What drives the property prices ? the Malaysian case

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Abstract

The aim of this paper is to investigate the drivers of the property prices. In particular, the paper seeks to identify the lead-lag relationship between the property prices and macroeconomic variables. Malaysia is taken as a case study. The standard time series techniques are employed for the analysis. The findings tend to indicate that inflation rate followed by exchange rate are the drivers of the property prices in Malaysia but not the interest rate or GDP. This is an important finding since the results would help the policy makers take steps to stabilize the property prices at least in the Malaysian context.

Keywords: property prices, macrovariables, lead-lag, Malaysia

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1.0 INTRODUCTION: THE ISSUE MOTIVATING THE PAPER

The booming property market in Malaysia is a double-edged sword to property investors. On the one hand, existing property holders will be delighted to find better appreciation of property values. On the other hand, it is bad news for property buyers as it means more expensive property prices and of course, bigger mortgages.

Nevertheless, owning a house is a lifelong dream for most people, individuals or families. It is of no surprise that major portion of a family's take home income is deducted for monthly home financing installment. As mentioned earlier, the continual increase of property prices will strain the purchasing power of future property buyers.

The question is what drives property prices? We believed it must be related to the macroeconomic variables. This is because macroeconomic variables give an idea about the purchasing power of the people on the street (i.e. GDP, inflation rate). In addition, some of the variables directly or indirectly impact the purchasing power of people by making property prices cheaper or more expensive (i.e. exchange rate and interest rate).

Thus, this paper tries to determine whether the above macroeconomic variables do affect property sector index in Malaysia. The first motivating factor of this research is simply because it is unclear whether rising house prices in Malaysia is actually due to fundamental reasons and not speculative reasons. It is vital to contain speculative pricing as it will not only hurt the home buyers, but also property developers themselves when the bubbles burst.

Secondly, this paper will be useful to property investors as it indicates the proper timing of entering the market. As an example, investors are able to forecast the movement of future property prices based on the current or expected movement of macroeconomic variables. Thirdly, it is hoped that this research is able to shed some light on policy formulation in curbing fluctuations of property prices to ensure future generation can still afford to buy properties.

2.0 THE OBJECTIVE OF THE STUDY

Due to the extreme importance of understanding property prices, we have tested the long run theoretical relationship between macroeconomic variables and property prices by using the standard time series econometrics. Time series econometrics is better than regression because it tests the long term theoretical relationship between the variables rather than making any early assumption of such relationship. It also identifies the leader and follower variables which will be beneficial for policy making purposes.

3.0 THEORETICAL FRAMEWORK

Theoretically, all prices are set by supply and demand. However, we believed that demand is more relevant in setting up property prices. This is based on the belief that property prices should not exceed property buyers' purchasing power. A few variables that we believe affect demand of property (represented by Property Sector Index or PRP) are economic development, inflation rate, exchange rate and interest rate.

Economic development reflects the purchasing power of the people. As economy becomes better and income rises, more people will have better purchasing power and demand for properties will increase. Consequently, the increasing demand will drive property prices. We used Real Gross Domestic Product (GDP) as an indicator of economic development.

Inflation rate will also impact property prices albeit indirectly. It is expected that as inflation rate increases, most consumer product prices will increase. As a result, there will be less disposable income to be allocated towards property investment which may suppress demand for property. Consumer Price Index (CPI) is used to represent inflation rate.

Interest rate affects property price because most purchases are done on credit. It is rare to find property purchases done on cash basis. The impact of interest rate can be explained in two ways. In financing terms, any increase of interest rate will make the financing cost more expensive. As a result, there will be less demand towards property which may negatively impact property prices. In addition, higher interest rates mean it is more profitable to keep the money in the bank rather than investing in properties. 3-months Treasury Bill Rate will be used to represent interest rate (TBILL).

Being small and having open properties market, it is expected that exchange rate will have some bearing on property prices in Malaysia. In fact, the incentive given by the Malaysian government to encourage foreigners purchase properties in Malaysia (i.e. Malaysia My 2nd Home Programme) shows the openness of this property market. As the local currency depreciated, it is cheaper for non-locals to purchase properties which will increase demand and pressure property prices upward. Weighted real effective exchange rate (WREER) is used in this context.

Based on the theoretical arguments above, it can be said that macroeconomic variables do affect property prices. However, we cannot be really sure unless we tested the theories. In fact, it may be argued that property prices affect macroeconomic variables instead. As an example, in order to curb rising property prices, government may increase the interest rate. Increasing interest rate will encourage saving rather than spending and may reduce property demand.

In addition, there are also interactions between the macroeconomic variables themselves. According to the International Fisher effect, for example, the expected difference in inflation rates equals the difference in current interest rates between two countries. This further intricate relationship when what is important to policy makers is to know which variable has the largest impact, if any.

Thus, it is vital to (i) test the theoretical relationship; and (ii) confirm which variable is exogenous and endogenous. Time series econometrics addresses these two questions by among others, testing cointegration and ranking the impact of one variable shock to other variables and itself (Variance Decompositions). This will be explained further in the methodology section below. Overall, due to theories being inconclusive, we would like to test them by using real data.

4.0 LITERATURE REVIEW

A quick look into the Malaysian Housing Price Index for Q4/2011 showed an overall house price of RM217,297. In Q1/2000, the price was only RM135,293. It means the house price index has arisen by 56.9 percent or the price has almost doubled since year 2000.

Recent literature are interested on the impact of borrowing to housing prices as most house purchases are done on credit. McQuinn and O'Reilly (2008) found co-integration between actual house prices and the average amount borrowed, which was derived from disposable income levels and interest rates. This study used quarterly Irish data from 1980 to 2005 and suggested that low interest rate will drive higher housing price. It conforms to expectation as most people will invest in property which will gives better rental income as compared to interest earned from keeping money in the bank with the low financing cost as an added bonus.

Oikarinen (2009) employed time series econometrics to study the relationship between house prices against housing and consumption loan separately for Finland's quarterly data set from 1975 to 2006. Using the loan-to-GDP ratio, it is found that housing price affect housing loans and vice versa. The outstanding loan stock of house stocks of households is divided by the GDP to avoid multicollinearity problems in the data (Oikarinen, 2009, p. 749). In addition, GDP or income was found to affect housing price. Interestingly, interest rate did not affect housing price in contrast to McQuin and O'Reilly (2008) above.

Yang, Wang and Campbell (2010) utilized multivariate persistent shock metric and focused on the monetary policy on regional house prices in Sweden between 1991 and 2002. Here, 6-months Treasury Bill Rate is used to represent monetary policy. In Sweden, mortgage rate tends to be tied to market short-term interest rate and subject to renegotiation on a regular basis in Sweden (Yang et. al, 2010, p. 869). Thus, short term rather than long term interest rate is used though they did compare the results with long term rates. It is found that there is significant regional effect of monetary policy on housing markets, in particularly on the three biggest cities in Sweden.

It is logical to believe that surrounding areas play some roles in affecting property prices. Research by Weber, Bhatta and Merriman (2007) tried to link tax increment financing (TIF) districts to housing price appreciation by using standard hedonic regression controlling. TIF reflects future commitment of municipalities to develop certain area and may improve property value in the vicinity. Chicago's single-family home sales data for January 1993 to December 1999 is used in this research. It is concluded that TIF influenced housing values but the influence varied positively and negatively for different type of TIF (commercial, mixed and industrial) districts.

Xiao (2007) was interested to understand the factors influencing the price of Hong Kong's residential property market between March 1980 and February 2006. Due to the volatile nature of this property market, the study seeks to identify speculative bubbles with present value approach. Here, speculative pricing are identified when property prices are not based on fundamentals. According to Xiao (2007), there is no unified theoretical framework, which clearly defines the fundamentals. Typically, different researchers will use different fundamentals in their theoretical or empirical models (Xiao, 2007). Nevertheless, it is found that luxurious properties are more affected by speculation and will be the focus of speculators as compared to lesser value properties.

In summary, the literatures above have been using interest rates, housing loans and surrounding areas to explain property prices. It can be seen that some of the literatures have contradicting results which maybe because of the different methodologies used. In addition, apart from Oikarinen (2007), none of the study used time series econometrics. This paper seeks to contribute to the existing literatures by employing time series econometrics to test the theories that there is long run theoretical relationship and Granger causality between macroeconomic variables and property prices in Malaysia.

5.0 THE METHODOLOGY USED

Masih and Algahtani (2008) and Masih, Al-Sahlawi and De Mello (2010) mentioned about the dilemma of testing non-stationary variables. On the one hand, testing the 'level' form of non-stationary variables will invalidate conventional stationary tests (i.e. R^2, t). On the other hand, if the variables were differenced to make them stationary, we will lose long-term information contained in the trend element. Fortunately, the development of time series techniques manages to overcome the above shortcoming inherent in traditional regression.

Basically, there are eight required steps to perform time series econometrics as detailed in Masih, Al-Elg and Madani (2009). The first step is to test the stationarity of the data. It is worth noting here that most of the economic and finance variables are non-stationary. Non-stationary series has an infinite variance (it grows over time), shocks are permanent (on the series) and its autocorrelations tend to be unity (Masih, 2009).

The second step is to determine the optimum order (or lags) of the vector autoregressive model. The order given will be used in the third step subject to certain conditions. The third step is testing cointegration. Cointegration implies that the relationship among the variables is not spurious i.e. there is a theoretical relationship among the variables and that they are in equilibrium in the long run. However, cointegration is not able to test causality.

The fourth step is Long Run Structural Modeling (LRSM). This test confirms whether a variable is statistically significant and tests the long run coefficients of the variables against theoretically expected values. Vector Error Correction Model (VECM) is the fifth step, and it is used to test Granger causality. The VECM shows the leading and lagging variables but it is unable to show relative exogeneity and endogeneity.

The sixth step (Variance Decompositions or VDCs) rank the variables by determining the proportion of the variance explained by its own past shocks whereby the variable that is explained mostly by its own shocks (and not by others) is deemed to be the most exogenous of all (Masih at. Al. 2009).

Step seven, the Impulse Response Function (IRF) and step eight, Persistence Profiles (PP) is in graph form. According to Masih et. al. (2009), IRF exposes relative exogeneity and endogeneity (similar to VDC), while PP estimates the speed with which the variables get back to equilibrium when there is a system-wide shock (unlike the IRF which traces out the effects of a variable-specific shock on the long-run relationship).

6.0 DATA, EMPIRICAL RESULTS AND DISCUSSIONS

As stated above, property sector index (PRP), real GDP (GDP), inflation rate (CPI), weighted real effective exchange rate (WREER) and interest rate (TBILL) are the variables used in this paper. All the data are converted into logarithms form (LPRP, LGDP, LCPI and LWREER) except for TBILL (already in percentage form). This conversion is necessary to achieve stationarity in variance (Masih et. al., 2009). LPRP, LGDP, LCPI, LWREER and TBILL are used as 'level' form variables.

Quarterly data for 20 years starting from 1991 (quarter 1) is collected by using Datastream. In total, there are 83 observations in this paper.

6.1 Step 1: Testing the non-stationarity/stationarity of each variable

In this step, the objective is to check whether the variables chosen were stationary or not. The checking can be done by using the Augmented Dickey-Fuller Unit Root Tests (ADF) and also the Phillips-Perron Test (PP). PP test is an alternative test for a unit root.

6.1.1 ADF Test

In order to confirm stationarity, the variables are tested at the 'level' form (Table 1) and 'differenced' form (Table 2). In testing the 'level' form, the lower table (include an intercept and a linear trend) of the ADF results should be used. The test statistic figures are obtained based on the highest value of Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) which sometimes give an equivalent test statistic results.

Ignoring the minus sign, the test statistics for all variables are smaller than their 95 percent critical value which means that the null hypothesis cannot be rejected. In other words, all the variables are non-stationary in its 'level' form.

For 'differenced' form variables, the upper table (include an intercept but not a trend) should be used instead. Again, the test statistic figures are obtained based on the highest value of AIC and SBC. Here, the test statistics for all variables are higher than their 95 percent critical value which means that the null hypothesis can be rejected (i.e. variables are stationary). Since the variables are non-stationary in 'level' form but stationary in 'differenced' form, these variables are known as I(1) from this ADF test.

Below is the summary of ADF results of the variables in its 'level' form and 'differenced' form.

Table 1. ADF results for 'Level' Form

Variable	**Test Statistic**		**Critical Value**	**Results**
	AIC	SBC		
LPRP	-2.5813	-3.4165	-3.4681	Non-stationary
LGDP	-2.8113	-2.8113	-3.4681	Non-stationary
LCPI	-2.1982	-2.4028	-3.4681	Non-stationary
LWREER	-1.5593	-1.5593	-3.4681	Non-stationary
TBILL	-2.4313	-2.5418	-3.4681	Non-stationary

Table 2. ADF results for ‘Differenced’ Form

Variable	Test Statistic		Critical Value	Results
	AIC	SBC		
DPRP	-5.1473	-4.7445	-2.8996	Stationary
DGDP	-4.3830	-4.3830	-2.8996	Stationary
DCPI	-6.7247	-6.7247	-2.8996	Stationary
DWREER	-5.8765	-5.8765	-2.8996	Stationary
DTBILL	-3.9073	-4.0685	-2.8996	Stationary

6.1.2 PP Test

Then, we used PP to confirm stationarity. As in ADF test, the variables were tested in the ‘level’ form (Table 3) and ‘differenced’ form (Table 4). The results are concluded based on the p-value. P-value informs the error we are making when rejecting the null (i.e. variable is non-stationary). If the p-value is high (the value is above 0.05), the null hypothesis cannot be rejected. On the other hand, if the p-value is low (the value is below 0.05), the null hypothesis can be rejected. In contrast to ADF test above, the PP test for ‘level’ form variables shown that GDP and CPI is I(0) instead.

As expected, the PP test confirmed that the ‘differenced’ form variables are stationary as in ADF test. Although PP test found that GDP and CPI are I(0), we have retained these variables because it was I(1) in the ADF test. In addition, intuitively, these variables are important when understanding property prices as confirmed by the literatures above.

The summary of the PP test results are shown below.

Table 3. PP results for ‘Level’ Form (Differenced Once)

Variable	Test Statistic (p-value)	Results
DPRP	0.135	Non-stationary
DGDP	0.002	Stationary
DCPI	0.003	Stationary
DWREER	0.198	Non-stationary
DTBILL	0.078	Non-stationary

Table 4. PP results for ‘Differenced’ Form (Differenced Twice)

Variable	Test Statistic (p-value)	Results
D2PRP	0.000	Stationary
D2GDP	0.000	Stationary
D2CPI	0.000	Stationary
D2WREER	0.000	Stationary
D2TBILL	0.000	Stationary

6.2 Step 2: Determination of the order (or lags) of the Vector Autoregressive (VAR) model

Before proceeding to the cointegration test, it is compulsory to determine the optimum order (or lags) of the vector autoregressive model. Referring to Table 5, it is found that there is a contradicting optimum order given by the highest value of AIC and SBC. As expected, SBC gives lower order as compared to AIC. This difference is due to the AIC tries to solve for autocorrelation while SBC tries to avoid over-parameterization. In other words, the different lag values may be attributable to the different nature or concern of the test.

Table 5. AIC and SBC results for order (or lags) of the VAR model

	AIC	SBC
Optimum lag	5	0

In addition, we have examined the issue of serial correlation (Table 6 for details) and confirmed that some of the variables are, in fact, serially correlated. In essence, since DGDP and DCPI have serial correlation or autocorrelation issue, we should use the highest order of VAR, which are 5 in this case. Unfortunately, selecting high order of VAR may result in over-parameterization issue because we have 83 observations only. As a result, the order of lag used is 2 on the basis of the average optimum lag value given by AIC and SBC.

Table 6. Serial correlation test results

Variable	Test Statistic (p-value)	Results
DPRP	0.323	No serial correlation
DGDP	0.007	Have serial correlation
DCPI	0.027	Have serial correlation
DWREER	0.665	No serial correlation
DTBILL	0.080	No serial correlation

6.3 Step 3: Testing cointegration

6.3.1 Johansen method

We have performed two tests to identify cointegration between the variables; namely Johansen method and Engle-Granger method. The Johansen method uses maximum likelihood (i.e. eigenvalue and trace) and may identify more than one cointegrating vectors while the Engle-Granger method can only identify one cointegrating vector.

According to the Johansen method (Table 7), we have found that there is at least one cointegrating vectors between the variables which confirm cointegration. This test considers the available number of cointegrating vectors or r. In the case when the null hypothesis is r = 0, there is no cointegration when we fail to reject the null. On the other hand, there is cointegration if the null is rejected.

Table 7. Johansen ML results for multiple cointegrating vectors – property sector index, real GDP, CPI, weighted real effective exchange rate and real interest rate, (Q1/1991-Q3/2011)

H_0	H_1	Statistic	Critical Value		Results
			95%	90%	
Maximal eigenvalue					
r = 0	r = 1	41.8389	37.8600	35.0400	Cointegration
r<= 1	r<= 2	20.8993	31.7900	29.1300	
Trace Statistic					
r = 0	r>= 1	95.2155	87.1700	82.8800	Cointegration
r<= 1	r>= 2	53.3766	63.0000	59.1600	

Notes: The statistics refer to Johansen's log-likelihood maximal eigen value and trace test statistics based on cointegration with unrestricted intercepts and restricted trends in the VAR. The above results show at least one cointegrating vectors at 95% level. The order (or lags) used is 2 with 83 quarterly observations.

6.3.2 Engle-Granger method

Alternatively, we have used the Engle-Granger method (Table 8). Here, it is found that the variables are non-stationary, which means that there is no cointegration between the variables. This result contradicts the earlier Johansen method test of cointegration and maybe due to the inefficiencies of this residual-based cointegration tests.

As mentioned in Pesaran and Pesaran (2009), the Engle-Granger method may gives contradicting result when there are more than two I(1) variables under consideration as in our case. Thus, we relied on Johansen method which is a better test and confirmed that there is at least one cointegration.

Table 8. Engle-Granger results for single cointegrating vector (Q1/1991-Q3/2011)

Variable	**Test Statistic**		**Critical Value**	**Results**
	AIC	SBC		
LPRP	-3.5445	-3.5445	-4.5969	Non-stationary
LGDP	-3.6014	-3.6014	-4.5969	Non-stationary
LCPI	-1.8768	-3.2809	-4.5969	Non-stationary
LWREER	-3.4839	-3.4839	-4.5969	Non-stationary
TBILL	-2.4886	-2.4886	-4.5969	Non-stationary

An evidence of cointegration implies that the relationship among the variables is not spurious, i.e. there is a theoretical relationship among the variables and that they are in equilibrium in the long run (Masih et. al., 2009). The long run theoretical relationship between property price, GDP, CPI, exchange rate and interest rate is consistent with theories, research done on local property prices and also our intuition.

6.4 Step 4: Long Run Structural Modeling (LRSM)

Earlier, we have mentioned that we want to identify the direction of causality between property price and macroeconomic variables. In other words, our focus variable in this paper is property price. Thus, we first normalized LPRP (i.e. normalizing restriction of unity) at the ‘exactly identifying’ stage (Panel A of Table 9). Next, we imposed restriction of zero on one of the macroeconomic variable at the ‘overidentifying’ stage (Panel B of Table 9).

When we normalized LPRP, we found that all the coefficients of the cointegrating vector are significant except for T-BILL (refer to Panel A of Table 9). However, when we imposed restriction of zero on T-BILL (refer Panel B of Table 9), we found that the overidentifying restriction is rejected (with a p-value of 0.000 error while rejecting the null).[1] Thus, we continue to include T-BILL as one of our variable in the following tests.

[1] We have also experimented with other variables by making overidentifying restrictions of these variables equal to zero. Unfortunately, we found that all the other results cannot be displayed due to non convergence except for LCPI. This is commonly due to lack of observation and may be solved by using Microfit 5. Unfortunately, we are unable to redo these tests in Microfit 5 due to time constraint.

Finally, we made all the other variables to be insignificant (overidentifying restrictions equal to zero). Consistent to the exactly identifying result where most variables are significant, it is found that this restriction made is incorrect. In other words, the variables are actually significant (i.e. Chi-Sq p-value = 0.000).

Table 9. Exact and over identifying restrictions on the cointegrating vector

	Panel A		Panel B	
LPRP	1.0000	(*None*)	1.0000	(*None*)
LGDP	-8.9499*	(2.6619)	-.22125	(*None*)
LCPI	10.50980*	(4.9522)	5.9596	(*None*)
LWREER	-3.11030*	(0.86287)	0.35629	(*None*)
TBILL	0.091898	(0.060756)	-0.0000	(*None*)
Trend	0.063822	(0.021207)	-0.030218	(*None*)
Log-likelihood	607.0106		588.6573	
Chi-Square	None		36.7067	[0.0000]

Notes: The output above shows the maximum likelihood estimates subject to exactly identifying (Panel A) and over-identifying (Panel B) restrictions. The 'Panel A' estimates show that all variables are significant[2] except for T-BILL (SE are in parenthesis). In addition, the overidentifying restriction on T-BILL=0 gives no convergence result. Thus, we remained with 'Panel A' instead.
*Indicates significance.

6.5 Step 5: Vector Error Correction Model (VECM)

The previous four steps tested theories and confirm that there is cointegration between the variables but it did not show which the leader and the lagged variables. Step 5 onwards allows us to answer this shortcoming. The statistical results generated from these steps will be welcomed by policy makers. Policy makers want to know which variable is the leader to focus their policies on those variables to make the biggest impact. Thus, we have performed VECM and the results are summarized in Table 10.

The statistical results showed that property price, inflation rate and exchange rate are exogenous while GDP and interest rate are endogenous. Masih et. al. (2009) explained

[2] $t-ratio = \frac{coefficient}{standard\ error}$

The manually calculated t-ratio (ignoring the minus sign) is compared with the following scale to confirm significance:

t-ratio	Results
>2	Variable is significant
<2	Variable is insignificant

the significance of the error correction term in the equation. One of the functions of error correction term is to show long term relationship of the variable.

The diagnostics test allows us to check for specification problem in terms of autocorrelation, functional form, normality and heteroskedasticity. Unfortunately, there seems to be some problems in the equation. In addition, we have used the CUSUM and CUSUM SQUARE (Figure 1) to check the stability of the coefficients. The CUSUM and CUSUMSQ tests employ the cumulative sum of recursive residuals based on the first set of observations and is updated recursively and plotted against the break points (Bahmani-Oskooee and Ng, 2002, as cited in Mohd Yusof, Kassim, A. Majid and Hamid, 2011).

As mentioned by Mohd Yusof et. al. (2011), if the plots of the CUSUM and CUSUMSQ statistics are found to be within the critical bounds of 5 percent level, the H_0 that all coefficients in the model are stable cannot be rejected. On the other hand, if the lines are found to be crossed, the H_0 of coefficient constancy can therefore be rejected at 5 percent significance level (Mohd Yusof et. al., 2011). Here, it is found that the parameters are structurally unstable which indicates structural breaks. Structural breaks may be corrected by using dummy variables. Unfortunately, we are unable to correct all these problems due to time constraint.

Table 10. Error correction models – property sector index, real GDP, CPI, Weighted real effective exchange rate and interest rate

Dependent Variables	DPRP		DGDP		DCPI		DWREER		DTBILL	
DPRP(-1)	-0.123	(0.143)	-0.003	0.024	0.004	0.005	0.016	0.020	0.980	0.425
DGDP(-1)	0.192	(0.630)	0.182	0.105	-0.015	0.021	-0.063	0.086	-2.955	1.870
DCPI(-1)	-6.936	(3.291)	0.319	0.551	0.221	0.112	0.589	0.452	22.151	9.769
DWREER(-1)	0.505	(0.895)	0.232	0.150	-0.044	0.030	0.221	0.123	-0.606	2.658
DTBILL(-1)	-0.009	(0.045)	0.003	0.007	0.001	0.002	-0.002	0.006	0.040	0.132
ECM(-1)	0.055	(0.067)	0.052*	0.011	-0.004	0.002	0.006	0.009	-0.442*	0.200
Chi-square SC(1)	9.868	[0.04]	37.957	[0.00]	4.688	[0.32]	8.184	[0.09]	11.661	[0.02]
Chi-square FF(1)	0.835	[0.36]	0.190	[0.66]	0.041	[0.84]	3.449	[0.06]	7.027	[0.01]
Chi-square N(2)	24.055	[0.00]	4.713	[0.10]	215.627	[0.00]	127.816	[0.00]	136.044	[0.00]
Chi-square Het(1)	0.001	[0.97]	0.815	[0.37]	11.563	[0.00]	3.287	[0.07]	17.578	[0.00]

Notes: SEs are given in parenthesis. The diagnostics are chi-squared statistics for: serial correlation (SC), functional form (FF), normality (N) and heteroskedasticity (Het). There are some problems in the equations.
*Indicates significance.

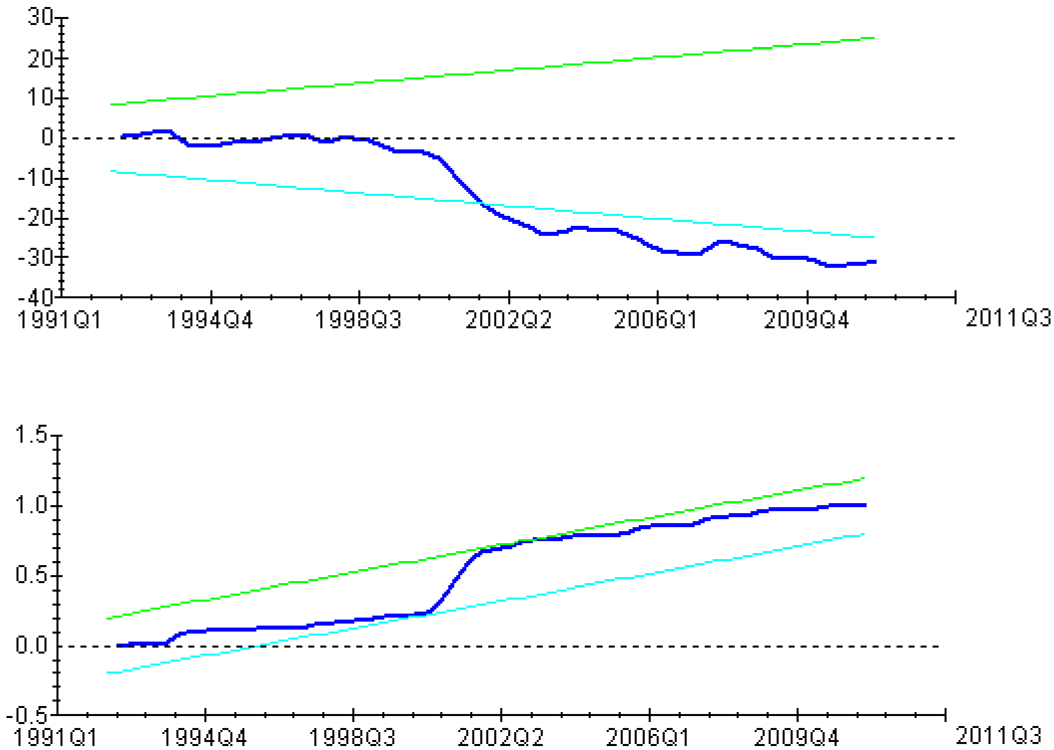

Figure 1. LPRP. (a) Plot of cumulative sum of recursive residuals and (b) plot of cumulative sum of squares of recursive residuals
Note: The straight lines represent critical bounds at 5% significance level.

Since VECM does not give information about relative exogeneity and endogeneity, we will have to perform the next step to identify the ranking of the variables.

6.6 Step 6: Variance Decompositions (VDCs)

6.6.1 Orthogonalized VDC

Variance Decompositions (VDCs) are made up of orthogonalized VDC and generalized VDC. Orthogonalized VDC result are shown in Table 11 below. Table 11 showed the variance of forecast error once we shocked 1 variable. Basically, we are interested in the variance of forecast error of the shocked variable on itself. This impact can be used to explain exogeneity and endogeneity of a variable.

However, we will not discuss orthogonalized VDC result because it has ordering bias. In orthogonalized VDC, the variable that is ordered first will usually become exogenous. Consequently, our exogeneity ranking will be incorrect.[3]

Table 11. Percentage of forecast variance explained by innovations in: Orthogonalized variance decompositions

Quarter	ΔLPRP	ΔLGDP	ΔCPI	ΔLWREER	ΔTBILL
Relative variance in ΔLPRP					
1	0.98	0.00	0.02	0.00	0.00
10	0.91	0.04	0.05	0.00	0.00
20	0.90	0.05	0.05	0.00	0.00
Relative variance in ΔLGDP					
1	0.03	0.94	0.01	0.01	0.01
10	0.38	0.45	0.05	0.07	0.05
20	0.47	0.32	0.04	0.11	0.06
Relative variance in ΔLCPI					
1	0.00	0.00	1.00	0.00	0.00
10	0.02	0.08	0.90	0.00	0.00
20	0.02	0.09	0.89	0.00	0.00
Relative variance in ΔLWREER					
1	0.17	0.08	0.01	0.74	0.00
10	0.19	0.10	0.03	0.68	0.00
20	0.19	0.10	0.03	0.68	0.00
Relative variance in ΔTBILL					
1	0.09	0.08	0.02	0.17	0.64
10	0.09	0.26	0.02	0.22	0.41
20	0.08	0.28	0.03	0.22	0.39

6.6.2 Generalized VDC

When performing generalized VDC, it is important to realize that the variance of forecast error given in each horizon will not be equal to 1. In other words, the results generated have to be recalculated to obtain Table 12

In VDC test, the variable that is explained mostly by its own shocks (and not by others) is deemed to be the most exogenous of all (Masih et. al., 2009). In our results, contributions

[3] In order to confirm the ordering bias of orthogonalized VDCs, we have changed the order of the variable by putting TBILL as the first variable, followed by other variables and putting LPRP as the last variable. The result confirmed our expectation whereby there is a change in exogeneity and endogeneity. Refer Appendix 7F to 7H for the details.

of own shocks to each variable at the end of forecast horizon 20 are as follows: property price (68%), real GDP (33%), inflation rate (85%), weighted real effective exchange rate (73%) and interest rate (63%).

Generalized VDC result confirmed that inflation rate is the most exogenous variable while real GDP is the most endogenous.

Table 12. Percentage of forecast variance explained by innovations in: Generalized variance decompositions

Quarter	ΔLPRP	ΔLGDP	ΔLCPI	ΔLWREER	ΔTBILL
Relative variance in ΔLPRP					
1	0.77	0.01	0.02	0.10	0.10
10	0.69	0.06	0.03	0.09	0.13
20	0.68	0.07	0.03	0.09	0.13
Relative variance in ΔLGDP					
1	0.03	0.84	0.01	0.03	0.09
10	0.42	0.47	0.04	0.03	0.04
20	0.56	0.33	0.04	0.03	0.04
Relative variance in ΔLCPI					
1	0.00	0.00	0.99	0.01	0.00
10	0.02	0.08	0.87	0.01	0.02
20	0.02	0.10	0.85	0.00	0.03
Relative variance in ΔLWREER					
1	0.13	0.08	0.02	0.76	0.01
10	0.15	0.10	0.02	0.73	0.00
20	0.15	0.10	0.02	0.73	0.00
Relative variance in ΔTBILL					
1	0.08	0.08	0.01	0.04	0.79
10	0.05	0.20	0.07	0.03	0.65
20	0.04	0.23	0.08	0.02	0.63

6.7 Step 7: Impulse Response Functions (IRFs)

We have also performed orthogonalized IRFs (not reported here). Next, we performed generalized IRFs for the most exogenous (inflation rate) and endogenous (GDP) variable in Figure 2 and 3 respectively. Consistent with our earlier results, it can be seen that the GDP variable is more responsive to the shock by interest rate as compared to the reverse. We have also performed generalized IRFs on all other variables too.

Response of LPRP when we shock LCPI	Response of LGDP when we shock LCPI

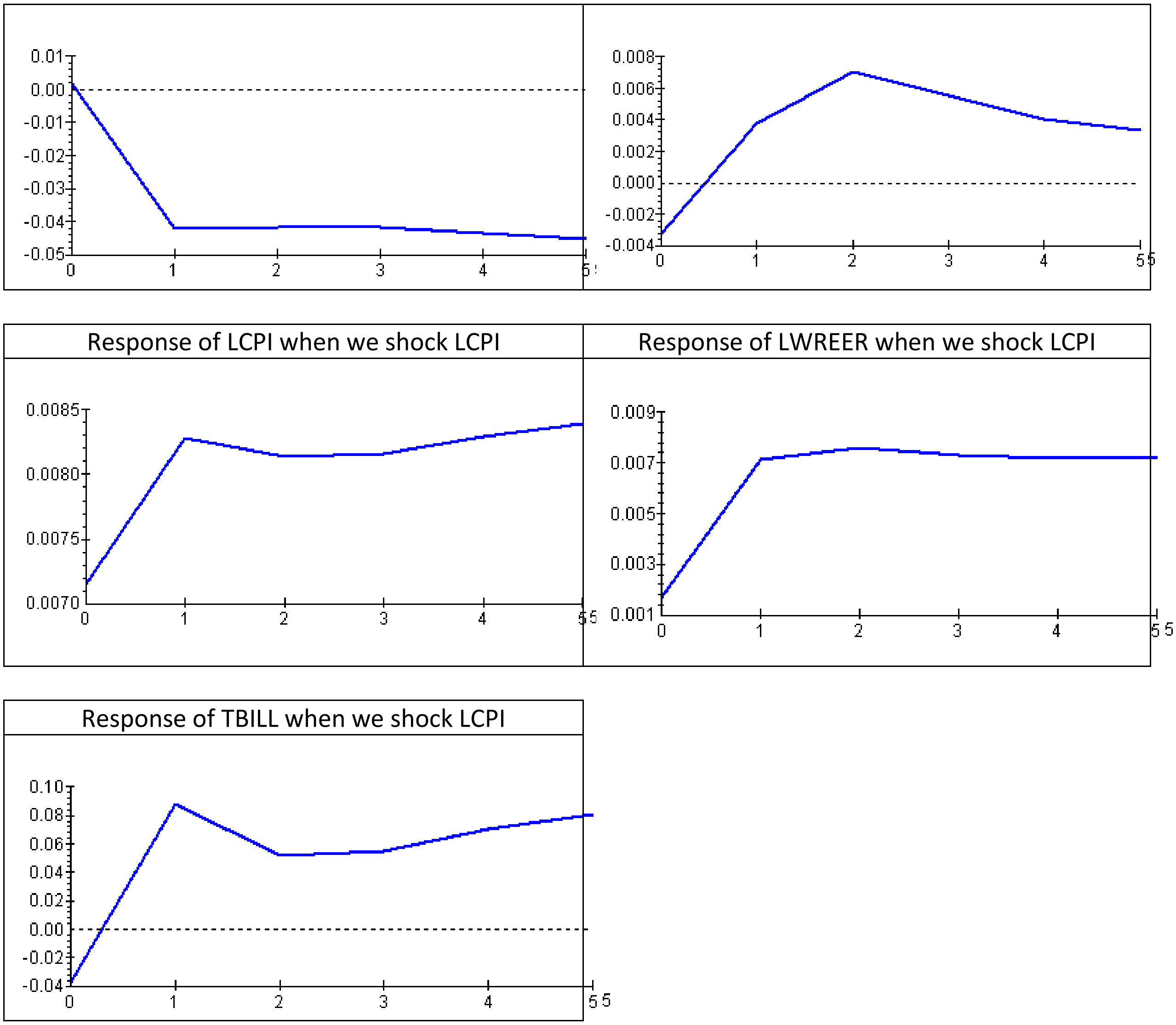

Figure 2. Generalized impulse responses to one SE shock in the equation for CPI

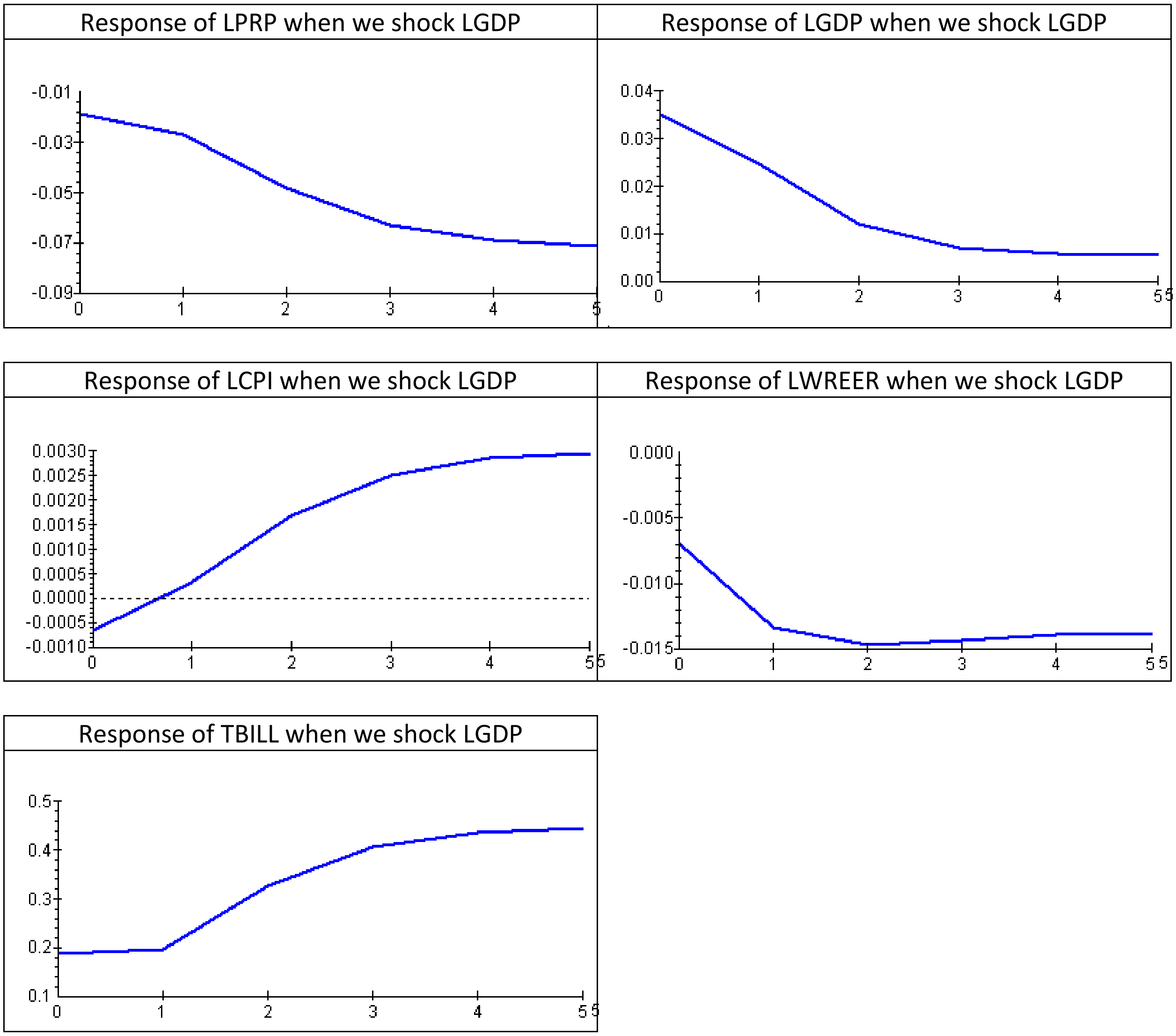

Figure 3. Generalized impulse responses to one SE shock in the equation for GDP

6.8 Step 8: Persistence Profiles (PF)

Finally, persistence profile indicated that where there is a system-wide shock to the cointegrating relationship, it will take about 3 ½ quarters to regain equilibrium (Figure 4).

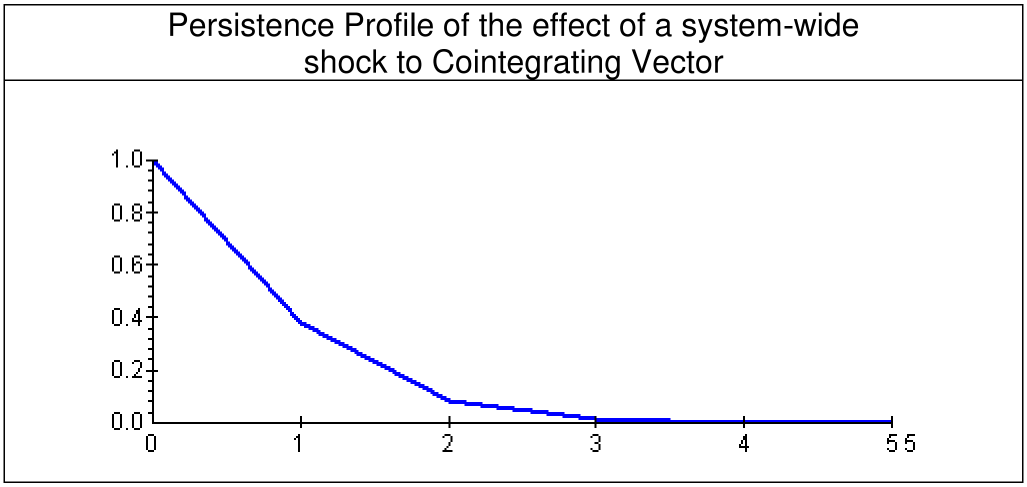

Figure 4. Persistence profile of the effect of a system-wide shock

7.0 DISCUSSION OF RESULTS

It is surprising to see that GDP does not affect property price in Malaysia which is contrary to the results found in Oikarinen (2009) who observed housing prices in Finland. According to Global Property Guide report, the house price to income ratio[4] is 25.32 and 17.77 for Malaysia and Finland respectively. In short, it is relatively more expensive to buy a house in Malaysia as compared to buying a house in Finland.

In addition, it is also mentioned in the report that Malaysia has a small rental market where the luxury ones caters mainly to expatriates while about half of rental properties in Finland received government incentives. Although it is more expensive to purchase properties in Malaysia, Malaysian has not much choice as compared to the Finnish.

Inflation rate has a negative effect on property prices in Malaysia (refer Panel A of Table 9). This is reasonable because increment in inflation rate means that the prices of

[4] According to Global Property Guide, the house price to income ratio is the ratio of the cost of a typical upscale housing unit of 100 square metres, compared to the country's GDP per capita. The formula is: (Price per square metre / GDP per capita)*100. The house price to income ratios are based on the Global Property Guide's own proprietary in-house research and IMF's GDP per capita figures.

consumption goods have been increasing too. As a result, Malaysian has less disposable income to spend for property purchases. Consequently, there will be less demand for property which will have negative impact on its prices. On the other hand, during the period of low inflation rate, the demand for property investment will increase which may positively impact property prices.

We have also seen the impact of exchange rate towards property prices in Malaysia which may be attributed to the open economy practiced here. Although the positive relationship is different from our expectation, a possible explanation is that stronger home exchange rate signals positive economic outlook for Malaysia. Thus, foreigners continue to invest in Malaysian properties although it will be more expensive to them.

8.0 CONCLUSIONS AND POLICY IMPLICATIONS

The objective of this paper is to understand property prices by testing its long term relationship with macroeconomic variables. The statistical results showed that inflation rate and exchange rate affect Malaysian property prices but not interest rate and GDP. It contradicts another similar research done in Finland which may be attributed to the different property markets between the two countries. In terms of policy implication, it is important that inflation rate is controlled to ensure stable growth in the property markets.

Policy makers must also be wary of exchange rate movement as it may result in more expensive property purchases. If the property market becomes stagnant due to the appreciation of the Ringgit, property developers may have to give additional goodies to maintain the attractiveness of Malaysian property market to foreigners.

Alternatively, policy makers may be interested to incentivize the rental market in Malaysia which is still not vibrant enough. Since rental market is a direct substitute for property purchases, a lively property rental market will surely give property developer a run for their money. Consequently, it will improve property market in Malaysia.

8.1 Limitations and recommendations for future research

In this paper, property sector index is used to represent Malaysian property prices. The relationship found in this paper should be interpreted with caution as the index may also be affected by speculative movement in the stock market per se. However, the influence of the composite index movement towards the property sector index is not covered in this paper.

Thus, it is recommended that real property price collected throughout Malaysia is used instead. It will definitely give better reflection of how property prices actually move in Malaysia.

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