

# **RESIDENTIAL PROPERTY PRICE HIKE AND SPECULATION**

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## **ABSTRACT**

This report provides an analytical overview of the behaviour of property price in Malaysia by examining factors influencing the property prices. It aims to determine whether property prices in Malaysia can be explained by the fundamental factors (macroeconomic and financial) or it is due to other unexplained factors. One of the unexplained factors could perhaps be speculation activities and this study intends to explore this possibility. This investigation on the existence of speculation in property market contributes significantly to the body of knowledge thus fills the gap in the literature of property market, particularly in the Malaysian setting. Several quantitative research methods and time-series econometric analyses are employed to meet the objectives of the study and these include the Dynamic Ordinary Least Square (DOLS), Johansen Cointegration Test, Autoregressive Distributed Lags (ARDL) Long Run Estimation, Vector Error Correction Model (VECM), Vector Autoregressive (VAR) and Augmented Dickey-Fuller (ADF). The findings from this study reveal that, based on the different segments of property prices (aggregate, terraced, detached, semi-detached, high-rise) and different states, most of the factors do have significant relationship with property price. In addition, the cointegration analysis indicates that the property price and its factors are cointegrated for all property market segments across states. This implies the presence of a long run relationship between the property price and its determining factors, despite slow adjustment of property price towards equilibrium in the long run. Slow adjustment denotes a persistent deviation from price equilibrium reflecting inefficiency in the residential property market in Malaysia. Results of the granger-causality test indicate that current property price is influenced only by its own past values, which means today's property price is influenced by the previous three months property price plus the cost of construction. Furthermore, there is a presence of ripple effect in which the house prices in KL, Negeri Sembilan, Perak, Penang and Melaka have spreading effect on other states in Malaysia and this implies that the residential property market in Malaysia is integrated. This study concludes that the residential property price hike in Malaysia is impacted by fundamental factors and is not speculative in nature.

Keywords: Price hike, Residential, Property, Speculation

## **INTRODUCTION**

### **1.1 Problem Statement**

Empirical research documents that property price is closely related to a set of macroeconomic factors and market-specific conditions, which are expected to influence both the demand and the supply side of the market (Ciarlone, 2015). Property prices in general are influenced by economic fundamentals as well as supply and demand dynamics of the local housing market. In general, property price has been showing an increasing pattern over time worldwide (Egert and Mihaljek, 2007; Ong, 2013; Osmadi et al., 2015; Kamal et al., 2015; The Economist, 2016).

Literature shows that researchers use the aggregate House Price Index (HPI) to represent property price. Glindro et al. (2011) uses the HPI in their studies on factors affecting property price in nine Asia-Pacific economies (Australia, China, Hong Kong, Korea, Malaysia, New Zealand, the Philippines, Singapore and Thailand). Similarly, studies on Malaysia also use the HPI to represent property price (see for examples, Lean and Smyth, 2014; Ibrahim and Law, 2014; Zandi et al., 2015; Tang and Tan, 2015). The HPI is made available by the National Property Information Centre (NAPIC). Apart from the aggregate HPI, NAPIC also publishes four sub-indices corresponding to various types of houses, namely, Terraced Houses, Semi-Detached Houses, Detached Houses and High-Rise Houses. Among the various types of houses, terraced houses seem to be the most important type of houses since they receive the dominant weight in the construction of the aggregate HPI i.e. 72.7% (Ibrahim and Law, 2014). Besides the HPI, there are also other measures employed to represent property price, for example the historical residential property prices by Hui and Ng (2012) in their study on Hong Kong property market.

The phenomenon of property price hike has caught considerable attentions from researchers and policy makers worldwide. Most studies focus on determining the factors contributing to the increasing pattern of the property price regardless of the economic landscapes. In doing so, researchers incorporate various possible factors based on different methods that may influence property price which include macroeconomic, demographic, industry, location and land/zoning (Egert and Mihaljek, 2007; Glindro et al., 2011; Ong, 2013; Ibrahim and Law, 2014; Pillaiyan, 2015; Zandi et al. 2015; Tang and Tan, 2015; Kamal et al., 2016).

### **1.2 Research Objectives**

This study analyses the relationship between residential property price hike and speculation and is focusing specifically on the following objectives:

- To determine the significant macroeconomic and financial factors influencing the residential property price in Malaysia for the period of 2000-2015.
- To examine the long run behavior of the residential property price. This includes measuring the speed of adjustment towards the equilibrium, the influence of lagged factors and the response of residential property price towards shocks in the identified factors.
- To examine the ripple effect of the residential property prices across different states and different residential property market segments in Malaysia. The presence of ripple effect indicates that house price in one state may have a spreading effect on house price in other states.
- To conclude on the presence of speculation in the property market in Malaysia.

## **2.0 LITERATURE REVIEW: FACTORS AFFECTING PROPERTY PRICE**

As mentioned earlier, several commonly cited factors affecting property price have been highlighted in previous literature like the gross domestic products (GDP), interest rates, inflation, property loans growth, money supply, stock market performance and population growth. This section reviews previous literature with regards to these identified factors affecting property price, the common measures used by researchers in representing the factors and the findings on the relationship between the factors and property price.

### **2.1 Gross Domestic Product (GDP)**

GDP is identified as one of the important factors influencing property price. Ciarlone (2015) and Pillaiyan (2015) argue that real GDP as the main factor determining property price. According to Zhu (2004), real GDP growth encompasses information related to household income, such as unemployment and wages. The GDP growth also provides a measure of the state of the business cycle and household income (Tsatsaronis and Zhu, 2004). Most research findings show significant positive relationship between GDP and property price (see for examples; Ong, 2013; Ibrahim and Law, 2014; Zandi et al., 2015). Ibrahim and Law (2014) put forward that the positive relationship between GDP and property price is explained by the positive effect of GDP on the economic prosperity in the form of higher disposable income and the expansion of property loans growth. These will push the demand on property higher causing the price to increase. Nevertheless, Zhu (2006) reports an insignificant relationship between the GDP and property prices in Hong Kong, Korea and Singapore. So does Pillaiyan (2015) where he shares similar insignificant relationship between GDP and property price in his study on Malaysian property market. To measure GDP, most researchers employ real GDP as a common proxy in their studies (see for examples, Ong, 2013; Ibrahim and Law, 2014; Pillaiyan, 2015).

### **2.2 Interest Rates**

Interest rates are another influencing factor incorporated by researchers in examining property price (see for examples, Zhu, 2004; Ramazan et al., 2007; Tang and Tan, 2015). Looking at property transactions, as most purchases are done on credit, an increase in interest rates may result in additional costs to home buyers. Payment on loan installment is generally determined by the loan amount, interest rate and the duration of the loan. A lower interest charge on the loan will result in a lower monthly payment. Zhu (2004) states that consumers' property purchasing decisions are more sensitive to the interest rates charged on the loan than to the size of the loan in relation to the household income.

Interest rates are commonly measured using short term money market rate (Ibrahim and Law, 2014) and average lending rates (Tang and Tan, 2015). Sutton (2002) and Tsatsaronis and Zhu (2004) show that the nominal interest rates perform better than the real interest rates in explaining property price, given that banks typically make the decision to grant a housing loan based on the ratio of debt servicing costs to income, depending on the nominal and not the real rate. Common findings are observed on the inverse relationship between interest rates and property price. Ramazan et al. (2007) record an inverse relationship between interest rates and property price with different effects across different states of economy. They find stronger relationship in the developed economies compared to that of the developing. This could be due to the fact that developing economies have a less mature financial market and are thus borrowing constrained. This notion is enhanced further by Ibrahim and Law (2014) and

Tang and Tan (2015) on Malaysia property market and Zhu (2004) on industrialized countries.

### **2.3 Inflation**

Inflation is also identified as one of the important factors influencing property prices (Tsatsaronis and Zhu, 2004; Zhu, 2004). Higher inflation could result in higher mortgage finance and cost of construction, hence consequently pushes the property price higher (Tsatsaronis and Zhu, 2004). Zhu (2004) and Hui and Ng (2012) elaborate further that property investment is considered as a good hedge against inflation. As such during periods of higher uncertainty on investments such as in bonds and equities associated with high inflation, property market becomes more attractive as investment for long-term savings. Inflation is represented by Consumer Price Index (CPI) (see for examples, Zhu, 2004; Ong, 2013; Pillaiyan, 2015).

Tsatsaronis and Zhu (2004) report a significant positive relationship between inflation and property price. The findings are then supported by Pillaiyan (2015) and Zandi et al. (2015). Tsatsaronis and Zhu (2004) argue that the positive relationship reflects the effect of monetary expansion that boosts economic growth which in turns, leads to an increase in inflation rate. With limited investment opportunities, excess capital pours into the property sector, causes an increase in the property price. Ong (2013) however finds insignificant relationship between inflation and the property price.

### **2.4 Property Loans Growth**

Another influencing factor is property loans growth. The financial sector directly influences the property market through mortgage financing. Davis and Zhu (2004) express that property price is sensitive to the availability of property loans from the banking sector. Egert and Mihaljek (2007) regard this factor as an institutional factor that could either facilitate or hinder households' access to the property market. They argue that property prices tend to depend on how much individuals can borrow from financial institutions, while borrowing in turns depends on the real income and the interest rate. Basically, the better availability of property loans will increase the demand for property when the households are borrowing constrained (Barakova, 2003). Ong (2013) claims that the growth in demand for loans will then be reflected in higher property prices. Property loan growth is represented by various measures, among others, growth rate on housing loans (Egert and Mihaljek, 2007), total bank loans (Ibrahim and Law, 2014), number of housing loans approved (Pillaiyan, 2015) and loan to GDP ratio (Oikarinen, 2009).

It can be expected that the development of property market and the lifting of credit constraints be positively correlated with the growth of property prices (Egert and Mihaljek, 2007). Ibrahim and Law (2014) record a strong relationship between loans growth and property prices in Malaysia. Loan growth is also found to exert significant impacts on short-run fluctuations in property prices. Goodhart et al. (2004) argues that the financial sector liberalization is likely to increase the cyclical nature of financial systems by fostering cyclical lending practices of banks, hence affecting property prices. Gerlach and Peng (2005) provide support for the link between property prices and bank lending in the case of Hong Kong property market. More specifically, they find a strong relationship between property prices, bank lending and real GDP.

Zhu (2006) evaluates the structure of property loan markets and property price in six Asian economies - China, Hong Kong, Indonesia, Korea, Singapore and Thailand. He finds strong relationship between property prices in these economies and their property

loan markets. Most notably, property loans are found to be a significant driving factor in all markets except Indonesia, the country with the least developed banking sector. The relationship between property loans growth and property price can also be observed in different direction. Zhu (2004) for example states that, an increase in property price enhances property loans growth since property acts as collateral for borrowing. Rising property price strengthens the borrowing capacity of households and improves the performance of banks' mortgage portfolios.

## **2.5 Money Supply**

One of the monetary policy transmission channels is the so-called wealth channel. It implies that monetary policy can affect the real economy via its impact on asset prices. For example, a loosening of monetary policy is often linked with an increase in asset prices which eventually leads to a positive impact on firms' investment behaviour or household consumption. The wealth channel has frequently been introduced to macroeconomic models in analysing the impacts of monetary policy on the real economy (Koivu, 2012). The existence of wealth channel can also be examined on the property price that is, examining the impact of monetary policy on property price. Among the most common measures used to represent money supply are M2 (Koivu, 2012) and M3 (Pillaiyan, 2015). Goodhart and Hofmann (2008) explain that a growth in money supply leads to an increase in the price of a broad range of assets and a decrease in interest rates. As such, an increase in money supply will lead to an increase in property prices. This is supported by Greiber and Setzer (2007) and Adalid and Detken (2007). Greiber and Setzer (2007) find a strong relationship between broad money supply and property prices in Europe and the US. They also show that causality ran in both directions where an increase in money supply causes an increase in property prices and vice versa. Similar analysis is conducted by Adalid and Detken (2007) in several industrialized countries. They find a significant relationship between growth in money supply and property prices. This relationship is detected to be at the strongest point during periods of price booms. Consistent to these studies, Pillaiyan (2015) also records that property prices are related to the growth in money supply in the Malaysian property market. The strong relationship between money supply and property prices may indicate a significant amount of wealth being stored within the property market. In Malaysia, as it is globally, property is seen as a safe investment. In addition, Koivu (2012) finds evidence that easy monetary policy leads to higher property price in China.

## **2.6 Stock Market Performance**

Stock market performance is another important factor affecting property price (Ibrahim, 2010). There are two possible ways on how stock market influences property price. First, households who realise gains in share prices will channel their gains in buying properties, known as the wealth effect. The wealth effect proposes that a stock market boom will lead to a property price growth. Secondly, firms holding property will see an increase in their companies' net value due the improvement in balance sheet, known as the credit-price effect. Investors will be willing to pay a higher price for these companies, thus pushing up the stock prices of these companies. Most studies measure stock market performance using market index (see for examples, Hui and Ng, 2012; Lean and Smyth, 2014).

Literature documents that stock market and property market are highly related, from which either one of these two effects arises i.e. wealth effect - from stock market to property market and credit price effect - from property market to stock market (Jud and

Daniel, 2009; Hui and Ng, 2012). Similarly, Lin and Lin (2011) who study six Asian economies (China, Hong Kong, Japan, Singapore, South Korea and Taiwan) find that property market leads the stock market in some countries and the stock market leads the property market in others. Although in general literature finds relationship between stock market performance and property price, Lean and Smyth (2014) argue that the wealth effect differs across states in Malaysia. They find evidence of stock price leading property price in Kuala Lumpur, Penang and Selangor unlike in other states. This segmentation of wealth effect could be due to the fact that some states are less developed and not financially advanced as compared to the three states. Consistently in Thailand property market, Ibrahim (2010) finds significant relationship between stock market performance and property price, implying that stock market stability is critical for the stability of the property market.

## **2.7 Population Growth**

Malaysian population is increasing hence pushing greater demand for housing (Choy et al., 2011; Hong, 2013). The inequilibrium between demand and supply of properties due to population growth causes the continuous increase in property price. The increase in population growth, which can be attributed to the migration of local citizens, foreign workforce and Malaysians returning from overseas to retire, has created greater demand for housing (Kamal et al., 2016).

Among the measures employed by researcher in measuring population growth are, growth in total population (Jud and Daniel, 2009; Ong 2013) and growth in urban population (Li, 2013) over the years. Consistent results are found in the literature concerning the impact of population growth on property price worldwide. Jud and Daniel (2009) examine the dynamics of property price in areas across the United States and reveal that property price is strongly influenced by the growth of population. Similar evidence is recorded by Ong (2013) in his study on Malaysia property market and Choy et al. (2011) and Li (2013) on China property market. Consistent with previous studies, a recent study by Kamal et al. (2016) find that population growth influences developers' decision in determining property price in Malaysia.

## **2.8 Cost of Construction**

According to Real Estate and Housing Developers' Association Malaysia (REHDA), the increases in prices of building materials have also affected the property price (Osmadi et al., 2015). Ong (2013) classifies construction cost as expenses incurred by a contractor for labour, raw material, equipment, financing from a bank and the services involved in building the property while Kamal et al. (2016) include land price and regulatory barriers as construction costs. In addition, Osmadi et al. (2015) include premiums paid by developers to the federal and states government for every housing project as one of the costs of construction in Malaysia.

There are several measures of construction costs adopted in the literature. Jud and Daniel (2009) use the producer price index to represent construction cost while Glindro (2011) uses the construction cost index to measure construction cost. Capozza (2002) employs cost of converting land from agricultural use to new residential structures as a measure of construction cost.

Osmadi et al. (2015) argue that the main cause of surging prices of properties in Malaysia is due to the high amount of construction premiums to be paid by the developers. Apart from the high construction premiums, increasing material and labour costs also lead to higher construction cost. Worsening the situation, Kamal et al. (2016)

observe that the price of raw materials has been increasing over the years and this contributes to the increase in the cost of construction, hence the property price. The impact of construction cost on property price is also documented by Ong (2013) and Paciorek (2013). Jud and Daniel (2009) conclude that construction cost contributes to the increase in property price in the US market.

### **3.0 METHODOLOGY**

#### **3.1 Research Method**

To examine the relationship between property prices and the influencing factors, this study employs quantitative research method and time-series econometric analysis including Dynamic Ordinary Least Square (DOLS), Johansen Cointegration Test, Autoregressive Distributed Lags (ARDL) Long Run Estimation, Vector Error Correction Model (VECM), Vector Autoregressive (VAR) and Augmented Dickey-Fuller (ADF).

#### **3.2 Data Collection**

This study covers a period ranges from 2000 to 2015. This study utilizes quarterly data spanning from Q1 to Q4 of five house price indexes (HPI) for the national as well as the states level i.e. Aggregate HPI, Terraced HPI, Detached HPI, Semi-Detached and High-Rise HPI. These data are sourced from NAPIC ([www.napic.jp-ph.gov.my](http://www.napic.jp-ph.gov.my)).

As part of the objectives is to examine factors influencing property price in Malaysia, this study incorporates macroeconomic and financial market data, namely GDP, interest rate, inflation, property loan growth, money supply, stock market performance, population growth and producer price index. These data are obtained from the Bank Negara website, Department of Statistics Malaysia, Bursa Malaysia and DataStream database. Based on past literature, these factors are found to have influence on property price. The data series are transformed into logarithm for consistency and standardization of measurement, obtaining linearity and reducing the problem of heteroscedasticity.

#### **3.4 Methodologies Applied**

Standard time-series econometric methods are used to examine the relationship between property prices and the influencing factors. The methods used are in accordance to the nature of the data set utilized and the objectives of this study. The methods employed are: Dynamic Ordinary Least Square (DOLS), Johansen Cointegration Test, Autoregressive Distributed Lags (ARDL) Long Run Estimation Vector Error Correction Model (VECM), Vector Autoregressive (VAR) and Augmented Dickey-Fuller (ADF).

In ensuring that the regression results are not spurious, we perform common specification test on regression models and the models must satisfy the specification. The test includes the serial correlation test using the Breusch-Godfrey LM test (DOLS and ARDL) while Ljung-Box Q-statistic (VAR). The null of these tests is that there is no serial correlation/auto correlation in the residuals. The presence of serial correlation (if any) in DOLS and ARDL are corrected by including/increasing lag of the dependent variable (HPI) into the regression models (see for example; Drukker, 2003).

##### **3.4.1 Dynamic Ordinary Least Square (DOLS)**

The least square regression is used to determine the significant factors affecting property price in Malaysia being the first objective of this study. Specifically, we utilize

a procedure developed by Stock and Watson (1993) known as dynamic OLS (DOLS) which allows for variables integrated of alternative orders (in this sense, a higher order of integration), as well as tackling the problem of simultaneity among the regressors. Stock and Watson (1993) suggest a parametric approach for estimating long-run equilibrium equations which may involve variables integrated of different orders but still cointegrated. The potential of simultaneity bias and small-sample bias among the regressors is dealt with by the inclusion of lagged and led values of the change in the regressors.

#### 3.4.2 Johansen Cointegration Test

Apart from identifying the significant factors affecting property price, this study also examines the presence of cointegration between the property price and the identified factors. The presence of cointegration will tell us the existence of long run relationship between property price and the identified factors. A long run relationship will eventually establish equilibrium between property price and its factors. With the existence of long run relationship, any deviation or gap will be reverted to the equilibrium. To examine the presence of cointegration, the Johansen cointegration test is used based on Johansen (1995).

#### 3.4.3 Auto Regressive Distributive Lag (ARDL)

After performing the cointegration test on property price and its identified factors, if the result indicates the presence of cointegration, this means that there is a long run relationship between property price and its factors. We then proceed with the estimation of the long-run relationship between property price and its factors. The estimation is to be performed using the ARDL method based on Pesaran et al. (2001). The main advantage of the ARDL method is that, it can cater for data set with different integration order i.e.  $I(0)$  and  $I(1)$  and is suitable for small sample analysis (Shahbaz, 20017, Lean and Smyth 2014, Khan et al., 2016).

#### 3.4.4 Vector Error Correction Model (VECM)

In VECM, we first estimate the long run equation and the estimated parameters are imposed through the error correction term (ECT). In line with our second objective, the VECM is used to examine the speed of adjustment of property price to equilibrium.

#### 3.4.5 Vector Autoregressive (VAR)

The ARDL cointegration verifies the existence of long run relationship but does not indicate the causal relationship (direction) between property price and its factors. In order to study causal relationship (direction), we perform the VAR. Among the studies that proceed from the ARDL cointegration test to the VAR modeling include Shahbaz et al. (2008), Feridun (2009), Mansor et al. (2010) and Lean and Smyth (2014).

#### 3.4.6 Augmented Dickey Fuller (ADF)

The ADF is a test for unit root of a data series. The null hypothesis of the ADF indicates the presence of unit root (non-stationary). Studies like Meen (1999) and Lean and Smyth (2013) used the ADF to examine the ripple effect of house prices. In relation to this study, rejecting the null means there is a presence of ripple effect i.e. house price in one state may have a spreading effect on other states. In contrast, failure to reject the null means no ripple effect i.e. price is segregated between states. The Schwartz Information Criterion (SIC) is used for the optimal lags selection in the ADF tests.



## 4.0 DATA ANALYSIS AND FINDINGS

### 4.1 Data Preliminaries

Based on the data on the HPI, the average annual growth rates are computed to compare the rate between market segments and states in Malaysia. Table 2 shows the detail of the average annual growth in the HPI over the years (2000-2015).

Table 2: Average Annual Growth Rate per Quarter of HPI (2000-2015)

	Aggregate	Terrace	Detached	Semi-Detached	High-Rise
National	0.82	0.80	0.93	0.83	0.84
Kuala Lumpur	0.97	1.01	1.11	0.98	0.82
Selangor	0.81	0.83	0.82	0.85	0.61
Johor	0.56	0.54	0.71	0.68	0.67
Penang	0.92	1.01	0.64	0.64	1.01
Perak	0.84	0.81	1.04	0.88	n.a.
Negeri Sembilan	0.75	0.77	0.74	0.76	0.24
Melaka	0.24	0.26	0.15	0.21	0.11
Kedah	0.78	0.73	1.08	0.85	n.a.
Pahang	0.95	0.92	1.13	1.01	n.a.
Terengganu	0.98	0.91	1.14	1.04	n.a.
Kelantan	0.71	0.75	0.89	0.79	n.a.
Perlis	0.88	0.91	n.a.	0.95	n.a.
Sabah	1.12	1.11	1.38	1.16	1.03
Sarawak	0.85	0.79	1.01	0.87	n.a.

Note: n.a.= data is not available

Based on Table 2, the HPI (detached) recorded higher quarterly growth rate compared to other market segments. At the aggregate level, noticeable increases are recorded in Kuala Lumpur, Penang, Pahang, Terengganu and Sabah. These states have also recorded higher quarterly average annual growth rates as compared to the national level.

### 4.2 Dynamic Ordinary Least Square (DOLS) Regression

We use the DOLS regression to determine which factors are affecting property price in Malaysia, in line with the first objective of this study. The following Table 6 summarizes the result (Refer Appendix IV for detail on the statistical results of DOLS).

The summary of the DOLS Regression - Factors affecting the HPI

Aggregate segment

- GDP influences residential property price in Sabah only
- Interest rate influences residential property price in all states except KL, Johor, Penang, Pahang, Terengganu and Sarawak
- Loan growth is does not influence residential property price in any state
- Money supply influences residential property prices in all states except Johor and Kelantan
- KLCI influences residential property price only in KL
- Population change influences residential property price only in Perlis

- Cost of construction influences residential property price in all states except Terengganu and Sabah

#### Terraced segment

- GDP influences residential property price only in Perlis
- Interest rate influences residential property price in all states except KL, Johor, Pahang and Sarawak
- Loan growth influences residential property price in Sabah and Sarawak
- Money supply influences residential property prices in all states except Johor, Kedah, Kelantan and Perlis
- KLCI influences residential property price only in Sarawak
- Population change influences residential property price in Terengganu and Perlis
- Cost of construction influences residential property price in all states except Kedah, Terengganu, Kelantan and Sarawak

#### Detached segment

- GDP influences residential property price in Penang, Perak, Kelantan and Sabah
- Interest rate influences residential property price in all states except KL, Penang, Melaka, Pahang, Terengganu and Sarawak
- Loan growth influences residential property price only in Johor
- Money supply influences residential property prices in Selangor, Johor, Penang, Perak and Sarawak
- KLCI influences residential property price in KL, Selangor, Kedah and Sabah
- Population change influences residential property price in Negeri Sembilan and Kelantan
- Cost of construction influences residential property price in all states except Melaka, Pahang, Terengganu, Kelantan, Perlis and Sarawak
- Semi-Detached segment
- GDP influences residential property price only in Sabah
- Interest rate influences residential property price in Melaka, Kedah, Pahang, Terengganu, Perlis and Sabah
- Loan growth influences residential property price in KL, Selangor, Johor and Kedah
- Money supply influences residential property prices in all states except KL, Johor, Pahang, Terengganu, Kelantan and Sabah
- KLCI influences residential property price in KL, Selangor and Penang
- Population change influences residential property price only in Kedah
- Cost of construction influences residential property price in all states except Penang, Pahang, Terengganu, Kelantan and Sabah

#### High Rise segment

- GDP influences residential property price in Melaka and Sabah
- Interest rate influences residential property price in KL, Selangor, Negeri Sembilan, Melaka and Sabah
- Loan growth influences residential property price in Penang and Sabah
- Money supply influences residential property prices in KL and Penang
- KLCI influences residential property price only in Negeri Sembilan
- Population change does not influence property price in any state

- Cost of construction influences residential property price in KL, Selangor, Johor, Penang, Negeri Sembilan, Melaka and Sabah

In conclusion, this study found that the HPI are influenced by the identified factors. However inconsistencies are reported. For example, for detached segment, GDP is found to influence the property prices in Penang, Perak, Kelantan and Sabah but not in other states.

Comparing between the factors, it is observed that the cost of construction and interest rates are the dominant factors influencing residential property prices (across states and market segments). The least influencing factors are loan growth and population change. In term of states, it is found that Kelantan, Terengganu and Pahang are the least influenced by the fundamental factors.

Overall, the DOLS regression results indicate that the property price in Malaysia is explained by the fundamental factors.

Table 6: Dynamic Ordinary Least Square (DOLS) Regression

Segment	Factor	National	KL	Selangor	Johor	Penang	Perak	N9	Melaka	Kedah	Pahang	Terengganu	Kelantan	Perlis	Sabah	Sarawak
Aggregate	GDP														√	
	INT	√		√			√	√	√	√			√	√	√	
	LG															
	MS	√	√	√		√	√	√	√	√	√	√		√	√	√
	KLCI		√											√		
	POPCH COC	√	√	√	√	√	√	√	√	√	√	√	√	√		√
Terraced	GDP														√	
	INT	√		√		√	√	√	√	√		√	√	√	√	
	LG														√	√
	MS	√	√	√		√	√	√	√		√	√			√	√
	KLCI														√	√
	POPCH COC	√	√	√	√	√	√	√	√	√	√	√		√	√	√
Detached	GDP														√	
	INT			√	√		√	√		√			√	n.a.	√	
	LG				√										√	
	MS	√		√	√	√	√									√
	KLCI		√	√						√					√	
	POPCH COC	√	√	√	√	√	√	√		√			√		√	
Semi-D	GDP														√	
	INT	√							√	√	√	√		√	√	
	LG		√	√	√					√					√	
	MS	√		√		√	√	√	√	√				√		√
	KLCI		√	√												
	POPCH COC	√	√	√	√		√	√	√	√				√		√
High-Rise	GDP						n.a.	√		n.a.	n.a.	n.a.	n.a.	n.a.	√	n.a.
	INT		√	√				√	√						√	
	LG				√										√	
	MS	√	√			√									√	
	KLCI							√							√	
	POPCH COC	√	√	√	√	√		√	√						√	

Notes: n.a. = data is not available

### 4.3 Johansen Cointegration Test

This study proceeds with the cointegration test to examine the presence of cointegration between the property price and the identified factors. The presence of cointegration will indicate the existence of long run relationship between property price and the identified factors. A long run relationship will eventually establish equilibrium between property price and its factors.

Table 7: Johansen Cointegration Test

Segment	National	KL	Selangor	Johor	Penang	Perak	N 9
Aggregate	4	3	4	2	3	2	2
Terraced	4	3	4	2	3	3	2
Detached	2	2	2	2	2	2	2
Semi-D	4	3	3	2	3	4	2
High-Rise	3	3	3	3	2	1	3

  

Segment	Melaka	Kedah	Pahang	Terengganu	Kelantan	Perlis	Sabah	Sarawak
Aggregate	2	2	2	2	2	2	2	2
Terraced	2	2	3	3	2	2	3	2
Detached	2	3	3	2	2		3	2
Semi-D	2	2	2	2	3	3	3	2
High-Rise	3						4	

Notes: Trace test indicates the number of co-integrating equations at the 0.05 level. Johansen Cointegration tests were based on the assumption of a constant and no trend in estimation equation.

Based on Table 7, property prices and factors are cointegrated for all the property market segments, hence indicating the presence of long run relationship between property price and its determining factors. With the presence of cointegration between property price and factors, we further analyze the significance of the long run relationship in the following section.

### 4.4 ARDL Long-Run Relationship

We use the ARDL to determine the long run relationship between property price and its factors, in line with the second objective of this study. Table 8 below summarizes the result (Refer Appendix V for detail on the statistical results of the ARDL).

## Summary of the ARDL – the long run relationship between the HPI and factors

### Aggregate segment

- GDP influences residential property price only in Penang
- Interest rate influences residential property price in all states except KL, Perak, Negeri Sembilan and Terengganu
- Loan growth influences property price only in KL
- Money supply influences residential property prices in Kedah, Perlis and Sarawak
- KLCI influences residential property price only in KL
- Population change influences residential property price only in KL and Negeri Sembilan
- Cost of construction influences residential property price in Perak, Negeri Sembilan and Sarawak

### Terraced segment

- GDP influences residential property price in KL, Johore and Sabah
- Interest rate influences residential property price in Perak, Negeri Sembilan, Pahang, Terengganu and Kelantan
- Loan growth influences residential property price only in Penang
- Money supply influences residential property prices in Melaka, Kedah, Terengganu, Perlis and Sarawak
- KLCI influences residential property price only in Sarawak
- Population change influences residential property price in KL and Kelantan
- Cost of construction influences residential property price in Perak, Negeri Sembilan, Kelantan and Sarawak
- Detached segment
- GDP influences residential property price only in KL
- Interest rate influences residential property price in Perak, Negeri Sembilan, Kedah and Terengganu
- Loan growth influences residential property price only in KL
- Money supply influences residential property prices only in Johor
- KLCI influences residential property price in Johor and Perak
- Population change influences residential property price only in KL
- Cost of construction influences residential property price only in Melaka
- Semi-Detached segment
- GDP influences residential property price only in Perak
- Interest rate influences residential property price in KL, Selangor, Penang, Perlis and Sabah
- Loan growth influences residential property price only in Sarawak
- Money supply influences residential property prices in Perak, Melaka and Sarawak
- KLCI influences residential property price in KL and Selangor
- Population change influences residential property price in Perak and Perlis
- Cost of construction does not influence residential property price in any states

### High Rise segment

- GDP influences residential property price in Johore, Penang and Melaka
- Interest rate influences residential property price in Negeri Sembilan, Melaka and Sabah

- Loan growth influences residential property price in KL and Penang
- Money supply does not influence residential property price in any states
- KLCI influences residential property price only in Selangor and Penang
- Population change does not influence property price in Johor and Melaka

Table 8: ARDL Long-Run Relationship

Segment	Factor	National	KL	Selangor	Johor	Penang	Perak	N 9	Melaka	Kedah	Pahang	Terengganu	Kelantan	Perlis	Sabah	Sarawak
Aggregate	GDP					√										
	INT		√				√	√				√				
	LG		√													
	MS									√				√		√
	KLCI		√													
	POPCH		√					√								
Terraced	COC						√	√								√
	GDP		√		√										√	
	INT					√	√	√			√	√	√			
	LG					√										
	MS								√	√		√		√		√
	KLCI															√
Detached	POPCH		√				√	√								
	COC						√	√								√
	GDP		√							√		√		n.a.		
	INT		√													
	LG	√	√													
	MS					√										
Semi-D	KLCI	√			√		√									
	POPCH	√							√							
	COC		√													
	GDP	√	√	√		√								√	√	
	INT		√													
	LG	√														√
High-Rise	MS			√					√							√
	KLCI				√											
	POPCH					√										
	COC	√														
	GDP	√			√	√	n.a.	√	√	n.a.	n.a.	n.a.	n.a.	n.a.	√	n.a.
	INT		√			√										

Notes: n.a. = data is not available



## Cost of construction influences residential property price only in Negeri Sembilan

In conclusion, the study found that there exists a long run relationship between residential property price and the influencing factors. However, inconsistencies are reported. For example, at the semi-detached segment, interest rates influence the property prices in Kuala Lumpur, Selangor, Penang, Perlis and Sabah but not in other states.

Comparing between factors, interest rates is the most dominant factor influencing residential property prices (across states and market segments). The least influencing factors are loan growth and population change. These results enhance our earlier finding based on the DOLS regression.

### 4.5 Vector Error Correction Model (VECM)

The presence of a long run relationship leads to the establishment of equilibrium whereby any deviation from equilibrium will eventually converge to equilibrium and stabilize. Following this, there is a need to examine the speed of adjustment (convergence) to equilibrium. As an example, in the long run, when the property price deviates from its equilibrium, it will converge at a certain speed of adjustment to its equilibrium. For this purpose, the VECM is suitable in measuring the speed of adjustment. The speed of adjustment is represented by the error correction term (ECT) in VECM.

Table 9: Error Correction Term (ECT) ( $\lambda$ )

Segment	National	KL	Selangor	Johor	Penang	Perak	N9
Aggregate	0.0291	0.0938	0.0647	0.0021	0.0309	-0.0832	-0.0453
Terraced	0.0145	0.0679	-0.0476	0.0101	-0.0188	-0.3403	-0.0216
Detached	-0.1420	-0.2718	-0.1499	-0.0503	0.0883	-0.0284	-0.2807
Semi-D	0.0619	-0.0431	0.0078	0.0331	0.0338	-0.3387	-0.2901
High-Rise	0.0399	0.0875	0.0317	0.0402	0.0380	n.a.	-0.1789

  

Segment	Melaka	Kedah	Pahang	Terengganu	Kelantan	Perlis	Sabah	Sarawak
Aggregate	0.0273	-0.0519	0.0146	-0.0146	-0.0289	0.0281	-0.0489	0.0440
Terraced	0.0298	-0.1302	0.1013	0.0730	0.0605	0.0240	-0.1897	-0.0193
Detached	-0.0026	-0.3208	-0.0621	-0.1418	-0.1018	n.a.	0.0575	0.0212
Semi-D	-0.0488	0.0505	-0.0170	-0.0241	-0.0397	-0.1195	-0.0588	0.0494
High-Rise	-0.3059	n.a.	n.a.	n.a.	n.a.	n.a.	0.0006	n.a.

Notes: n.a. = data is not available

Table 9 shows the significance of the ECT for all the property market segments. This indicates the presence of adjustment towards equilibrium. Comparatively, the detached segment has the highest rate of adjustment compared to other market segments. However, the magnitude of the adjustment is too slow. For example, for terraced, the speed is merely 1.45% (national). As a rule of thumb, the speed of adjustment ( $\lambda$ ) must be between  $-2 < \lambda < 0$ . This finding supports the previous finding of Ibrahim and Law (2014) in which they recorded speed of adjustment of 10% (Aggregate National) and 13% (Terrace National) but no adjustment for other property market segments in their study on Malaysian property market.

Based on the ARDL and the VECM, we can conclude that despite the existence of the long run relationship between property price and its factors, convergence to equilibrium is too slow. This indicates a persistent deviation of property price from its equilibrium. This finding therefore supports Tang and Tan (2015) conclusion on the inefficiency of property market price in Malaysia.

#### 4.6 Vector Autoregressive (VAR)

The VAR is to test whether a current value of residential property price is explained by its past values and past values of other factors. In conducting a granger causality test using VAR, the test can be sensitive to the selected lag length. In order to address this issue, a rigorous way to determine the optimal lag length is by using the Akaike Information Criterion (AIC) or Schwarz Information Criterion (SC). Based on Table 9, a lag length of 1 is selected for this study as suggested by SC. The same lag length of 1 is selected for the different property market segments.

Table 10: Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	493.0568	NA	0.0000	-21.0894	-20.7714	-20.9703
1	895.4134	647.2692*	4.07e-26*	-35.8006	-32.93836*	-34.72838*
2	948.7644	67.2687	0.0000	-35.3376	-29.9312	-33.3123
3	1013.5450	59.1478	0.0000	-35.3715	-27.4209	-32.3932
4	1151.0580	77.7244	0.0000	-38.56773*	-28.0729	-34.6363

Notes: \* indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

After identifying the optimal lag length, we then proceed with the granger-causality tests. This test determines whether past values of the factors (including past value of property price) help to predict the current property price. Table 11 shows the results of the granger causality.



Based on Table 11, the current property price is influenced by its own past values. This is to say that today's property price is influenced by the previous three months property price. This result is consistent across the different property market segments and states. However, the granger-causality test indicates that none of the past values of the factors influences the property price, except the cost of construction in selected states and market segments.

The past values of cost of construction seem to have a significant influence on the current property price for detached, semi-D and high-rise segments in selected states. For example, the previous 3 months' cost of construction influence detached segments in Johor, Penang, Perak, Negeri Sembilan, Melaka and Kedah. For semi-D, the previous 3 months' cost of construction influence KL, Selangor, Johor, Penang, Perak and Negeri Sembilan, while for high-rise, the previous 3 months' cost of construction influence Penang and Negeri Sembilan.

Based on the finding, it is apparent that the residential property price today is influenced by the current factors rather than the past. This study supports Ibrahim and Law (2014) where they also report a lack of causal relationship between property price of different market segments and factors in their study on Malaysia. The increasing trend in property price, that is, the price hike that is observed today is mainly due to the current phenomenon, not the past factors.

#### **4.7 Ripple Effect**

In this section, we examine the third objective of the study i.e. to study the ripple effect of property price across different states and different residential property market segments in Malaysia. The presence of ripple effect implies that the house price in one state may have a spreading effect on other states. The price ripples out and significantly influences house price changes in the rest of other states (Canarella et al. 2012). In contrast, the absence of ripple effect indicates that the house price is segmented with long run divergence. This means the house price in one state may have the tendency to drift further away from house prices in other states.

To meet this objective, this study follows the method adopted by Meen (1999) i.e. the unit root test. This method is also applied by Lean and Smyth (2013) in their studies on house prices and the ripple effect in Malaysia. Following Lean and Smyth (2013), we first compute the ratio of the HPI state to the HPI national for each state and each market segment. We then perform the Augmented Dickey Fuller (ADF) to test for unit root of the ratio. The null hypothesis of the test indicates the presence of unit root (non-stationary). Rejecting the null means there exists the ripple effect i.e. house price in one state may have a spreading effect on other states. In contrast, failure to reject the null means no ripple effect i.e. price is segregated between states. The Schwartz Information Criterion (SIC) is used for the optimal lags selection in the ADF tests.

Table 17: Ripple Effect

	All	Terraced	Detached	Semi Detached	High Rise
KL	√	√	√	√	√
Selangor			√	√	
Johor					
Penang	√	√	√	√	√
Perak	√	√	√	√	n.a.
N. Sembilan	√	√	√	√	√
Melaka	√	√	√	√	√
Kedah			√	√	n.a.
Pahang			√		n.a.
Terengganu			√	√	n.a.
Kelantan	√				n.a.
Perlis			n.a.	√	n.a.
Sabah			√		
Sarawak			√	√	n.a.

Note: √ indicates the presence of ripple effect; n.a. = data is not available

Table 17 indicates the presence of ripple effect for all property market segments in KL, Penang, Perak, Negeri Sembilan and Melaka (Refer Appendix VI for detail on the statistical results of the ripple effect). For example, referring to KL, it is found that the house prices in KL have ripple/spreading effect on house prices in other states. In other words, the residential property price hike in KL (all property market segments) causes the price hike in other states (all property market segments). The same applies to Penang, Perak, Negeri Sembilan and Melaka.

However, there is also evidence of ripple effect in other states as well like Selangor, Pahang, Terengganu, Kelantan, Perlis, Sabah and Sarawak but not for all property market segments. In the case of Selangor for example, the residential property price hike in Selangor causes the price hike in other states but only on detached and semi-detached segments. While for Pahang, the ripple effect is found only for detached segment.

This finding supports Lean and Smyth (2013) on the presence of ripple effect and regional cluster in their study on house prices in Malaysia. The states with ripple effect detected in this study are clustered around the central region of Malaysia except Penang. We can therefore conclude that house prices in the central region and Penang have significant influence on the house prices in other states in Malaysia. Based on this finding, we infer that the residential property market in Malaysia is integrated. According to Gupta and Miller (2012) and Tang and Tan (2015) with the presence of ripple effect, investors can technically predict or forecast the movement of house price.

## 5.0 CONCLUSION AND RECOMMENDATIONS

The increasing trend of property price in Malaysia has raised the attention of many parties, be it from home buyers, investors, researchers, policy makers and economists. Factors influencing property price have been widely discussed and numerous factors have been examined by past researchers in the attempt to better understand the property market price behavior. Some common factors in the literature display consistent results whereas others are specific to particular economies and market segments. Accordingly, this study examines the factors influencing property price in Malaysia.

The findings from this study show that, based on the different segments of property prices (aggregate, terraced, detached, semi-detached, high-rise) and different states, most of the factors do have significant relationship with property price.

By examining national and states level data, this study differs from the previous studies such as Pillaiyan (2015) that concludes the presence of speculation in the

Malaysian property market. Pillaiyan (2015) concludes that the property price has deviated from the economic fundamentals for the last 15 years due to insignificant influence of GDP on property price based on the national data (aggregate). This study hence provides rigorous information on the behavior of property price in Malaysia.

This study expands the analysis and looks into the dynamic nature of the property price by examining the long run behaviour of the price and its association with the identified factors. In addition, this study also analyses the possibility of the property price to be significantly influenced by the past or lagged values of the factors as to provide more comprehensive findings and understandings on the behaviour of the property price in Malaysia.

The cointegration analysis indicates that the property price and its factors are cointegrated for all property market segments across states, hence implying the presence of a long run relationship between the property price and its determining factors. By using the ARDL to determine the long run relationship between property price and the factors, this study found that most of the factors significantly influence property price in the long run.

This study recorded a slow adjustment of property price towards equilibrium in the long run. This implies a persistent deviation from price equilibrium reflecting inefficiency in the residential property market in Malaysia.

This study continues to examine whether past values of the factors (including past value property price) influence the current property price, using the granger causality test within the Vector Autoregressive (VAR) framework. Results of the granger-causality test indicate that current property price is influenced by its own past values, which means today's property price is influenced by the previous three months property price. This result is consistent across the different property market segments and states. However, the granger-causality test indicates that none of the past values of the factors influences the property price, except the cost of construction in selected states and market segments.

In line with this result, the impulse response functions also imply that property price in all segments respond to shocks in its own values, not to shocks in other factors, which are the GDP, interest rates, loan growth, money supply, stock market performance, population growth and cost of construction. Similar findings are obtained for the other property market segments and across states. These prices do not respond to the shocks in other factors. They are only responsive to the shocks in their own values.

This study examines the ripple effect of residential property prices in Malaysia. It concludes on the presence of ripple effect in which the house prices in KL, Negeri Sembilan, Perak, Penang and Melaka have spreading effect on other states in Malaysia. The states with ripple effect identified in this study are clustered around the central region of Malaysia except Penang. We infer that the residential property market in Malaysia is integrated.

In conclusion, with the significant influence of factors affecting house prices and the presence of ripple effect which indicates that the market is integrated, this study concludes that the residential property price hike in Malaysia is supported by fundamental factors and is not speculative in nature.

This study examines factors influencing the residential property price in Malaysia by focusing on macroeconomic and financial variables including GDP, interest rates, inflation, property loan growth, money supply, stock market performance, population growth and cost of construction. Despite other factors being discussed in the literature, this study focuses only on the macroeconomic and financial variables in line with the

nature of time series data. As discussed in the introduction section, the influence of other factors (cross section data) such as behavioural, demographic, industry, location, design, developers' profit margin and land/zoning are acknowledged but beyond the scope of this study. The factors chosen for this study are also in line with the time series methodology employed to achieve the objective of this study.

With regards to residential property price hike, it is recommended for future research to incorporate both time series and cross section data with appropriate methodologies to capture comprehensive understanding on the behavior of residential property price in Malaysia.

## 6.0 REFERENCES

- Adalid, R., & Detken, C. (2007). Money's role in asset price booms, ECB Working Paper, No 732.
- Alin, A. (2010). Multicollinearity, *Wiley Interdisciplinary Reviews: Computational Statistics*, 2(3), 370-374.
- Barakova, I., Bostic, R. W., Calem, P. S., & Wachter, S. M. (2003). Does credit quality for homeownership, *Journal of Housing Economics*, 12(4), 318-336.
- Canarella, G., Miller, S.M., & Pollard, S.K. (2012). Unit roots and structural change: an application to US house price indices, *Urban Studies*, 49(1), 757-776.
- Choy, H.T.L., Ho, W.K.O., & Mak, S.W.K. (2011). Region-specific estimates of the determinants of residential investment, *Journal of Urban Planning and Development*, 137(1), 1-6.
- Ciarlone, A.A. (2015). Property cycles in emerging economies, *Studies in Economics and Finance*, 32(1), 17 – 52.
- Davis, E.P., & Zhu, H.B. (2004). Bank lending and commercial property cycles: some cross-country evidence, Working Paper No. 150, Bank for International Settlement, Basel, Switzerland.
- Drukker, D.M. (2003). Testing for serial correlation in linear panel-data models, *Stata Journal*, 3(2), 168-177.
- Egert, D., & Mihaljek, B. (2007). Determinants of property price in central and Eastern Europe, CESIFO Working Paper.
- Gerlach, S., & Peng, W. (2005), Bank lending and property prices in Hong Kong. *Journal of Banking and Finance*, 29(2), 461-481.
- Glindro, E.T., Subhanij, T., Szeto, J., & Zhud, H. (2011). Determinants of property price in nine Asia-Pacific economies, *International Journal of Central Banking*, September, 163-204.
- Goodhart, C., Hofmann, B., & Segoviano, M. (2004). Bank regulation and macroeconomic fluctuations. *Oxford Rev Econ Policy* (Winter), 20(4), 591-615.
- Goodhart, C., & Hofmann, B. (2008), Property price, money, credit, and the macroeconomy. *Oxford Rev Econ Policy*, 24(1), 180-205.
- Greiber, C., & Setzer, R. (2007). Money and housing – Evidence for the Euro Area and the US. Deutsche Bundesbank Discussion Paper, Series 1: Economic, Studies, No. 12/2007.
- Gujarati, D. N., & Porter, D.C. (2009). *Basic Econometrics*. New York: McGraw-Hill.
- Gupta, R., & Miller, S. M. (2012). "Ripple effects" and forecasting home prices in Los Angeles, Las Vegas, and Phoenix. *The Annals of Regional Science*. 48(3), 763-782.
- Lean, H.H., & Smyth, R. (2013). Regional house prices and the ripple effect in Malaysia, *Urban Studies Journal*, 50(5), 895–922.
- Hong, T.T. (2013). Housing satisfaction in medium- and high-cost housing: The case of Greater Kuala Lumpur, Malaysia, *Habitat International*, 36, 108-116.
- Hui, E.C.M., & Ng, I. (2009). Price discovery of property markets in Shenzhen and Hong Kong, *Construction Management and Economics*, 27(12), 1175-96.
- Ibrahim, M.H. (2010). Property-stock price relations in Thailand: an empirical analysis, *International Journal of Housing Markets and Analysis*, 3(1), 69 – 82.
- Ibrahim, M.H., & Law, S.H. (2014). Property price and bank credits in Malaysia: An aggregate and disaggregate analysis, *Habitat International*, 42, 111-120.
- Jud, G.D., & Daniel, T.W. (2009). The dynamics of metropolitan housing prices, *JRER*, 23(1), 29-45.
- Kamal, E. M., Hassan, H., Osmadi, A., & Fatah, H.A. (2015). Housing price control: is it a way forward? *Sustainable Development*, 2, 1225-1235.



- Kamal, E. M., Hassan, H., & Osmadi, A. (2016). Factors influencing the housing price: developers' perspective, *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 10(5), 1603-1609.
- Koivu, T. (2012). Monetary policy, asset prices and consumption in China, *Economic Systems*, 36, 307–325.
- Lean, H.H., & Smyth, R. (2014). Dynamic interaction between property price and stock prices in Malaysia, *International Journal of Strategic Property Management*, 18(2), 163-177.
- Li, J. (2013). What causes China's property boom? *Property Management*, 31(1), 4 – 21.
- Lin, T.C. and Lin, Z.H. (2011). Are stock and real estate markets integrated? An empirical study of six Asian economies, *Pacific-Basin Finance Journal*, 19(5), 571-585.
- Lind, D.A., Marchal, W.G. & Wathen, S.A. (2015). Statistical techniques in business and economics, 16<sup>th</sup> Edition, McGraw-Hill.
- Meen, G. (1999). Regional house prices and the ripple effect: a new interpretation, *Housing Studies*, 14(1), 733–753.
- Oikarinen, E. (2009). Interaction between property price and household borrowing: the Finnish case, *Journal of Banking and Finance*, 33, 747-756.
- Ong, T.S. (2013). Factors affecting the price of housing in Malaysia, *Journal of Emerging Issues in Economics, Finance and Banking (JEIEFB)*, 1(5), 414-429.
- Osmadi, A., Kamal, E.M., Hassan, H. & Fattah, H.A. (2015). Exploring the elements of housing price in Malaysia, *Asian Social Science*, 11(24), 26-38.
- Pesaran, M. H., & Shin, Y. (1999). An autoregressive distributed-lag modelling approach to cointegration analysis. *Econometric Society Monographs*, 31(7), 371–413.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.
- Pillaiyan, S. (2015). Macroeconomic drivers of property price in Malaysia, *Canadian Social Science*, 11(9), 119-130.
- Ramazan, S., Bradley, T. E., & Bahadir, A. (2007). Macroeconomic variables and the housing market in Turkey. *Emerging Markets Finance and Trade*, 43(5), 5-19.
- Shahbaz, M. (2007). Stock returns and inflation : An ARDL econometric investigation utilizing Pakistani data. *Pakistan Economic and Social Review*, 45(1), 89–105.
- Stock, J.H. & Watson, M. (1993). A simple estimator of cointegrating vectors in higher order integrated systems, *Econometrica*, 61(1), 783-820.
- Sutton, G. (2002). Explaining changes in property price. *BIS Quarterly Review*, September, 46-55.
- Tang, T.C., & Tan, P.P. (2015). Real interest rate and property price in Malaysia: an empirical study, *Economics Bulletin*, 35(1).
- Le, Thai-Ha; Chang, Y., & Park, D. (2017). Governance, vulnerability to climate change, and green growth: International evidence, *Economics Discussion Papers*, Leibniz Information Centre for Economics, No. 2017-16.
- The Economist, 2016 <http://www.economist.com/news/finance-and-economics/21695912>.
- Tsatsaronis, K., & Zhu, H. (2004). What drives housing price dynamics: cross-country evidence, *BIS Quarterly Review*, March.
- Zandi, G., Supramaniam, M., Aslam, A., & Theng, L.K. (2015). The economic factors affecting residential property price: the case of Penang Island, *International Journal of Economics and Finance*, 7(12), 200-210.

- Zhu, H. B. (2004). What drives housing price dynamics: Cross country evidence, *BIS Quarterly Review*, March.
- Zhu, H.B. (2006). The structure of housing finance markets and property price in Asia, *BIS Quarterly Review*, 55-69.