Causality of Residential Properties Price Movements in Malaysia

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Abstract

Many studies had been previously conducted to analyse factors that affects price of residential properties but none of these research addresses the issue specifically to Malaysia. This paper serves the purpose to fill in the gap whereby factors which were empirically proven to affect price of residential properties are tested with Malaysian data, covering the period from 1990 to 2009. Data used in this study were collected from Government's official sources, i.e. as published by the Central Bank of Malaysia (Bank Negara Malaysia), Department of Statistics Malaysia and National Property Information Centre (NAPIC) of the Valuation and Property Services Department of Malaysia. The time series techniques namely cointegration, vector error correction model and variance decomposition were used to estimate the significance of identified variables to the price of residential properties. It is important for policymakers especially the Federal Government to know the variables that significantly influenced the price of residential properties as to control the price so as to preserve the wealth effect and to balance racial composition in an area.

Keywords: *Malaysia, Residential Properties, Econometrics*

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1 Introduction

Residence serves as a shelter for human beings, and one of the human basic needs apart from food and clothing **(Denton 1990)**. In satisfying the need for shelter, people would either buy their own house or rent it from others, whom can afford to own more than one property. Therefore, we could say that house plays dual role of consumption and investment **(Glindro et al. 2008, Stepanyan, Poghosyan & Bibolov 2010)** and it is acquired via cash or bank loans.

Malaysian household debt as at end of 2009 is observed at **RM**516.6 Billion or 76.6% of GDP, where almost half of the debt (46.2%) was obtained to fund acquisition of residential properties **(Bank Negara Malaysia 2009)**. This strengthen the fact that house is the people's largest investment. When price of property appreciates, borrowers can negotiate or refinance for a higher loan. Money generated from refinancing could be used for consumption, and consequently support in creating the multiplier effect in the economy.

As for banks, property loan is the safest bet as it is collateralised by property, presumably higher than their value. In Malaysia, maximum loan-to-value (LTV) for housing loan is 90% for the first two property loans and 70% for three or more loans. Furthermore, the value of real estate normally appreciates and rarely depreciates. Therefore, property loan made up a substantial portion of Malaysian banks loan portfolio (27% in 2009).

Nevertheless, over-reliance on housing loan would expose individuals and banks to adverse movement of property price that would led both bank and borrowers into trouble, as value of collateral would dropped to a lower level than the outstanding loan. This would ignite what is being described by **Bernanke, Gertler & Gilchrist (1996)** as the accelerator model where people start to give up on their mortgages and lost hope in the property market, enormous amount of auctions and demand is way less than supply. This would exacerbate the situation where NPL increased rapidly and in turn dragged the country into a major financial crisis **(Cocco 2004, Yao & Zhang 2005).**

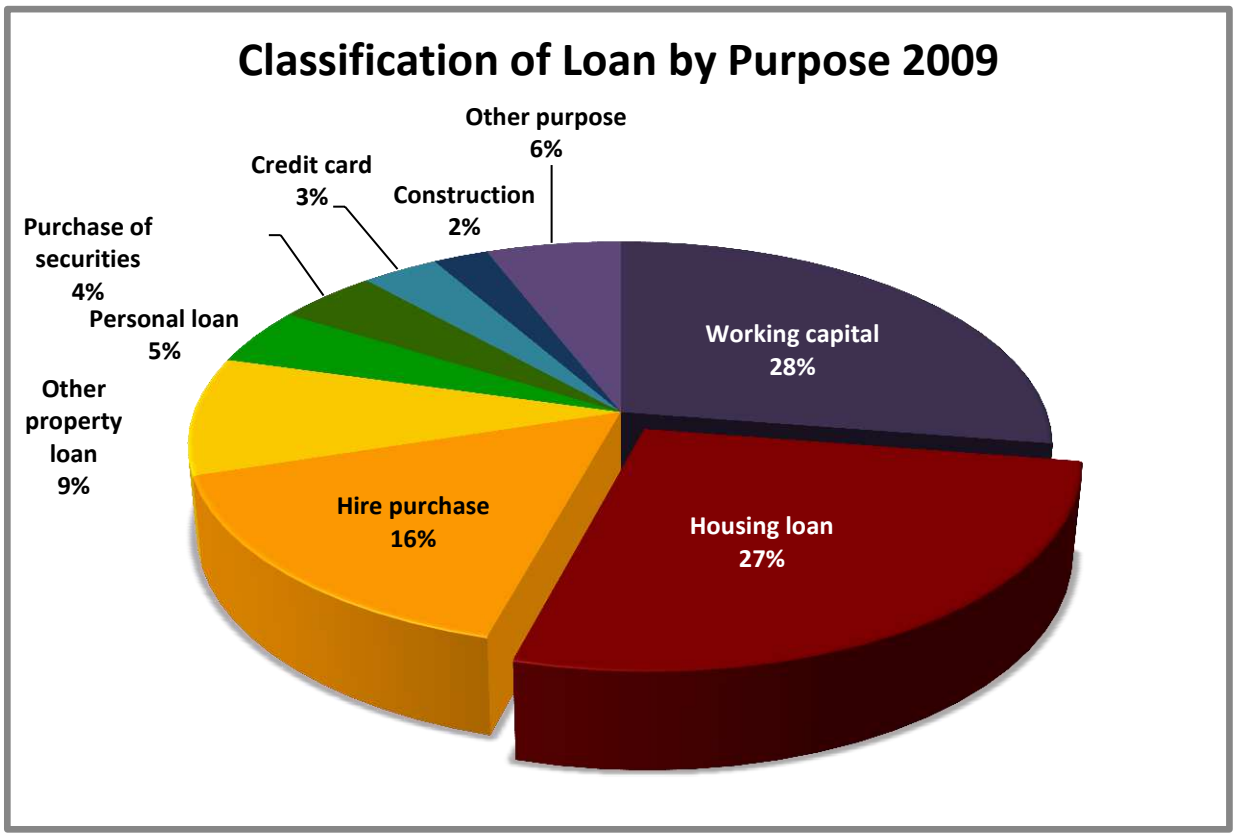

Chart 1 : Classification of Loan by Purpose 2009
Source : Bank Negara Malaysia

The topic's sheer importance had attracted vast research conducted for this topic covering group of countries, individual countries and even towns. Nevertheless, determinants of price of residential property from Malaysia perspective have yet to be uncovered despite wide coverage in this area. To the author's knowledge, this is the first paper that tries to cover this gap.

As it is a tool for wealth creation, the study could help the policymakers in achieving their objectives. For instance, Malaysia had embarked into an Economic Transformation Program (ETP) to transform Malaysia into a high income-nation by 2020. The Government aspires to uplift Gross National Income (GNI) per capita from **RM**23,700 in 1999 to **RM**48,000 in 2020. As previously discussed, increased in price of residential properties would have a significant positive impact on household consumption **(Girouard & Blondal 2001, Campbell & Cocco 2007)**. As such, the Government have to put an effort to control the price of real estate as sharp decline in house prices would have a bigger impact than equity price busts do **(Helbling & Terrones 2003, Case, Quigley & Shiller 2005)**, which subsequently could trap Malaysian in the middle income range.

As some of the factors like income, unemployment rate and population are said to be spatial in nature, result from this study could be assisting the Government to attract investment in particular area, thus balancing the composition of race inhibiting in that area i.e. Penang, Kedah, Kelantan, Terengganu, etc.

On a high level, this entire paper is focus in addressing the research issue of determining factors that affect price of residential properties in Malaysia.

The rest of this paper is structured as follows: The following section presents a literature review on the subject; section 3 discusses the theoretical framework from which the econometric model is derived; while section 4 describes data and methodology. Section 5 presents the empirical results and interpretations; Section 6 provides policy recommendations and areas for future research and Section 7 concludes the paper.

2 Literature Review

The topic had been widely studied over the years which covered a wide range of samples. Previous study had covered towns, cities and metropolitan areas **(Bourassa & Hendershott 1995, Abraham & Hendershott 1996, Case & Mayer 1996, Capozza et al 2002, Jud & Winkler 2002, Kim & Lee 2004, Karantonis & Ge 2007, Lee 2009)**, group of countries like OECD countries **(Tsatsaronis & Zhu 2004)**, European countries **(Egert & Mihaljek 2007, Hilbers et al. 2008)**, advanced economies **(Sutton 2002, Iossifov et al. 2008, Goodhart & Hofmann 2008)**, former Soviet Union countries **(Stepanyan, Poghosyan & Bibolov 2010)** and Asia Pacific countries **(Glindro et al 2008)**. Some of the countries were also covered extensively in the previous research like Australia **(Tu 2000, Abelson et al. 2005, Stubbs 2005)**, USA **(Case & Shiller 1990, Peek & Wilcox 1991, Baffoe-Bonnie 1998)**, Germany **(Demary 2008, Belke 2009, Kajuth 2010)**, Switzerland **(Borowiecki 2008)**, China **(Hanink, Cromley & Ebenstein 2010)**, Canada **(Hossain & Latif 2007)**, United Kingdom **(Stern 1992, Munro & Tu 1996)** and Bulgaria **(Rizov 2003)**.

From the previous research, most concluded that income is among the most important factor for movement of price of residential properties. It was empirically proven that income and

price is highly and positively correlated **(Case & Shiller 1990, Peek & Wilcox 1991, Stern 1992, Bourassa & Hendershott 1995, Abraham & Hendershott 1996, Munro & Tu 1996, Tu 2000, Jud & Winkler 2002, Capozza et al 2002, Sutton 2002, Tsatsaronis & Zhu 2004, Abelson et al. 2005, Egert & Mihaljek 2007, Hossain & Latif 2007, Karantonis & Ge 2007, Demary 2008, Glindro et al 2008, Goodhart & Hofmann 2008, Hilbers et al. 2008, Kajuth 2010, Stepanyan, Poghosyan & Bibolov 2010)**. The result is very logical where increase in salary would improve demand on residential properties and subsequently the price. Further, salary is an important factor in any business. Increase in salary would more likely to increase the cost of production or development, therefore increase in price.

Next factor with the highest result is movement in interest rate **(Peek & Wilcox 1991, Abraham & Hendershott 1996, Munro & Tu 1996, Baffoe-Bonnie 1998, Tu 2000, Jud & Winkler 2002, Sutton 2002, Tsatsaronis & Zhu 2004, Abelson et al. 2005, Stubbs 2005, Egert & Mihaljek 2007, Karantonis & Ge 2007, Goodhart & Hofmann 2008, Iossifov et al. 2008)**. Unlike income, interest rate is negatively related to price of residential properties. Increase in cost of financing would make properties less affordable, hence weaken the demand. Consequently, price will weaken.

It is logical that once the population increased, the demand for residential properties will follow. This theory had been found to be accurate by some researchers whereby population is empirically proven to move in line with price **(Borowiecki 2008, Bourassa & Hendershott 1995, Capozza et al 2002, Case & Shiller 1990, Jud & Winkler 2002, Kajuth 2010, Peek & Wilcox 1991)**.

Next, some of the authors looked at the effect of the labour market to price. If unemployment rate is low, it is more likely that more people are employed and would have money to demand for their own house. This would in turn make the price of house to increase, which had been proven by previous researchers **(Abelson et al. 2005, Abraham & Hendershott 1996, Baffoe-Bonnie 1998, Egert & Mihaljek 2007, Kim & Lee 2004, Tu 2000)**. Looking at the financial crisis in 2009 in USA, it started from the burst of property market bubble. Non-servicing loans made it being recalled by banks that subsequently dump it off to the market via auction. Too much supply and less demand due to people being conservative and holding on to their cash made the problem unbearable and many financial institutions collapsed due

to plunge of their collateral value. This had a domino effect in many industries where many companies were closed down and employees laid off. Without job, people cannot afford to service their mortgage, making the matter worst.

In the quest for literatures, the author noted that many other factors were proven by previous research as having significant impact on the price. For instance, **Abelson et al. (2005), Abraham & Hendershott (1996), Baffoe-Bonnie (1998), Borowiecki (2008), Demary (2008), Goodhart & Hofmann (2008), Hossain & Latif (2007), Lee (2009), Tsatsaronis & Zhu (2004)** proved that inflation or CPI largely affected the price. **Abraham & Hendershott (1996), Capozza et al (2002), Jud & Winkler (2002), Kajuth (2010), Peek & Wilcox (1991), Tu (2000)** research showed plausible relationship with construction cost due to the fact that developers need to make profit. If the business is not profitable, developers would surely withdraw from the market.

Other authors like **Sutton (2002), Tsatsaronis & Zhu (2004), Abelson et al. (2005)** and **Glindro et al (2008)** found that equity price had negatively impact the price of properties, **Baffoe-Bonnie (1998)** and **Stepanyan, Poghosyan & Bibolov (2010)** pointed foreign investment resulting from money improves demand and price of real estates, **Belke (2009)** and **Hanink, Cromley & Ebenstein (2010)** mentioned about house specification or customers preference impact on properties, **Capozza et al (2002)** noted that transaction cost related to financing of the purchase is important as people may choose to rent instead of buy and **Tsatsaronis & Zhu (2004), Egert & Mihaljek (2007)** and **Glindro et al (2008)** found that credit availability also play a role in price.

Other factors were also proven to be the cause of fluctuation of price like the findings of **Case & Mayer (1996)** and **Hanink, Cromley & Ebenstein (2010)** that mentioned spatial factors like amenities are strongly and positively affect the price. **Case & Shiller (1990)** and **Hossain & Latif (2007)** proved that prior year house price does have an effect on the current year price as it is expected to be moved in a certain pattern. **Rizov (2003)** however came out with interesting findings whereby accession to the EU does give a positive impact to price.

The closest result to Malaysia was the study by **Glindro et al (2008)** but the result covered a range of Asia Pacific countries, in which it might be bias and not suitable as a decision making

tool for Malaysian policymakers. Thus, the issue for Malaysian context has remained unresolved as there is no research that specifically covers Malaysia. Further, literature review on research conducted in this issue is inconclusive due to variation of determining factors according to research sample. Therefore, this paper would perhaps address the issue in Malaysian context. In order to test the significance of the variables on the movement of price of residential properties, the author will use the time series techniques.

3 Theoretical Framework

Based on the economic model, price is determined by supply and demand **(Parkin 1993)**. As such, we could say that the price of residential property is dependent on the equilibrium of demand and supply of the residential property.

Demand is subject to choices of customers where it is determined mainly by preferences and constraints. Among the factors that could affect the customer's preference and constraints are Income (Y), Interest Rate (R), Population (P) and Unemployment Rate (U). Movements of these variables may affect the demand of residential property (DH). As such, the relationship could be summarised as follows:

$$\mathbf{DH = f\ (-R, +Y, +P, -U)}$$

Supply on the other hand is in the hands of the housing developers, with a main purpose to maximise profit. Therefore, factors that would affect profit such as the Income (Y) and Interest Rate (R) could positively or negatively impact the supply of residential property (SH). As such, we could theoretically summarise the factors affecting supply of residential property as follows:

$$\mathbf{SH = f\ (-R, +Y)}$$

With acceptance to the economic theory that Price (PH) is determined by the demand (DH) and supply (SH), we could further summarises the factors of Price (PH) as the following equation:

PH = f (-R, +Y, +P, -U)

The equation itself does not assist the policymakers in making decisions. It does not focus into significant factors that would affect the price of residential properties. It also does not tell us that level of movement of price of residential properties giving certain degree of movement of the variables. Despite the vast research conducted in to address the similar if not same issue in other countries or towns, the issue remains unanswered as Malaysian market differs from other countries that had been analysed before. As such, we could say that the theory is still inconclusive and unable to address the issue in Malaysian context. Therefore, there is a need for a scientific research to find an empirical answer for the issue raised. While the equation can be applied to other countries, testing the equation will enable the policymakers to note factors that are really important in controlling the price of residential properties.

4 Data & Methodology

4.1 Data

In order to test the equation, annual data of the following variables were collected from reliable online sources, i.e. Government database as published via the Central Bank of Malaysia (Bank Negara Malaysia), Department of Statistics Malaysia and National Property Information Centre (NAPIC) of the Valuation and Property Services Department of Malaysia.

- House price index (PH);
- Average loan rate (R);
- Unemployment rate (U);
- Population (P); and
- Gross National Income (GNI) per capita (Y).

Online source were preferred due to availability of most of the data, efficiency in extracting and analyzing the data and constraint of time and resources. As such, we were confronted with inconsistencies in availability of data i.e. not all variables have data covering period more than 20 years. Therefore, our study will only cover the period from 1990 to 2009 (20 years).

From here, the first stage of review, descriptive analysis is done to transform raw data that had been collected into a form that will make them easy to understand by way of rearranging and reordering the data. Data were systematically listed next to each other in a table **(Appendix 2)** so that it is easier to logically and statistically answer some of the questions related to the variables.

In order to make the data more meaningful to the reader even before the second stage of analysis is done, data were manipulated in order to portray consistent patterns in the data so that the results can be studied and interpreted in a brief and meaningful way. Absolute figures of certain data were transformed into index for more effective comparison and to quickly identify the growth over-time. This was done for House Price (PH), Population (P) and Income (Y). Mean was used as a measure of central tendency to interpolate data that had not been reported for unemployment rate for the year 1991 and 1994.

Due to the limitation in time and resources, some of the data such as CPI, construction cost, availability of credit, price *vis-a-vis* the size or specification of the property, transaction cost, amenities, etc are not taken into consideration as one of the factors. Furthermore, these factors were either less considered by previous research or it does not have significant affect on the price of residential property.

4.2 Methodology

Time series technique, i.e. cointegration, error correction modeling and variance decomposition were used in this study to find empirical evidence of the causality of movement in price of residential properties in Malaysia as mentioned in the earlier paragraphs. This method is favored over the traditional regression method for the following reasons.

Firstly, as evident by **Engle & Granger (1987)**, most finance variables (including price indexes, unemployment rate, interest rate, income per capita) are non-stationary. Therefore, performing ordinary regression on the variables will render the results to be misleading, as statistical tests like t-ratios and F statistics are not statistically valid when applied to non-stationary variables. Performing regressions on the differenced form of these variables will

solve the problem of non-stationarity. Nevertheless, by doing so, an even greater mistake would be committed. When variables are regressed in their differenced form, the long term trend is removed. Thus, the regression only captures short term, cyclical or seasonal effects. It was argued that regressing the variables in their differenced form had removed the long term (theoretical) relationships and therefore not suitable for social science.

Secondly, in traditional regression, the dependent and independent variables were pre-determined by the researcher based on existing theories. However, it was argued that, in any field of finance and economics, there is always more than one theory that explain the cause of a variable, in this case the causality of price of residential properties in Malaysia. Cointegration techniques are advantageous in that it does not presume variables that are endogenous and exogenous. In the final analysis, the data will determine which variables are in fact endogenous, and which are exogenous. In other words, with regression, causality is presumed whereas in time series, it is empirically proven with the data.

Thirdly, time series techniques embrace the dynamic interaction between variables i.e. cointegrated, whereas traditional regression methods, disregard the interaction between variables. Economic intuition tells us that some of the variables i.e. house price index (PH), population (P) and GNI per capita (Y) are related in the long run.

5 Empirical Results & Interpretations

5.1 Testing the Stationarity of Variables

Empirical testing was started by determining the stationarity of the variables used[2]. In order to proceed with the testing of cointegration, variables should ideally be I(1) variables i.e. non-stationary in their original level form and stationary in their first differenced form. The differenced form for each variable used was created by taking the difference of their log forms. For instance, differenced form of PH, $dPH = PH - PH_{t-1}$. The Augmented Dickey-Fuller (ADF) test was conducted on each variable (in both level and differenced form). ADF is favored because it take care the effect of autocorrelation. The result of the test is shown in the following table:

[2] A variable is stationary when its mean, variance and covariance are constant over time.

Table 1: Result of ADF test conducted on level form variables

Variables	AIC	SBC	Test Statistic	Dickey-Fuller Statistic	Variables Stationarity
PH	25.4718	24.1937	0.2753	3.1004	Non-Stationary
R	27.5621	29.7988	0.3950	3.1004	Non-Stationary
U	6.3562	8.2734	2.0985	3.1004	Non-Stationary
P	38.0664	37.1078	2.2272	3.1004	Non-Stationary
Y	16.0166	15.3776	0.5415	3.1004	Non-Stationary

Table 2: Result of ADF test conducted on differenced form variables

Variables	AIC	SBC	Test Statistic	Dickey-Fuller Statistic	Variables Stationarity
dPH	24.9504	24.1030	5.3028	3.1223	Stationary
dR	25.4384	27.4158	1.4953	3.1223	Non-Stationary
dU	7.3785	9.3558	2.4234	3.1223	Non-Stationary
dP	33.5897	33.0247	7.5189	3.1223	Stationary
dY	16.6042	14.6269	3.7044	3.1223	Stationary

Relying primarily on the AIC and SBC criteria, the conclusion that can be made from the above results is that all the variables we are using for this analysis are I(1) variables, and thus we may proceed with testing of cointegration[3]. Note that in determining which test statistic to compare with the 95% critical value for the ADF statistic, we have selected either the DF or ADF regression order based on the highest computed value for AIC or SBC.

5.2 Determination of Order of the VAR (Vector Auto Regression)

The order of the vector auto regression (VAR) i.e. number of lags to be used need to be determined before proceeding with the test of cointegration. As per the table below, results show that AIC recommends order of 2 whereas SBC favors zero lag[4].

[3] The null hypothesis for the ADF test is that the variable is non-stationary. In cases of variable in level form, the test statistic is lower than the critical value and hence we cannot reject the null. Conversely, in many cases of the variable in differenced form, the test statistic is higher than the critical value and thus we can reject the null and conclude that the variable is stationary (in its differenced form).

[4] Based on highest computed values for AIC and SBC, after stipulating an arbitrary relatively high VAR order, ideally 6. However, due to limited observations, VAR order of 2 was selected.

Table 3: Determination of VAR

	AIC	SBC
Optimal Order	2	0

Conflict between recommendation of AIC and SBC were addressed in the following manner. First autocorrelation for each variable were checked. In this case, autocorrelation for variables using VAR 2 and VAR 1 (if it is to be used) were tested. If the result shows autocorrelation, adopting lower order will not remove the effects of autocorrelation. The disadvantage of taking a higher order is that we risk over-parameterization. Therefore, in this case, given that we only have a short time series (20 observations), this is the main concern.

Table 4: Testing of Autocorrelation

Variables	VAR 2		VAR 1	
	Chi Sq (P-Value)	Implication (at 5%)	Chi Sq (P-Value)	Implication (at 5%)
PH	24.8%	No Autocorrelation	36.3%	No Autocorrelation
R	7.0%	No Autocorrelation	1.0%	Autocorrelation
U	14.3%	No Autocorrelation	7.9%	No Autocorrelation
P	19.3%	No Autocorrelation	62.3%	No Autocorrelation
Y	0.5%	Autocorrelation	95.4%	No Autocorrelation

From the result, it is seen that both VAR 2 and 1 produced a variable that have autocorrelation. Considering the trade-off of lower and higher orders, as well as limitation in number of observations, the author decided to go ahead with the higher VAR order of 2 since the data is sufficient to move to the next stage.

5.3 Test of Linear Cointegration

Once variables has been established as I(1) variables and determined the optimal VAR as 2, cointegration were tested. In doing so, both Engle-Granger and Johansen method were employed. Table 5 shows that the variables are cointegrating and the gap between them are narrowing. However, Engle-Granger method cannot accommodate more than one cointegrating relationships. Thus, further test of the relationship using Johansen method was conducted.

Table 5: Test for cointegration using Engle-Granger method

Variables	AIC	SBC	Test Statistic	Dickey-Fuller Statistic	Cointegration Between Variables
RESID	24.9408	23.6627	3.6058	3.1004	Variables are Cointegrated

The following table shows the result of Johansen test. Eigenvalue shows that there is one cointegrating vector between the variables but Trace shows 3 cointegrating vectors. Again, due to limited observations, r=1 was selected[5].

Table 6: Test for cointegration using Johansen method

Test Method	Null	Alternative	Statistic	95% Critical Value	Accept / Reject Null
Eigenvalue	r=0	1	58.5620	37.8600	Reject the Null
	r<=1	2	29.3910	31.7900	Accept the Null
Trace	r=0	1	131.0149	87.1700	Reject the Null
	r<=1	2	72.4529	63.0000	Reject the Null
	r<=2	3	43.0619	42.3400	Reject the Null
	r<=3	4	16.4883	25.7700	Accept the Null

5.4 Long Run Structural Modelling (LRSM)

The theoretical relationships among the variables were quantified in the following step. It was done to compare statistical findings with theoretical (or intuitive) expectations. Relying on the Long Run Structural Modelling (LRSM) component of MicroFit, the effect of normalizing the variable of interest i.e. House Price Index (PH), came up with the following result in Table 7. The t-ratios were manually calculated and it was noted that all of the variables are insignificant.

Table 7: Calculating the coefficient of the variables & over-identification of variables

Code	Variable	Coefficient	Standard Error	T-Value	Restrictions	CHSQ	Outcome[6]
a1	PH	1.0000	-	n/a	n/a	n/a	n/a
a2	R	0.0443	0.0509	0.8715	a1=1; a2=0	31.3%	Accept the null
a3	U	0.6539	0.3622	1.8056	a1=1; a3=0	0.0%	Reject the null
a4	P	8.0949	8.6719	0.9335	a1=1; a4=0	4.8%	Reject the null
a5	Y	2.2099	1.8433	1.1989	a1=1; a5=0	0.0%	Reject the null

[5] In the case of Maximal Eigenvalue and Trace, the test statistic for null of r = 0 is greater than the 95% critical value whereas for other null hypotheses, statistic is less than the critical values.

[6] If the null is accepted, the restriction is valid. If the null is rejected, the restriction is invalid.

The result had made the author curious as at least one or two variables should significantly affect PH because these variables are cointegrated. In order to confirm the initial results or the author's intuition, the significance of the variables were verified by subjecting the estimates to over-identifying restrictions. This had been done to all of the variables (making one over-identifying restriction at a time) and the results confirmed the author's intuition as it turned out only restriction on interest rate (R) is valid. As such, the other variables i.e. unemployment rate (U), population (P) and income per capita (Y) had a significant impact on PH.

From the analysis, the following cointegrating equation (numbers in parentheses are standard deviations) were noted:

$$\underset{}{PH} + \underset{(0.36)}{0.65U} + \underset{(8.67)}{8.09P} + \underset{(1.84)}{2.21Y} \rightarrow I(0)$$

5.5 Vector Error Correction Model (VECM)

The analysis so far had established that PH, U, P and Y are significantly cointegrated. However, the cointegrating equation reveals nothing about causality, that is, which index is the leading variable and which is the dependent variable. Information on direction of Granger-causation can be particularly useful for policymakers. By knowing which variable is exogenous and endogenous, policymakers would know which of these variables affect the others. It is important for decision making in stabilising the economy as they would have a clue on which variables should be tackled for effective impact. In this case, exogenous variables would be a subject of interest for the policymakers.

In doing so, Vector Error Correction Model (VECM) was used. In addition to decomposing the change in each variable to short-term and long-term components, exogenous and endogenous variables were able to be determined. The principle in action here is that of Granger-causality, a form of temporal causality where the extent to which the change in one variable is caused by another variable in a previous period can be determined. By examining the error correction term, e_{t-1} for each variable, and checking whether it is significant, three of the variables (R, P

and Y) were noted to be exogenous variables. Other variables such as PH and U were found to be endogenous. As such, using PH as the dependent variable looks plausible as it is affected by other variables.

Table 8: Result of VECM

Variables	ecmt1(-1)		Endogeneous / Exogeneous	Period to Equilibrium
	Coefficient	T-Ratio		
dPH	0.3295	3.5977	Endogenous	3.0 Year(s)
dR	1.3695	0.5808	Exogenous	0.7 Year(s)
dU	2.6501	4.2145	Endogenous	0.4 Year(s)
dP	0.0686	1.7430	Exogenous	14.6 Year(s)
dY	0.0335	0.1631	Exogenous	29.8 Year(s)

Result of the test showed that the exogenous variables (R, P and Y) would receive shock from the economy and transmit it to PH. As such, in stabilising the price of house in Malaysia, policymakers should monitor the interest rate, population and income per capita as changes would likely affected house price significantly. As such, any change in policy that relates to interest rate, population (relaxing or strengthening immigration policy) and income per capita would be a subject of interest to the policymakers.

In addition, the VECM also produces a statistic that may be of interest to the policymakers. The coefficient of e_{t-1} tells us how long it will take to get back to long term equilibrium if that variable is shocked. The coefficient represents proportion of imbalance corrected in each period. For instance, in the case of PH, the coefficient is 3.0. This implies that, when there is a shock applied to this variable, it would take on average, 3 years for the variable to get back into equilibrium with the other variables.

5.6 Variance Decomposition (VDC)

Whilst VECM showed which variables are endogenous and exogenous, it does not indicate the relative endogeneity or exogeneity of the variables. In other words, it is difficult to tell which variable is the most driver (exogenous) and which is the most follower (endogenous). VECM is not able to assist in this regard, hence the need of variance decomposition (VDC). Relative endogeneity can be ascertained in the following way. VDC decomposes the variance of

forecast error of each variable into proportions attributable to shocks from each variable in the system, including its own. The least endogenous variable is thus the variable whose variation is explained mostly by its own past variations.

First, orthogonalized VDCs was applied and the following result was noted.

Table 9: Orthogonalized VDCs for the tenth period

	PH	R	U	P	Y
PH	93.7%	0.2%	0.1%	2.8%	3.2%
R	25.7%	65.5%	3.5%	1.5%	3.8%
U	76.5%	5.9%	9.4%	3.5%	4.7%
P	4.0%	16.6%	13.2%	59.2%	7.0%
Y	67.7%	12.0%	10.0%	0.7%	9.5%

From the above table, rows read as the percentage of the variance of forecast error of each variable into proportions attributable to shocks from other variables (in columns), including its own. The columns read as the percentage in which that variable contributes to other variables in explaining observed changes. The diagonal line of the matrix (highlighted) represents the relative exogeneity. As such, the degree of exogeneity (extent to which variation is explained by its own past variations) of each variable is depicted in Table 9 above.

The author found that this result is somehow puzzling. It is not consistent with VECM. VECM showed that PH and U are endogenous but the result in Table 9 above showed that PH is the most exogenous variable. Further, it showed that the exogeneity of Y is more or less similar to U. As such, in order to make sense of this result, two important limitations of orthogonalized VDCs should be recognized. Firstly it assumes that when a particular variable is shocked, all other variables are "switched off". Secondly and more importantly, orthogonalized VDCs do not produce a unique solution. The generated numbers are dependent upon the ordering of variables in the VAR. Typically, the first variable would report the highest percentage and thus would likely to be specified as the most exogenous variable. In relating to the variables, PH was the first variable appeared, therefore it was reported as most exogenous. To experiment further, the author rearranged all the variables to prove that orthogonalized VDCs are

"biased" by the ordering of variables, and rerun the orthogonalized VDC. The result in Table 10 confirmed the author's scepticism. Y is the most exogenous, followed by P, R, PH and U[7].

Table 10: Orthogonalized VDCs for the tenth period (alternative ordering)

	Y	P	U	R	PH
Y	89.2%	2.7%	1.5%	5.0%	1.7%
P	14.9%	78.5%	3.8%	2.2%	0.6%
U	68.1%	16.8%	2.9%	7.8%	4.4%
R	65.8%	3.0%	3.5%	21.6%	6.1%
PH	42.4%	11.2%	8.9%	26.1%	11.4%

Due to the findings, it is worthwhile to continue on testing the data with Generalized VDCs, which are invariant to the ordering of variables. In interpreting the numbers generated by the Generalized VDCs, additional computations had been performed. This is due to the fact the result from each variables does not add up to 1.0. Therefore, all results need to be converted into percentage form. Thus, the result is as the following Table 11.

Table 11: Generalized VDCs for the tenth period

	PH	R	U	P	Y
PH	42.7%	11.7%	14.1%	12.2%	19.3%
R	14.6%	14.3%	25.0%	8.6%	37.4%
U	30.0%	3.1%	24.2%	16.1%	26.6%
P	4.1%	11.0%	8.7%	61.2%	15.0%
Y	27.7%	1.2%	26.6%	8.1%	36.5%

The author then ranked the variables according to their exogeneity based on different approach as follows:

Table 12: Ranking of exogeneity using different methods

Exogeneity	Orthogonalized	Orthogonalized (alternative ordering)	Generalized
1	PH	Y	P
2	R	P	PH
3	P	R	Y
4	Y	PH	U
5	U	U	R

[7] Statistically, this implies that the variance-covariance matrix of residuals is not diagonal or near diagonal, that is, error co-variances are not near zero.

The result above shows that Orthogonalized VDCs (with alternative ordering of variables) is more consistent with the result of VECM. It was noted that PH and U is less endogenous than Y, P and R.

The above result does point out the potential result for movement of price of residential properties. Income (Y) and population (P) are the most influential factors. However, the impact is very substantial. In referring to the result of LRSM, 1% increase in population would increase the property price by 8% and 1% increase in income would increase the property price by 2.2%. This does not looks healthy as residential properties are becoming less affordable in terms of purchasing power, which might be due to the following factors:

- Influx of foreigners, mostly professionals that push up demand in high-end residential properties and made many property developers jumped into the bandwagon due to its lucrative returns
- More percentage of Malaysians earning higher income, made properties of higher prices more demanded
- Relaxing in restriction in house ownership by foreigners
- More people are buying residential properties as investments
- Speculative activities in the property market

The result also indicated that the transaction of property may be much higher than local demand and increase of property prices is way above the rise in income. As such, it is likely that the residential property market in Malaysia is experiencing a bubble.

5.7 Impulse Response Functions (IRF)

The impulse response functions (IRFs) essentially produce the same information as the VDCs, except that they can be presented in graphical form. For the sake of completeness, we have included the various graphs of IRFs in **Appendix 3**.

5.8 Persistence Profile

The persistence profile illustrates the situation when the entire cointegrating equation is shocked, and indicates the time it would take for the relationship to get back to equilibrium. Here the effect of a system-wide shock on the long-run relations is the focus (instead of variable-specific shocks as in the case of IRFs). The chart below in **Appendix 4** shows the persistence profile for the cointegrating equation of this study.

The chart indicates that it would take approximately 9 years for the cointegrating relationship to return to equilibrium following a system-wide shock.

6 Recommendation & Limitation of the Research

6.1 Policy Implication/Recommendation

Out of the 4 factors in affecting price of residential properties, it is most likely that interest rate (R) and unemployment (U) can be dropped from the policymakers consideration. From LRSM, data shows that interest rate is less significant in determining PH. Further, in VECM and VDC, unemployment is said to be less exogenous. The author's intuition also tells that fluctuation of Malaysian R and U within certain band would not have any impact on price of residential properties (PH). The impact shown in the calculation is most likely to be coincidence in nature. It would only be affected if the rates gone out of proportion i.e. when there is a prolonged surge of these rates. It could be somehow proven by looking at the log of the variables being tabulated in a graph **(Appendix 5)**. PH, P and Y show a gradual increase over the period while movement of R and U is somehow erratic.

Thus, policymakers should focus on population (P) and income (Y) which are positively correlated with PH. The following could be the most likely reason related to population and income that could drive an increase or decrease in PH:

- Demographic movement of younger generation from rural to urban area where property price is substantially higher (focused area like Kuala Lumpur, Johor Bahru and Penang

Island) and jobs paying higher salaries. As such, urban population growth could have a bigger effect on PH as demand is on pricier properties.

- Likewise, the impact could also due to an increased in demand for higher priced properties which is bigger in size, closer to the city centre (i.e. golden triangle), located with a posh enclave (i.e. Damansara and Bangsar), closer to transportation hub (i.e. KL Sentral), in the location where land is scarce (i.e. Penang Island), etc.
- Sizeable younger generation where property acquisition is more rapid. Young people would be more incline in taking on debt in purchasing house for investment, thus enabling them to own more expensive properties.
- Influx of foreign professionals that demand high-end properties had possibly made many property developers jumped into the bandwagon due to its lucrative returns.
- Relaxing the rule of purchasing properties in Malaysia by foreigners enabling them to own properties just like Malaysian, without extra restrictions, charges or taxes.
- Speculative buying by locals and inflows of "hot moneys" for Malaysian properties.

As such, creating high income jobs would have a positive impact on Price (PH) and subsequently the wealth effect. Government could create such employment in areas that the average Price (PH) is low like Kelantan, Terengganu, Perak, etc where price of properties are lesser. By doing this, demand for properties in central location would be reduced. Job creations can be done by decentralising certain Government units to designated location in the states. It can also be done with participation from private sectors and foreign investors by allocating certain location for specific industries where there is good infrastructure, nearby supporting industries, tax breaks, etc. For instance, Kerteh in Terengganu can be developed as petro-chemical based industrial area and Tanjung Malim in Perak can be developed as a hub for automotive related industries. Success of this proposal was proven by **Case & Mayer (1996)**, whereby price of properties increase due to spatial factors like income, employment, amenities, etc as a result of booming manufacturing industry in that area. Apart from developing other areas, decentralising would also help in reducing congestion and concentration to big towns like Kuala Lumpur, Johor Bahru and Penang Island. This would in turn reduced rapid population growth in big towns, thus reducing sharp increase in property price. Perhaps making nearby towns like Rawang (in Selangor), Nilai and Seremban (both in Negeri Sembilan) more accessible to Kuala Lumpur like building more effective and efficient rail system would help to improve demand and price of properties in that areas. This had

been proven where price of properties in satellite town like Petaling Jaya (in Selangor) is at par with Kuala Lumpur while having all the amenities as good, if not better than Kuala Lumpur.

As discussed, effect of population and income would increase demand for high-end properties. Some would also be able to purchase more than one properties for investment purpose. As discussed before, hike in demand would shift the demand curve upwards and consequently Price (PH) would increase. While price of high-end properties increases, demand would build up on medium and low cost properties. This would in turn pressure price of these properties to go up.

However, the author would like to caution the reader as hike in Price (PH) may not last long. This is due to accumulation of properties for investment purpose where it could be rented out. People would be buying properties rather than renting as property price grows more rapidly than income. Price would escalate faster and eventually demand for rental properties would dry up. As a result, demand of properties would suffer from a sudden drop due to lack of demand from investors and investors would struggle to service their mortgage due to weak demand from the rental market. Consequently this would lead to oversupply of properties and collapse the property market. As such, the Government have to carefully balance the development of properties. Further, Government can also impose ruling on accumulating properties for speculating purpose. Among the policy that had been put in place is the loan-to-value ruling whereby individual purchasing third and above properties can only finance their properties up to 70% of its value. This would in turn limit the demand and substantial increase in price of high-end properties.

Putting floor price on properties that can be bought by professional does not help to curb escalating price of properties. Since it is capped at RM 500,000, developers are more than willing to develop high-end properties targeting foreigners as to maintain the value of their development and their brand. On the other hand, the authorities can perhaps limit the number of properties bought by foreigners and only those who are staying in Malaysia or made Malaysia their second home can purchase properties.

Speculative purchase is difficult to control. It can be control by staggered tax regime which had been scrapped few years back. The longer the property is held, the lesser real property gains tax is charged on disposal.

6.2 Limitation of research

Limitation of this study shall be discussed in this section as to caution the reader on the areas not being covered. As faced by other researchers, this review is subject to availability of data of variables used to test the relationship between the dependent and independent variables. As there is limitation of time and resources, the author only considered data that is published online and freely available to researchers without having the need to formally request for in-depth information from relevant sources. Therefore, result of this review is based on Malaysian average figure, not segmented to specific location i.e. Greater Kuala Lumpur, results at the states level, town specific etc.

In the author's opinion, it is important to gauge data to specific location due to wide disparity in residential property price between Kuala Lumpur (or perhaps Greater Kuala Lumpur) as compared to the states. For instance, average price of residential properties in Kuala Lumpur as at end of 2009 is **RM**405,458 not surprising as the most expensive, and the state with lowest price of residential property is Kelantan with average price of **RM**63,504 **(Appendix 6)**. This may perhaps due to other factors such as different level of urbanization between towns, the scarcity of land near the Central Business District (CBD), land ownership control imposed by State Government, population of professional expatriates and spatial factors as introduced by **Kim & Lee (2004)** such as employment, accessibility, amenities, natural and social environment, etc. It is also interesting if the author could analyse the variables based on the size and quality or grade of the property.

Finally, it would be good if population and income can be segmented to sub-classes so that the actual effect on each class can be separately evaluated.

7 Conclusion

Due to its sheer importance to individual as consumption and investment tool, to banks as preservation of value is of risk management concern and to policymakers as to move Malaysia as a developed nation, issue of factors affecting price of residential properties had been analysed to a certain extent. A simple demand and supply model had been used and factors like population and income per capita had appeared to be the most significant factors that would affect the Price (PH). Effect of population perhaps can be mitigated by dispersing the crowd away from the city centre like the Kuala Lumpur, Johor Bahru and Penang Island. In reducing the effect of income, the policymakers should perhaps control the supply of high-end properties that would eventually have the pulling effect to all other properties. The authorities can also reduce the effect of speculative buying by employing tax regime that would tax the speculators heavily. Finally, as a likely solution to the literature gap, this research covers Malaysia.

As mentioned above, this research is subject to limitations. As such, future research is recommended to address the limitations in order to make the result more accurate. Future research could also make use of non-linear econometrics estimator to be compared with the result of this research, due to limitations of time-series. On the other hand, future research could also look at the Price (PH) and to determine whether there are abnormalities that would lead to property bubble. This could be an alarm to the policymakers to make decision as to avoid burst of such bubble.

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Appendix 1

Main factors that affect pricing of residential properties as highlighted in previous research.

Empirical Research	Main factors						
	Labour Market	Interest Rate	Income/GDP	CPI/Inflation	Construction Cost	Population	Other Factors
Abelson et al. 2005	√	√	√	√	-	-	• Equity price
Abraham & Hendershott 1996	√	√	√	√	√	-	
Baffoe-Bonnie 1998	√	√	-	√	-	-	• Money supply
Belke 2009	-	-	-	-	-	-	• House specification
Borowiecki 2008	-	-	-	√	-	√	
Bourassa & Hendershott 1995	-	-	√	-	-	√	
Capozza et al 2002	-	-	√	-	√	√	• Transaction cost
Case & Mayer 1996	-	-	-	-	-	-	• Location/amenities
Case & Shiller 1990	-	-	√	-	-	√	• Prior year house price
Demary 2008	-	-	√	√	-	-	
Egert & Mihaljek 2007	√	√	√	-	-	-	• Credit availability
Glindro et al 2008	-	-	√	-	-	-	• Credit availability • Land supply • Exchange rate • Institutional factors • Equity price
Goodhart & Hofmann 2008	-	√	√	√	-	-	
Hanink, Cromley & Ebenstein 2010	-	-	-	-	-	-	• Size of house • Location/amenities
Hilbers et al. 2008	-	-	√	-	-	-	• Demographic factors
Hossain & Latif 2007	-	-	√	√	-	-	• Prior year house price
Iossifov et al. 2008	-	√	-	-	-	-	
Jud & Winkler 2002	-	√	√	-	√	√	
Kajuth 2010	-	-	√	-	√	√	

Empirical Research	Main factors						
	Labour Market	Interest Rate	Income/GDP	CPI/Inflation	Construction Cost	Population	Other Factors
Karantonis & Ge 2007	-	√	√	-	-	-	• Construction period • Speculative investment
Kim & Lee 2004	√	-	-	-	-	-	
Lee 2009	-	-	-	√	-	-	
Munro & Tu 1996	-	√	√	-	-	-	• Construction period
Peek & Wilcox 1991	-	√	√	-	√	√	
Rizov 2003	-	-	-	-	-	-	• Accession to EU
Stepanyan, Poghosyan & Bibolov 2010	-	-	√	-	-	-	• Remittance & foreign inflows
Stern 1992	-	-	√	-	-	-	
Stubbs 2005	-	√	-	-	-	-	
Sutton 2002	-	√	√	-	-	-	• Equity price
Tsatsaronis & Zhu 2004	-	√	√	√	-	-	• Credit availability • Equity price
Tu 2000	√	√	√	-	√	-	
Total	**6**	**14**	**21**	**9**	**6**	**7**	

Appendix 2

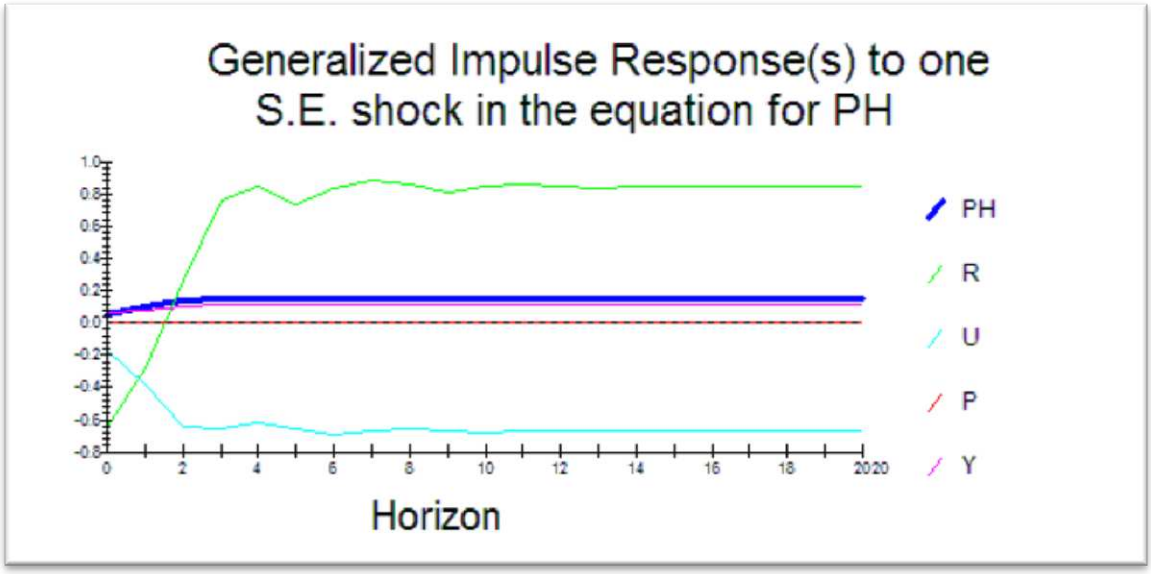
Data collected for analysis.

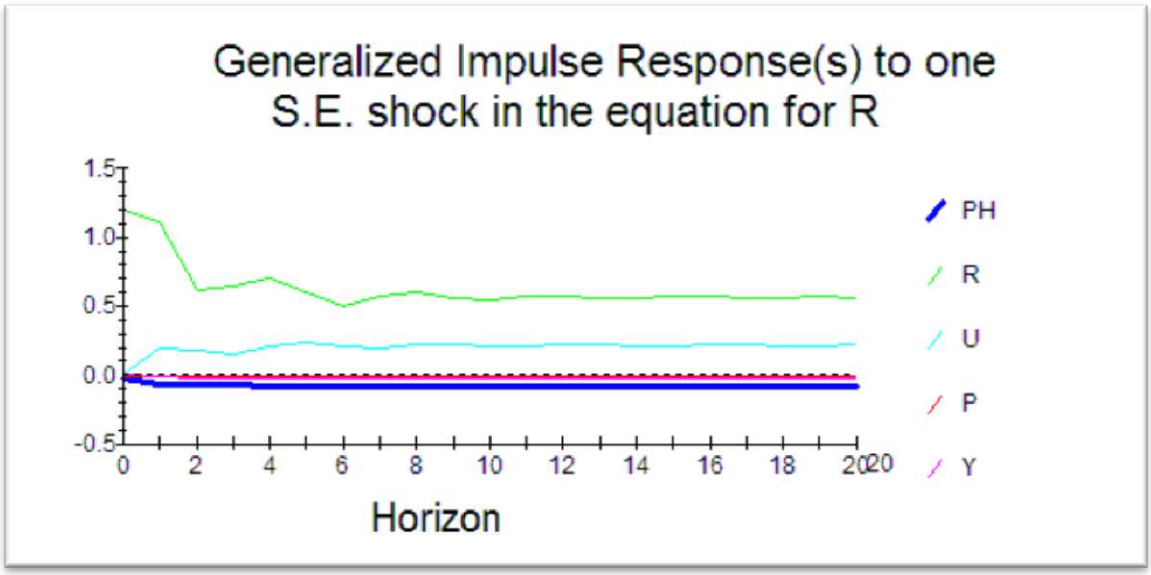
Year	House Price Index (base Year 1990)	Average Lending Rate (ALR)	Population Index (base Year 1990)	GNI per Capita Index (Current Price, base Year 1990)	Unemployment
	PH	R	P	Y	U
1990	100.0	8.79%	100.0	100.0	4.5%
1991	125.5	9.35%	102.5	109.8	4.1%*
1992	140.7	10.16%	105.2	118.9	3.7%
1993	147.5	10.03%	108.1	133.0	4.1%
1994	159.3	8.76%	111.1	146.9	3.6%*
1995	188.5	8.73%	114.3	162.8	3.1%
1996	212.8	9.94%	116.9	181.4	2.5%
1997	216.8	10.62%	119.7	195.4	2.5%
1998	196.4	12.13%	122.5	192.6	3.2%
1999	191.8	8.56%	125.5	195.3	3.4%
2000	203.4	7.67%	129.8	221.3	3.0%
2001	205.6	7.13%	132.7	216.2	3.5%
2002	210.7	6.61%	135.5	231.8	3.5%
2003	219.1	6.30%	138.4	251.1	3.6%
2004	229.6	6.05%	141.3	279.0	3.5%
2005	235.1	5.95%	144.3	302.9	3.5%
2006	239.6	6.49%	148.2	329.6	3.3%
2007	251.8	6.41%	150.2	366.8	3.2%
2008	264.0	6.08%	152.1	413.4	3.3%
2009	268.1	5.08%	154.1	378.5	3.7%

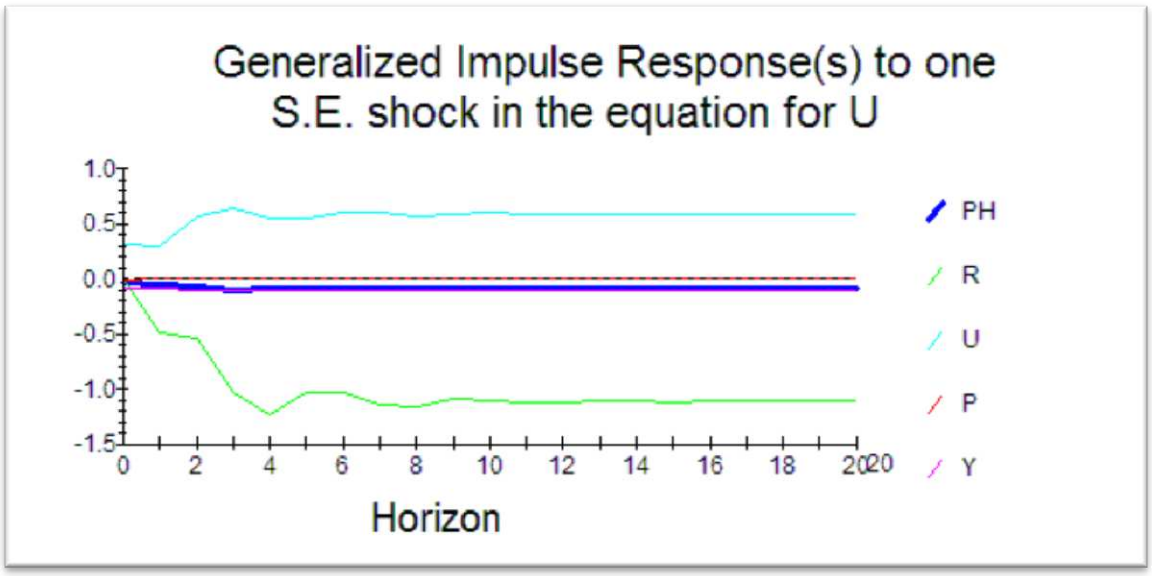
Source: Bank Negara Malaysia, Department of Statistics Malaysia and National Property Information Centre (NAPIC).

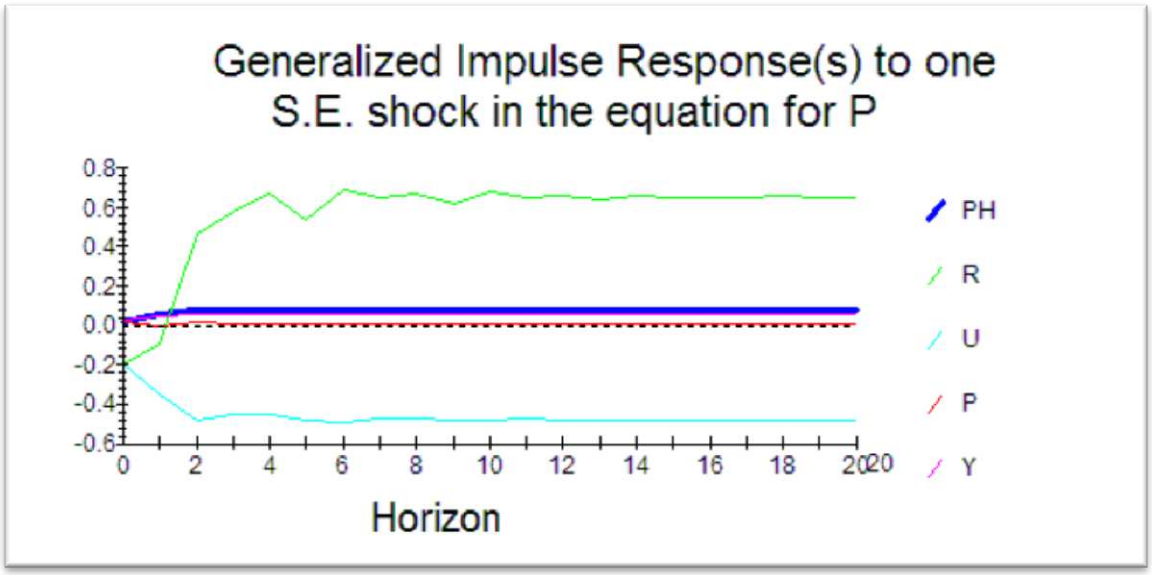
Appendix 3

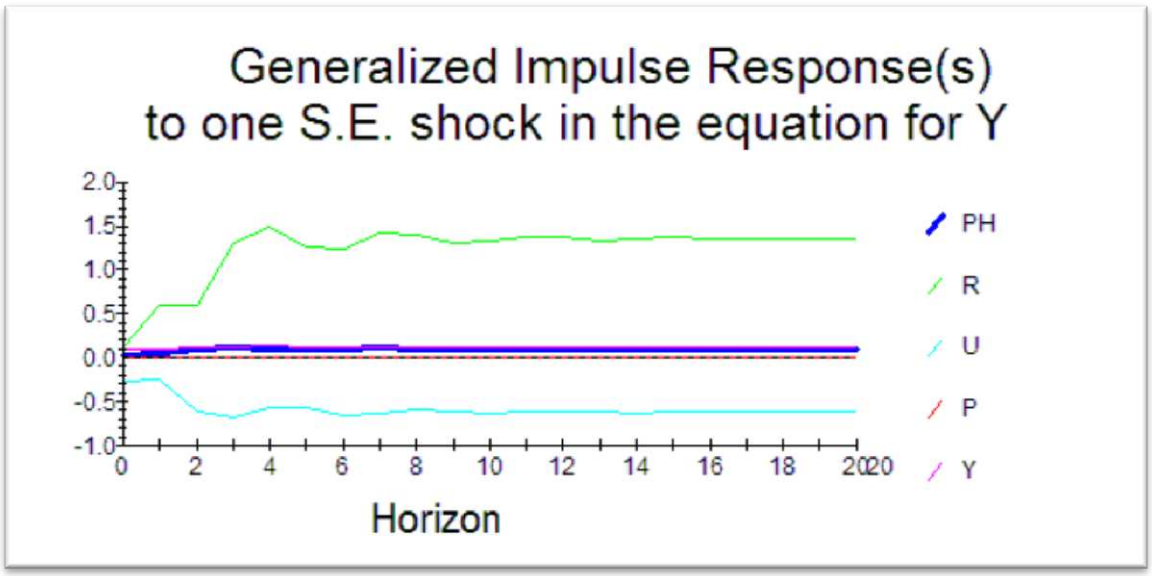
Impulse response





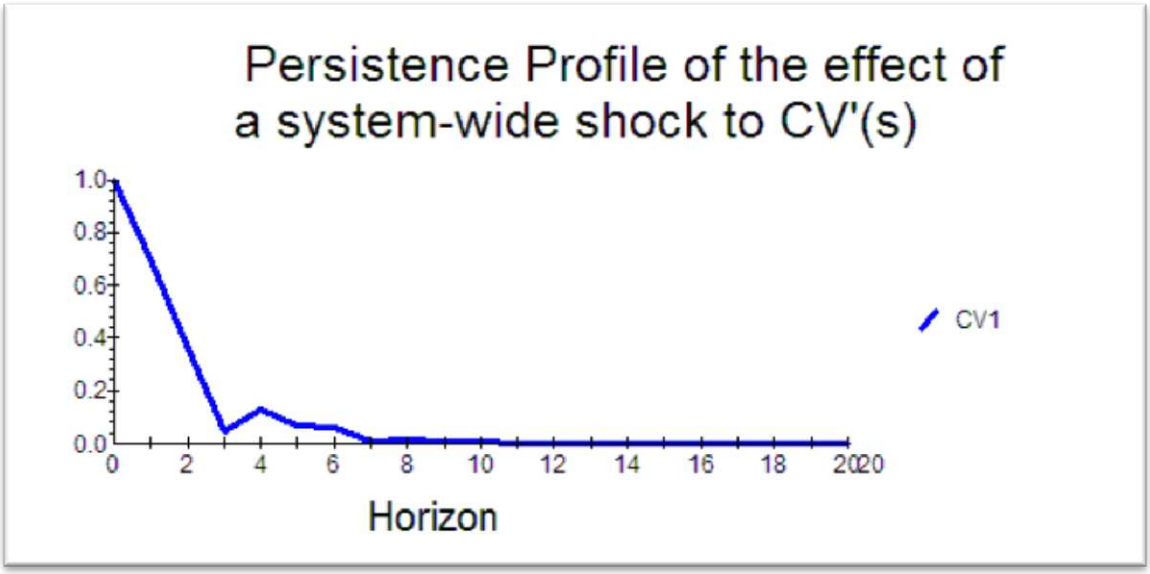

Generalized Impulse Response(s) to one S.E. shock in the equation for U
1.0
0.5
0.0
-0.5
-1.0
-1.5
0
2
4
6
8
10
12
14
16
18
20
20
Horizon
PH
R
U
P
Y


Generalized Impulse Response(s) to one S.E. shock in the equation for P
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0
2
4
6
8
10
12
14
16
18
20
20
Horizon
PH
R
U
P
Y

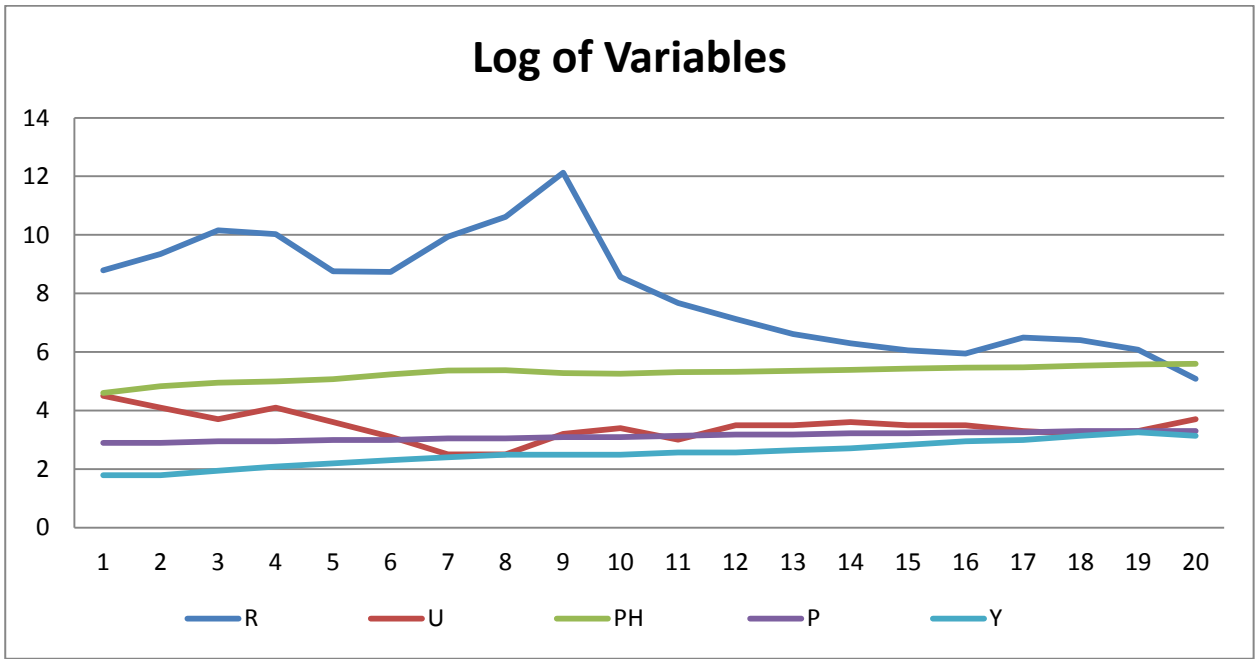

Generalized Impulse Response(s) to one S.E. shock in the equation for Y
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
0
2
4
6
8
10
12
14
16
18
20
20
Horizon
PH
R
U
P
Y

Appendix 4

Persistence Profile



Appendix 5


Log of Variables
14
12
10
8
6
4
2
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
R
U
PH
P
Y

Appendix 6

Average property price according to states for the year ended 2009.

States	Residential	Commercial	Industrial	Agricultural	Development	Others	Total
Kuala Lumpur	405,458	953,641	817,483	ND	4,622,205	ND	556,739
Putrajaya	382,194	1,171,567	588,000	ND	ND	ND	434,769
WP Labuan	240,385	860,000	471,478	94,276	296,777	ND	304,712
Selangor	272,715	830,372	1,292,861	251,816	648,305	138,400	368,362
Johor	160,347	407,790	877,189	165,066	437,237	5,460,000	212,323
Pulau Pinang	241,035	401,707	1,002,718	193,772	542,172	75,000	297,720
Perak	91,389	271,818	584,528	81,081	345,219	50,000	124,541
Negeri Sembilan	118,476	282,590	637,243	141,126	391,798	ND	168,720
Melaka	125,420	386,658	552,972	109,559	191,938	ND	174,581
Kedah	126,476	289,721	459,045	126,485	523,314	ND	183,389
Pahang	120,530	416,622	333,632	140,335	369,148	111,673	167,968
Terengganu	69,673	339,880	515,977	48,042	67,448	ND	74,154
Kelantan	63,504	366,405	342,906	36,745	71,822	ND	65,540
Perlis	115,209	284,363	340,000	55,061	389,620	ND	94,660
Sabah	193,908	367,389	446,189	668,644	836,246	1,215,000	356,247
Sarawak	135,176	236,995	277,311	88,608	402,209	409,400	142,436
Malaysia	209,496	525,370	845,857	139,827	492,112	587,580	256,466

Source: National Property Information Centre (NAPIC)