi-Ds and detached houses and yet, foreign buyers still consider the prices as competitive relative to similar types in their countries.

Urban areas that are comparatively more dynamic economically began to see the development of massive flats, apartments, and condominiums. As the price of landed houses went up, the housing demography also changed. Malaysia's housing landscape observed the customer segment who previously would opt for a landed house now has to satisfy with a high-rise house. Land price is not the only factor that has caused the shift in buying preference. Since economic activities are concentrated in urban areas such as Kuala Lumpur and Klang Valley, high rises are built to meet the demand of urbanites.

Attempts have been made in the literature to determine the connection between house price and macroeconomic variables, mostly at the country level. Such studies however, never considered the different types of houses that signify an important underlying variable, which is the nature of potential house buyers in Malaysia. Thus, previous studies might have investigated the determinants of house prices as a whole but left a gap in capturing the possibility of macroeconomic variables' effects on prices of different house types. This study intends to bridge the gap, and the findings might provide the policy maker an insight on how property-related macroeconomic variables might influence the choice of different house types. Against this backdrop, the broad objective of this study is to analyse the long-term relationships among house price (of different house types), liberalisation, house supply, and amount of loan approved for construction. As such, these research objectives are sought after:

(a) To examine the impact of liberalisation on house price in Malaysia,
(b) To determine the impact of house supply on house price in Malaysia,
(c) To determine the impact of amount of loan distributed on house price in Malaysia.

The remainder of this paper is as follows. Section 2 discusses the previous literature. Section 3 describes the econometric modelling and estimation techniques. Empirical findings are described in Section 4, while Section 5 concludes this study with policy recommendations.

LITERATURE REVIEW

Price theory asserts that in a free market economy, the market price is determined by supply and demand. The equilibrium price is set so as to equate the quantity being supplied with that being demanded. In reality however, the price may be distorted by other factors such as tax and other government regulations.

The house price studies can be divided into several clusters – dynamic (studies which focuses on growth rate of house price variables, rather than level), cycle (studies which focuses on the boom-bust of house price), and residential facilities (studies which focuses on the property and building management aspects. Examples of the dynamics study are the studies by Capozza, Hendershott, Mack and Mayer (2002), Hort (1998), Englund and Ioannides (1997), Caplin and Leahy (2011), Favara and Song (2014), and Kim and Rous (2012). The cycle study includes the studies by Cooper (2013), Bordo and Landon-Lane (2011), Ren, Xiong and Yuan (2012), and Kannan, Rabanal, and Scott (2012). Meanwhile, Kuethe and Keeney (2012), and Richardson, Vipund, and Furbey (1974) conducted the residential facilities study.

While there is a substantive body of literature on house prices in particular in the current decade, no fixed set of price determinants has been identified. For example, Glindro, Subhanji and Zhu (2011) studied the macroeconomic and institutional impacts in explaining the differential impact between fundamental and speculative housing bubbles. According to them, the spillover effects of housing bubbles only have a mild adjustment on Asia Pacific property development and introduce only minor damage to the banking system.

Galati, Teppa and Alessie (2011) studied the roles of micro and macro factors in determining house prices in the Netherlands. They utilised house owner's subjective assessment of their house value. Their findings revealed that house prices are strongly related to household-specific and house-specific factors, including year of construction, cohort, education level, income, and wealth. Financing conditions, in particular the presence of a mortgage, mortgage type, and mortgage rate, play an important role. They also found that long-term interest rate influences how households value their homes. In addition, there is evidence of "well-behaved" dynamics of subjective house prices, indicating that house prices tend to converge to their long-term equilibrium value.

Malaysian residential house prices are believed to be partially factored by business-related factors that are often used to explain commercial-industry property prices Tan (non-dated). He used economic factors (such as per capita income, unemployment rate, customer price index (CPI) for durable goods), financial factors (such as loans and advances to housing developers, average commercial bank lending rate), and Composite Index.

Our review of the literature suggests that many house price determinant studies included finance-related variables such as the deregulation issue, policy, interest rate, and

mortgage rate. Michalski and Ors (2012) and Landier, Sraer, and Thesmar (2013) for example found that interstate banking deregulations had a strong and immediate impact on banking, which immediately caused a sharp increase in house prices.

The importance of monetary policy in addressing bubbles was discussed by Bernanke (2010). Assigning the correct monetary policy could be crucial as some observers claimed that excessively easy monetary policy by the Federal Reserve had caused house price bubbles in the US. The problem is when the unavoidable bubble burst, it will be a major source of financial and economic stresses (Ahearne, Ammer, Doyle, Kole, & Martin, 2005; Del Nego & Otrok, 2007). Nonetheless, the rise in house prices when interest rate falls is not a proof that low interest rates cause bubbles. The proponents of using the policy however, emphasised that a greater use of the monetary policy could prevent and control bubbles in the prices of houses and other assets (Jarocinski & Smets, 2008; Reifschneider & Williams, 2000).

Proponents of liberalization constantly defend the idea of the movement as engines of economic growth that benefit everyone. For them, liberalization lead to certain policy conclusions about whether it is appropriate to link economic to environmental or labor policies. The subject has normally been focused on talks on trade and financial liberalization (e.g., Jarocinski and Smets (2008) who incorporated basis of developments in real and nominal GDP and interest rates, explored how economic shock affects housing demand in the US.)

It is believed that financial liberalization started in the US in the early 1980s. Campbell and Hercowitz (2005) and Iacoviello and Neri (forthcoming) proposed that it started with the Monetary Control Act of 1980 and Garn-St. Germain Act of 1982. Both acts stimulate market innovations through the relaxation of collateral constraints on household debts and the deregulation of savings and loan industry. The development this scenario had allowed firm that had financial problems in the past and could not raise fund to obtain it through high-risk debt market. As a result, more firms borrowed to finance their operation. Coupled with changes in government policies, among others, abolishment of interest rates ceilings on deposit accounts, funds available for lending increased. At the same time the situation increased the propensity to borrow.

In relation to housing market sector, financial liberalization has brought important issues regarding the debt, financial fragility and affordability issues. A commonly used representation of financial liberalization is monetary policy. The effect of monetary policy on housing had been researched by (among others) Ahearne, Ammer, Kole and Martin (2005), Iacoviello and Minetti (2008) and Gupta, Jurgilas and Kabundi (2010).

Recently, Gupta, Miller and Wyk (2012) for instance, consider how financial market liberalization via monetary policy affects the US house dynamics. They found that housing market appears more sensitive to monetary policy shocks in the post-liberalization period. The negative effect of the monetary policy shock on house prices persists and remains significant for more than two years before liberalization, while after liberalization, prices recover rapidly in about one year.

In studying a two-sector general equilibrium model of housing where households face limited opportunities to insure against risks, Favilukis, Ludvigson and Nieuwerburgh (2011) found that the model generates large variability in the national house price-rent ratio because it fluctuates according to the state of the economy. It also rises in response to a relaxation of credit constraints and decline in housing transaction costs (financial market liberalization). These factors, together with a rise in foreign

ownership of U.S. debt calibrated to match the actual increase over the period 2000-2006. The model also predicts a sharp decline in home prices starting in 2007, driven by the economic contraction and by a presumed reversal of the financial market liberalization.

Vargas-Silva (2008) however found that response of the housing activity variable to a monetary policy shock is smaller and lasts for a shorter period in the US housing market. Further, he found monetary policy do not lead to increases in the GDP deflator, house prices, commodity price index, non-borrowed reserves and real GDP, or decreases in the federal funds rate for a certain period.

There are various ways on how local government regulations influence the amount, location, and shape of residential development. Molly and Gyourko (2015) reviewed how these constraint affect development induce negative externalities including the role of homeowners in the local political process, the influence of historical density, and the fiscal and exclusionary motives for zoning. It appears that regulation could affect the house supply subsequently house prices, construction, elasticity of housing supply, urban form, labour markets and also household sorting in community.

In the UK, house prices react to changes in local income in areas where there are tight supply constraints and inflexible planning system. Vermeulen and Hilber (2016) investigated the impact of various types of supply constraints on house prices in England by looking at how regulatory limits affect the house price elasticity of demand. According to them regulatory constraints such as policy reform and density affects the house supply which consequently gave a positive impact on house price-earnings elasticity. The constraints which related to insufficient land affects the house price in highly urbanized areas. Interestingly, uneven topography has a little impact on the quantity of house supply.

Although regulation addressed the regulation pertaining the density, for some, it is difficult to investigate the co-existence problem of high price level and high vacancy rate of residential housing markets. In China for example, Gangzhi and Yo (2015) analyses the supply characteristics of Chinese residential housing markets. The two-period signal model is utilized to explore reasons and how developers follow each other in real estate development. With the data of Chinese residential housing markets from 1999 to 2010 as a sample, they found the evidence of the behaviour, which possibly contributes to overbuilding. The interaction between the behaviour and demand shocks leads to the shortage of effective supply of these markets. They found that it is the asymmetry of following behaviour which has caused both a surplus of ineffective supply and a shortage of effective supply, which consequently affecting the house price in the country.

METHODOLOGY

Variables

The dependent variable for this study is house price while the independent variables are liberalisation, supply, and demand. In order to represent house price, this study used the house price index (HPI) obtained from the National Property Information Centre (NAPIC), Malaysia. To examine the long-term relationship of four types of houses, different HPIs were used, namely:

- Terrace: HPI_Terrace
- Semi-D: HPI_SemiD
- Detached/bungalow: HPI_Detached
- High-rise: HPI_Hi-Rise

There is no specific theory to tell which independent variables should be used to explain HPI. Nonetheless, we resort to the basic price theory, which suggests that the equilibrium price is determined by the demand and the supply factor. As such, in this study, to represent the demand side, we

utilised the amount of loans distributed (*LOAN*) since it indicates the easiness and openness of the country in providing loan facilities for construction, therefore creating demand for houses. Meanwhile, the supply variable is represented by the number of housing units approved for construction (*HS*). A conventional model that follows the demand-supply framework was then extended to capture the policy variable in this study. We extended the model by including property liberalisation (*LIB*) as our variable of interest and used lending interest rate as the proxy.

Hypotheses

(a) Liberalisation of the real estate policy has changed the housing market landscape. By factoring in lending interest rate, we associated higher liberalisation to lower interest rate. In this case, we expected that the relationship sign between interest rate and house price would be negative and could cause confusion in interpreting the result. In order to avoid this confusion, we used the inversion of interest rate.

(b) We hypothesised the demand factor (amount of loans distributed for construction) to have a positive relation with HPI, as the higher the amount of loan given out, the housing developers are in a better position to create higher demand. Consequently, the high demand would push the house price further.

(c) The supply of residential unit is expected to have a negative relationship with house price.

Equation

Generally, this study's equation for the house price model is as follows:

$$\ln HPI_t = \alpha + \theta_1 \ln LIB + \theta_2 \ln HS + \theta_4 \ln LOAN + e_t$$

(Eq.1)

where *HPI* represents house price index of different house types
LIB represents liberalisation
HS represents supply of residential unit
LOAN represents amount of loans distributed for construction
e is error term.

The duration specified for the study is between Q1: 1999 and Q4: 2012 (58 observations). The quarterly house price index has been measured and compiled by the Valuation and Property Services Department (VPSD) of NAPIC since 1997. The index measures the prices of residential houses. Data for *LIB*, *HS,* and *LOAN* were extracted from Bank Negara Malaysia's (BNM) statistics.

Unit Root Test

Test for nonstationary is often described as a test for unit roots using an autoregressive model. For the purpose of consistency, this study used three unit root tests, which are:

(a) Augmented Dickey-Fuller or ADF test (Dickey & Fuller, 1981)
(b) Phillip-Perror or PP test (Phillip & Perron, 1988)
(c) Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests

While ADF and PP tests use the existence of a unit root as the null hypothesis, KPSS unit root tests are different because y_t is assumed to be trend stationary under the null hypothesis. The KPSS unit root tests are often used to confirm results obtained from the other two unit root tests.

Johansen Cointegration Test, Vector Error Correction Model and Long-Term Model

In order to examine the possibility of our variables cointegrating in the long term, this study used the system-based reduced rank regression approach or also known as the Johansen vector autoregression approach

(Johansen, 1991, 1995). The cointegrating relationship is observed using the Johansen's Maximum Likelihood procedure among the *I*(1) variables. When more than two variables are involved, they might form several equilibrium relationships governing the joint evolution of all the variables. This cointegration analysis determines the number of cointegrating vectors, r, using the maximal eigenvalue procedure as given by Johansen (1988).

Two tests are provided, namely trace and maximal eigenvalue tests. The main importance of these two tests is that both tests have no standard distribution under the null hypothesis, although approximate critical values were tabulated by Oswald-Lenum (1992). Nevertheless, Johansen and Juselius (1990) suggested that the maximal eigenvalue test is more powerful than the trace test.

When there are more than two variables in the model, there is a possibility of having more than one cointegrating vectors; the model might form several equilibrium relationships governing the joint evolution of all variables. In general, for *n* number of variables, a study can have up to *n - 1* cointegrating vectors. In order to observe whether these cointegrating relationships exist, we employ multivariate equation error correction approach, known as vector error correction model (VECM). If it were confirmed that our model has negative and significant error correction term (*ect*), we would conclude it with the long-term model.

FINDINGS

In this section, we discuss the results of HPI of different house types: terrace, semi-D, detached, and high-rise. The same independent variables were employed for the various types.

Descriptive Analysis

Prior to discussing the relationships among all variables, we explain the descriptive analysis for all variables in the house price model (namely the house price index (HPI) of Malaysia, HPI of terrace house, semi-D, detached house, and high-rise). The independent variables for the housing model are liberalisation (proxied by lending interest rate), number of house supply, and amount of loan being distributed for housing development.

Table 5 shows a summary of the descriptive analysis of the variables used in this study. House price indices comprise national index, terrace index, high-rise index, detached house index, and semi-D index. On average, the high-rise price index is higher than the average Malaysian house index. The index series have right skewed distributions, indicating most values are concentrated to the left of the mean. In assessing the normality, we observe the Kurtosis value. The house price indices' Kurtosis values are larger than 0, denoting departure from normality. This is also supported by the Jarque-Bera test, where their *p*-values are all lower than 0.05, indicating that the null hypothesis of series are normally distributed can be rejected. Therefore, the variables will be transformed to logarithm form.

The lowest lending rate recorded was for the quarter 2012:Q4 that is 4.7%. On average, the number of houses built yearly was 41,512 units. The highest number of units built was in 2012: Q2 (77,541). The highest amount of loan distributed was in 2011: Q3, that is RM13,042 million.

Table 5 Descriptive analysis

	HPI MALAYSIA	HPI TERRACE	HPI SEMI-D (Index)	HPI DETACHED	HPI HI-RISE	LENDING RATE (% p.a)	HOUSE SUPPLY (Unit)	LOAN (RM Million)
Mean	122.78	121.24	126.85	120.69	129.13	6.17	41,512	4,111
Median	117.8	116.15	123	114.5	125	6.14	39,553	3,386
Maximum	176.5	175.1	182.7	187.9	174.1	9.55	77,541	13,042
Minimum	93.4	92.7	93.4	93.8	92.3	4.7	13,127	1,431
Std. Deviation	21.83	21.1	24.69	22.72	23.72	1.05	13,470	21.15
Skewness	0.87	0.94	0.64	1.6	0.2	0.65	0.21	1.61
Kurtosis	3.01	3.16	2.5	5.12	1.76	3.52	2.67	6.9
Jarque-Bera	7	8.35	4.36	34.38	3.97	4.64	0.68	60.08
Probability	0.03	0.02	0.01	0.00	0.04	0.05	0.04	0.00
Observation	56	56	56	56	56	56	56	56

Unit Root Tests

In this section, unit root results for all variables will be presented. Three types of test are used: ADF test, PP test, and KPSS tests. We use unit root tests to measure whether our variables (or time series) are stationary or not. Any time series data can be thought of as being generated by a stochastic or random process and a concrete set of data, which can be regarded as a (particular) realisation (i.e. a sample) of the underlying stochastic process (Gujarati, 1998, p. 455).

For the ADF test, the null hypothesis is that the variable has a unit root, thus it is not stationary. The results produced (τ) are compared against the critical Dickey-Fuller (DF) test. If the τ value is lower than the DF value, we reject the null hypothesis of the variable containing the unit root. Table 6 shows the result of the τ value at level and at first difference level for all variables. At level, all τ values are lower than 1% level of DF critical value, which is 3.571, indicating that these variables are not stationary at level. However, when these variables are tested at first difference level, their τ values are larger than the 1% level of DF critical value, which is 4.153. The results reject the null hypothesis and it can be concluded that these variables are stationary at first difference, *I*(1).

Table 2 reports the result of unit root test using the PP method. Holding the same null hypothesis that the variable has a unit root, thus is not stationary, the results show that all variables are stationary at first difference. In Table 2, the results show that all time-series are integrated of order *I* following KPSS tests. When a time series is not stationary, then time series regressions are spurious. Gujarati (1998) stated that as most of time series are nonstationary, one would be wary of doing regression based on time series data. He however suggested that even if individually, the time series variable are nonstationary, it is possible that there is still a (long-term) stable or equilibrium relationship between the two. In this case, the combination of these time series are said to be cointegrated.

Table 6 Unit root tests

	ADF Test					Phillip Peron Test					KPSS Test				
	Level		1st Difference		*I*(0)/*I*(1)	Level		1st Difference		*I*(0)/*I*(1)	Level		1st Difference		*I*(0)/*I*(1)
	C	C&T	C	C&T		C	C&T	C	C&T		C	C&T	C	C&T	
*ln*HPIM	2.30 (0)	0.25 (0)	−6.40** (0)	−6.87** (0)	*I*(1)	2.30 (0)	0.25 (0)	-6.50** (0)	-6.87** (0)	*I*(1)	0.89** (0)	0.19** (0)	0.47 (0)	0.14 (0)	*I*(1)
*ln*Terrace	1.71 (0)	−0.17 (0)	−6.99** (0)	−7.37 (0)	*I*(1)	1.88 (0)	−0.07 (0)	−7.06** (0)	−7.37** (0)	*I*(1)	0.88** (0)	0.19** (0)	0.40 (0)	0.15 (0)	*I*(1)
*ln*Semi-D	1.39 (1)	−0.94 (0)	−10.73** (0)	−10.99 (0)	*I*(1)	1.69 (1)	−1.82 (0)	−10.77** (0)	−11.12 (0)	*I*(1)	0.90** (1)	0.16** (0)	0.30 (0)	0.16 (0)	*I*(1)
*ln*Detached	−0.58 (1)	−3.17 (0)	−7.80** (0)	−7.74 (0)	*I*(1)	−0.32 (1)	−3.11* (0)	−12.57** (0)	−12.44** (0)	*I*(1)	0.91** (1)	0.08 (0)	0.16 (0)	0.15** (0)	*I*(1)
*ln*Hi-Rise	1.39 (1)	−0.94 (0)	−10.73** (0)	−10.99 (0)	*I*(1)	2.39 (0)	−0.21 (0)	−7.09** (0)	−7.56** (1)	*I*(1)	0.91** (0)	0.17** (0)	0.37 (0)	0.14 (1)	*I*(1)
*ln*LIB	−2.68 (1)	−3.19 (1)	−6.34** (0)	−6.20 (0)	*I*(1)	−2.42 (1)	−3.29 (1)	−6.35** (0)	−6.20** (0)	*I*(1)	0.81** (1)	0.19** (1)	0.09** (0)	0.15 (0)	*I*(1)
*ln*HS	−2.52 (0)	−2.66 (0)	−9.83** (0)	−6.80 (0)	*I*(1)	−2.53 (0)	−2.66 (0)	−9.83** (0)	−6.83** (0)	*I*(1)	0.40 (0)	0.15** (0)	0.16 (0)	0.14 (0)	*I*(1)
*ln*Loan	−2.85 (0)	−3.12 (0)	−8.00** (1)	−7.93 (1)	*I*(1)	−2.64 (0)	−3.11 (0)	−14.79** (1)	−13.63** (1)	*I*(1)	0.92** (0)	0.08 (0)	0.13** (1)	0.18 (1)	*I*(1)

Note:
Lag in parentheses ( ). C is constant. C&T is constant and trend. Asterisk** indicates the rejection of null hypothesis at least at 5% significant level. The rejection of null hypothesis for KPSS test is based on 95% CV for rejection of hypothesis of a unit root, which are 0.463 (constant and trend) and 0.1460 (constant and trend). H_0 = stationary.

Correlation Test

This section presents the results of house price model analysis starting from the correlation test, Johansen test for cointegration, the long-term relationship, the vector error correction model (VECM), and the Granger causality test. Table 7 shows the correlation matrix between Malaysia's HPI (ln*HPIM*), liberalisation (ln*LIB*), house supply (ln*HS*), and amount of loan distributed (ln*LOAN*). As liberalisation is proxied by an inverse of interest rate, we expect that the relationship between ln*LIB* and ln*HPIM* is positive. Early diagnostic shows HPI Malaysia (ln*HPIM*) is positively correlated with ln*LIB*, that is $\rho_{(\ln HPIM|\ln LIB)} = 0.90$. Negative correlation is seen between the HPIM and house supply $\rho_{(\ln HPIM|\ln HS)} = -0.25$. High positive correlation between amount of loan distributed and house price $\rho_{(\ln HPIM|\ln LOAN)} = 0.84$ provides an early indication that amount of loan might have a significant influence in explaining the house price.

Table 7 Correlation Analysis between HPIM and independent variables

	ln*HPIM*	ln*LIB*	ln*HS*	ln*LOAN*
ln*HPIM*	1.00			
ln*LIB*	0.90	1.00		
ln*HS*	–0.25	–0.26	1.00	
ln*LOAN*	0.84	0.76	–0.20	1.00

Although there is no specific guideline of how much coefficient is considered to contribute to multicollinearity problem, this study takes caution of coefficients that exceed 0.70. Thus, from the same table, multicollinearity is observed between the independent variables, that is between ln*LOAN* and ln*LIB* ($\rho_{(\ln LOAN|\ln LIB)}$ = 0.76). One possible answer for the high correlation between amount of loan distributed and liberalisation is due to the liberalisation policy that attracts borrowers. We decided to include loan due to its prominent influence elaborated in theory.

Johansen Cointegration Test – House Price Based on Different Types of Houses

Johansen cointegration test is employed to examine the possibility of the variables studied move together in the long-run. In Panel A (terrace) of Table 8, the results show that there is at least one cointegrating relationship between terrace price and liberalisation, house supply, and amount of loan. The trace statistic is higher than the 5% OL critical value at r = 0, rejecting the null hypothesis of no cointegrating relationship between variables tested. The result is similar to Max-Eigen value where its value (34.8) is slightly higher than the 1% critical value (32.24). In Panel B (semi-D) of the same table, the result suggests that there is at least one cointegrating relationship between the semi-D price and other variables. Its trace statistics (48.5) and Max-Eigen value (37.2) are larger than the 5% and 1% critical values respectively (47.9 and 32.2) at r = 0. Results in Panel C (detached) and D (high-rise) also show similar outcome for cointegrating relationship of detached and high-rise prices with their respective independent variables. To summarise, for each house type, its price index has at least one cointegrating relationship with variables ln*LIB*, ln*HS*, and ln*LOAN*, confirming the possible existence of long-term relationships among the variables.

Table 8 Johansen cointegration results

Panel A: lnTerrace				
H_0	Trace	5% / 1% CV OL[a]	Max-Eigen	5% / 1% CV OL[a]
$r = 0$	48.083*	47.89/54.46	34.796**	27.07/32.24
$r \leq 1$	14.287	29.56/45.65	6.268	20.97/25.52
$r \leq 2$	7.019	15.41/20.04	4.667	14.07/18.63
$r \leq 3$	2.352	3.76/6.65	2.900	3.76/6.65
Panel B: lnSemi-D				
$r = 0$	48.453*	47.89/54.46	37.298**	27.07/32.24
$r \leq 1$	11.143	29.56/45.65	5.877	20.97/25.52
$r \leq 2$	5.282	15.41/20.04	4.197	14.07/18.63
$r \leq 3$	1.071	3.76/6.65	1.073	3.76/6.65

Panel C: lnDetached				
$r = 0$	48.409*	47.89/54.46	36.043**	27.07/32.24
$r \leq 1$	10.368	29.56/45.65	5.836	20.97/25.52
$r \leq 2$	4.531	15.41/20.04	4.482	14.07/18.63
$r \leq 3$	0.048	3.76/6.65	0.048	3.76/6.65
Panel D: lnHigh-rise				
$r = 0$	51.589*	47.89/54.46	34.507**	27.07/32.24
$r \leq 1$	17.082	29.56/45.65	12.229	20.97/25.52
$r \leq 2$	4.823	15.41/20.04	3.688	14.07/18.63
$r \leq 3$	1.162	3.76/6.65	1.167	3.76/6.65

*(**) denotes rejection of the hypothesis at the 5% (1%) level

[a] Osterwald-Lenum critical value

VECM and Long-Term Relationship House Price Model

To confirm the long-term existence between house price and its independent variables, we run the VECM results for various types of price indices. The coefficients for error correction terms ECT (−1) are all negatively significant. The speed of adjustment however, is different from type to type. The ECT (−1) estimated coefficient of terrace is −0.06 and is significant at 5% level. It indicates that 6% of the disequilibrium in terrace price is corrected in one year. The ECT (−1) estimated coefficients of the prices of semi-D, detached, and high-rise are −0.09, −0.3, and −0.2 respectively. The results imply that the disequilibrium in detached price corrected faster than other types disequilibrium.

The goodness of fit of the specification (*R*2) regression remain moderate across the house type, that is between 28% and 59% while the standard error (s.e) are considered small as we can see from Panel II of Table 9. The robustness of the model has been confirmed by several diagnostic tests such as LM test (Breusch-Godfrey serial correlation test), White test (heterogeneity test), Jacque-Bera test (normality test), and Ramsey's reset test (stability test) as in Panel III of Table 9. The tests revealed that the modes have the desired economic properties. The residuals are serially uncorrelated and normally distributed.

After confirming the ECT that we desired, we would like to examine whether the independent variables perform similarly in affecting the prices of different house types. As different house types have different prices, and accordingly different affordability levels, it is interesting to analyse how liberalisation, house supply, and amount of loan would affect those houses' prices. In Table 10, it can be seen that *LIB* affects house prices of different types according to our hypothesis; a higher degree of liberalisation induces high house prices. For every 1% increase in *LIB*, prices of terrace and semi-D increased by 0.39%, price of detached increased by 0.06%, and price of high-rise increased by 0.42%. It can be said among the house types, liberalisation posed similar impacts on the prices of high-rise, terrace, and semi-D. The high impact on high-rise price is expected as demand for houses are focused on the urban and economically active areas. Although the terrace type is not a goal of foreign buyers, high liberalisation through low interest rates has 'trapped' potential terrace owners. They are caught in the dilemma of 'buy now or you will have to pay for the same house 20 to 30 per cent more, later. In addition, with the rapid hike in house prices, these owners are concerned with the possibility of BNM

tightening the monetary policy via interest rate to cool down the house price inflation. The desperation pushed the terrace price relatively higher than others.

Table 9 VECM – HPI based on various house types

		TERRACE	SEMI-D	DETACHED	HI-RISE
Panel I: Short-term coefficient of VECM results					
	ECT	−0.057* (−2.16)	−0.085** (−2.16)	−0.338* (−1.96)	−0.168** (−3.33)
	$\Delta ln\text{HPI}_{t-1}$	−0.208* (−1.50)	−0.563** (−3.52)	−0.404** (−2.02)	−0.155 (−1.13)
	$\Delta ln\text{HPI}_{t-2}$	−0.025 (−0.16)	−0.078** (−0.40)	−0.075 (−0.37)	–
	$\Delta ln\text{HPI}_{t-3}$	–	−0.011* (−0.072)	0.144* (1.85)	–
	$\Delta ln\text{LIB}_{t-1}$	0.096* (1.75)	−0.189 (−1.62)	0.225* (1.72)	0.484*** (3.24)
	$\Delta ln\text{LIB}_{t-2}$	−0.118 (−1.51)	−0.132* (−1.14)	0.597*** (3.61)	–
	$\Delta ln\text{LIB}_{t-3}$	–	0.199* (1.92)	−0.258* (−1.67)	–
Δ	$ln\text{HS}_{t-1}$	0.017* (1.81)	0.029*** (2.31)	0.064*** (2.73)	0.062* (1.70)
Δ	$ln\text{HS}_{t-2}$	–	−0.005 (−1.02)	0.055*** (2.74)	–
Δ	$ln\text{HS}_{t-3}$	–	−0.003** (−2.02)	0.070 (0.39)	–
	$\Delta ln\text{LOAN}_{t-1}$	−0.010* (−1.79)	0.018** (2.11)	−0.010*** (−2.48)	−0.043 (−0.02)
	$\Delta ln\text{LOAN}_{t-2}$	−0.002 (0.25)	0.082 (1.45)	−0.208* (−1.84)	–
	$\Delta ln\text{LOAN}_{t-3}$	–	0.024*** (2.30)	−0.01 (−1.32)	–
	C	0.013*** (4.46)	0.025*** (3.05)	0.027*** (4.62)	0.015** (2.01)
Panel II: Model Criteria					
	R^2	0.360	0.447	0.587	0.281
	Adjusted R^2	0.220	0.257	0.467	0.206
	s.e equation	0.014	0.012	0.021	0.030
	F-stat	4.721	2.367	2.671	3.751
	Akaike AIC	−5.600	−4.987	−4.555	−4.360
Panel III: Diagnostic checking					
	Normality	3.7749 [0.154]	0.9242 [0.630]	0.3361 [0.845]	0.5214 [0.771]
	Serial Correlation	2.9614 (2) [0.195]	1.0913 (2) [0.376]	0.6464 (2) [0.565]	19.964 (2) [0.168]
	Heterogeneity	0.5654 (1) [0.459]	1.1894 (1) [0.286]	0.3183 (2) [0.577]	2.329 (1) [0.140]
	Stability	0.3014 [0.8239]	0.8909 [0.601]	0.1256 [0.774]	0.4443 [0.594]

Note: Asterisks ** and * stand for significant at 1% (2.33) and 5% (1.65) respectively. Figures in ( ) denote *t*-value. For the criteria, we focused on the model with the highest R2 but lowest standard error (s.e) of regression, along with AIC. For Panel III, figures in [ ] denote *p*-value, while figures in ( ) stand for number of lag. Jacque-Bera is the test for the normality of the residuals. Serial Correlation LM Test is the test for the autoregressive. White Test is the test for the possible heteroscedasticity in the residuals. Ramsey's RESET test is the test for functional form.

Table 10 Long-term relationship of based on different house types

Dep. Variable = ln*HPI_*	TERRACE	SEMI-D	DETACHED	HI-RISE
ln*LIB*	0.385* (2.25)	0.389* (2.29)	0.062 (0.83)	0.417* (2.22)
ln*HS*	0.139* (2.28)	0.064 (1.13)	–0.091** (-2.86)	0.204** (3.26)
ln*LOAN*	0.426** (6.75)	0.449** (7.34)	0.398** (10.83)	0.391** (5.84)
C	0.500	1.133	2.559	0.109

Note: Asterisks ** and * stand for significant at 1% (2.33) and 5% (1.65) respectively. Figures in ( ) denote *t*-value.

The effects of the number of house supply on house prices are also significant across house types (except semi-D) and the effect is the largest on high-rise. Our results significantly reject our hypothesis (i.e. higher number of house supply reduces house price) for terrace and high-rise types. For every additional unit of house supply, the prices of terrace and high-rise increased by 0.14% and 0.20% respectively. House prices are positively affected by amount of loan distributed, especially for semi-D, where the elasticity of amount of loan distributed with respect to its house price is 0.5. Compared to other types, semi-D and terrace prices are more elastic when there are changes in the amount of loan given out. The result is perhaps due to the continuously increasing demand for these two house types. It might indicate that potential local buyers took advantage of the easiness to obtain loans and still kept their preference to buy landed houses, therefore creating a larger pool of terrace and semi-D buyers among Malaysians, causing the prices of these houses to jump more than other types of houses.

CONCLUSION

Liberalising the real estate sector has become a new strategy to attract foreign participants, especially potential house buyers who mainly aim to purchase houses for investment. Traditionally, terrace houses were associated with the low- and middle- income earners, while detached were for the rich ones. Liberalisation however has changed the demographic landscape of the house buyers. Terrace house price has increased following the spillover effect of the influx of foreign buyers on other residential types. The increase is beyond the affordability level of the low- and middle- income earners. Connection between house price and macroeconomic factors has been mostly at country level, creating gap in the literature of the economic impact on the residential types. As such, this study analysed the long-term relationship among house prices (of different house types), liberalisation, house supply, and amount of loan approved for construction.

By employing time-series analysis, this research utilised data span between 1999 and 2012. This study employed three unit root tests (ADF, PP, and KPSS), Johansen cointegration test, and VECM. The findings suggest that liberalisation posed similar impact on the price of high-rise, terrace, and semi-D. The high impact on high-rise price is expected as demand for houses is focused on the urban and economically active areas. However, a similar impact on terrace is worthy of note. Although the terrace type is not a goal of foreign buyers, high liberalisation through low interest rates has 'trapped' potential terrace owners. The research is not short of limitations since it is restricted by the absence of property tax values which its imposition is inconsistent. The values can be very helpful if future research might seek an alternative variable to represent the tax effect. The research provides insight into the impact of liberalisation on the residential market.

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