The relationship between Malaysia's residential property price index and residential properties loan supply

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Abstract
This paper aims to examine the linkages between residential properties prices and residential properties loans in Malaysia from 1999 to 2015, in addition to income level and the impact of the economic crisis. Even though residential properties are a basic necessity, there is no previous study that attempts to estimate the long-run and short-run relationship between loans and price level in residential properties in Malaysia. It is believed that property price level moves in the same direction as loan supply. The estimations are divided into two parts: the detection of long run relationships and the estimation the long-run and short-run elasticities from an ARDL model. The results support the hypothesis that the loan supply has a positive impact on the residential price levels; the robustness test also supports this conclusion. This implies the importance of closely monitoring the housing loan activities of banks to control residential property prices.

Keywords: Residential properties price; residential property loan; Malaysia

1. Introduction

In recent decades, the increasing of housing prices in Malaysia attracted the attention of researchers to investigate the determinants of housing prices. Among various types of properties, residential properties are particularly important because housing is a basic need. However, the residential price index of Malaysia increased almost two times from 1999 to mid-2015. Concurrently, loans for residential properties also increased significantly. Many researches have been conducted to determine the determinants of house prices in Malaysia such as Ng (2006), Ahmad Faizal (2011), Dziauddin et al. (2013) and Tang and Tan (2015), covering hedonic, bivariate and multivariate models. Besides, there are several papers test the same issue using disaggregate data such as Ibrahim and Law (2014). These studies identify several significant variables in their estimations. For instance, Ahmad Faizal (2011) and Tang and Tan (2005) find cointegration relationships among house prices and interest rate. and the Malaysia total and state-level house price index. Previous studies also tried to determine the dynamic between housing prices with stock prices, covering national and state level data (Lean, 2012; Lean and Smyth, 2014)

Nonetheless, to the best of my knowledge, only Ng (2006) and Ibrahim and Law (2014) empirically analyse the impact of housing loans on the house price levels in Malaysia. Ng (2006) focuses on investigating the determinants of the house prices using the Engle-Granger estimation; he concludes that the long-run impact of loan supply on the properties prices is positive. Nonetheless, his study has two weaknesses. First, the conclusion of cointegration based on the unit roots test on the error terms in the Engle-Granger estimation are influenced by dependent and independent variables; the impact is more obvious when more than two variables are examined. Second, the Engle-Granger test involves two-step estimation. If the error terms are erroneous in the first stage estimation, it will lead to a wrong conclusion. On the other hand, the vector error correction model estimated by Ibrahim and Law (2014) subject to the properties of the variables. In fact, they assume that a variable is differenced stationary when there is a mixed conclusion from different unit root tests and exclude level stationary variables. This paper attempts to fill the gap of knowledge by examining the linkages between the residential price and residential loan. Additionally, the income level is also examined. This paper applies an autoregressive distributed lag (ARDL) model to illustrate the short-run and long-run relationships among the variables. The largest advantage of the ARDL model is that we can determine the existence of long-run relationships among variables without knowing the order of integration of the variables through Wald statistics. The identification of order of integration is needed only when the Wald statistics fail to confirm the variables are connected in the long-run (Narayan, 2004).

2. Data Descriptions

This paper includes two potential determinants of residential price levels, namely gross domestic products (GDP) and loans for residential properties. This paper also includes dummies that measure the impact of the subprime mortgage crisis in the US on Malaysia's residential market. According to Frankel and Saravelo (2012), the impact from the subprime mortgage crisis was the most severe from the third quarter of 2008 to the first quarter of 2009. Table 1 shows the indicator for each variable and the data sources. Quarterly data from the first quarter of 1999 to the second quarter of 2015 are tested. All variables are seasonally adjusted using the Census X-13 technique and are transformed into natural logarithm form.

Table 1: Variables Indicators and Data Sources

Variables	Indicators	Data Sources
Residential properties prices	Residential properties prices index (base year=2010)	Bank for International Settlements
Loans for residential properties prices	The loans disbursed for residential properties	Monthly Statistical Bulletin, Bank Negara Malaysia
Income level	Gross domestic products (current price)	Monthly Statistical Bulletin, Bank Negara Malaysia

In particular, the residential properties prices cover all types of new and existing dwellings in Malaysia. The loan for residential properties, on the other hand, refers to the loans for residential properties from the Malaysian banking system. Gross domestic product (GDP) is a common indicator of income level of a country in many previous studies. All estimations are conducted using Eviews 9.

3. Methodology and Model Specification

Due to relatively small sample size and to preserve the degree of freedom, this paper limits the examined variables into two potential determinants of housing prices, namely housing loan and output level. The first estimation is to determine the existence of cointegration among the variables by constructing an unrestricted error correction model that can be illustrated by equation (1).

$$\Delta LRP_t = \alpha_0 + \beta_1 LRP_{t-1} + \beta_2 LLOAN_{t-1} + \beta_3 LGDP_{t-1} + \sum_{i=1}^{p} \theta_{1i} \Delta LRP_{t-1} + \sum_{j=1}^{p} \theta_{2j} \Delta LLOAN_{t-1} \sum_{k=1}^{p} \theta_{3k} \Delta LGDP_{t-1} + \theta_4 CRISIS + \varepsilon_t \quad (1)$$

where Δ denotes the first differenced of variables, α_0 is the constant, *LRP* is the natural logarithm of residential price index, *LGDP* is the natural logarithm of GDP, *LLOAN* is the natural logarithm of residential loans and *CRISIS* are the dummies representing the subprime mortgage crisis. The lag length is decided using the Hendry general to specific method. In order to test the existence of long-run relationship, F-statistic or Wald test is applied to test the null hypothesis of $\beta_1 = \beta_2 = \beta_3 = 0$ against the alternative hypothesis of $\beta_1 \neq \beta_2 \neq \beta_3 \neq 0$. The failure to reject the null hypothesis means there are no long-run relationships among the variables in the model. However, the F-statistics do not have standard distribution and therefore this study applies the critical values of F-statistic generated by Narayan (2005) that are appropriate when the number of observations in a study range from 30 to 80. There are two bounds of critical values: the upper bound where all variables are I(1) and the lower bound where all variables are I(0). There is evidence that the variables have long-run relationships if the F-statistic value is higher than the critical values. The opposite conclusion is arrived if the F-statistic value is below the critical value. Nonetheless, the outputs are inconclusive when the F-statistic value falls between the bounds. As mentioned in the introduction, we can skip the unit root tests if there are long-run relationships among the variables.

If the cointegrated relationship is confirmed, the next step is to construct a long-run relationship from an ARDL (p, p1, p2) model, as showed below:

$$LRP_t = \delta_0 + \sum_{p=1}^{p} \omega_0 \, LRP_{t-p} + \sum_{p=0}^{p1} \omega_1 \, LGDP_{t-p} + \sum_{p=0}^{p2} \omega_2 \, LLOAN_{t-p} + \omega_3 CRISIS + \vartheta_t \quad (2)$$

The model is estimated using OLS estimation procedure and the number of lag in equation (2) is determined by Akaike information criterion (AIC); the model with the lowest AIC will be selected. There are two important outputs from the ARDL equation: long-run and short-run elasticities. The long-run equation has the following general form.

$$LRP_t = \phi_0 + \phi_1 LGDP_t + \phi_2 LLOAN_t + \phi_3 CRISIS_t + \upsilon_t \quad (3)$$

We apply the following formulae to measure the long-run elasticity of residential properties loan (ϕ_1), GDP (ϕ_2) and crisis (ϕ_3), respectively.

$$\phi_1 - \left(\frac{\sum_{p=0}^{p1} \omega_1}{1 - \sum_{p=1}^{p} \omega_0} \right)$$

$$\phi_2 = -\left(\frac{\sum_{p=0}^{p1} \omega_2}{1 - \sum_{p=1}^{p} \omega_0} \right)$$

$$\phi_3 = -\left(\frac{\omega_3}{1 - \sum_{p=1}^{p} \omega_0} \right)$$

On the other hand, the short-run equations can be illustrated as below:

$$\Delta LRP_t = \delta_0 + \sum_{i=1}^{p} \delta_1 \, \Delta LRP_{t-i} + \sum_{j=0}^{p} \delta_2 \, LGDP_{t-j} + \sum_{k=0}^{p} \delta_3 \, LLOAN_{t-k} + \delta_4 CRISIS + \delta_5 \upsilon_{t-1} \quad (4)$$

where v_{t-1} is the error correction terms (ECT) and are derived from equation (2). Its coefficient represents the speed-of-adjustment. Hendry general to specific method is applied to determine the appropriate lag length. The error terms should be statistically significant and have a negative sign; this is important because it means any deviation from the long-run equilibrium in the short term will be eliminated. The following diagnostic tests are conducted to ensure the fitness of the model: Jarque-Bera normality test, Breusch-Godfrey serial correlation LM test and Breusch-Pagan-Godfrey serial heteroskedasticity test. In addition, the stability of the error correction model is also tested by observing the roots of the equation. Eviews 9 is applied for all estimations in this paper.

4. Results Discussion

The results discussion begins with the construction of unrestricted error correction model. Table 2 illustrates the F-statistics and the relevant critical values at 1%, 5% and 10% significance levels. The result indicates that the null hypothesis is rejected at the 5% significance level. Hence, there is cointegration in the model. Following this, an ARDL (p, p1 and p2) model is constructed and the optimal lag length is decided by using the AIC. Figure 1 shows that the optimal model of ARDL model is found when the ARDL (4,0,4) that has four lags is included for LRP and LLOAN. Table 3 contains the estimation outputs of the ARDL (4,0,4) model.

Table 2: F-statistic Output

F-statistic	4.4015	
Critical Value		
1%	I(0)= 4.068	I(1)=5.250
5%	I(0)= 2.962	I(1)=3.910
10%	I(0)= 2.496	I(1)=3.346

Note: Restricted intercept and no trend (k=3, n=60), available from Narayan (2005)

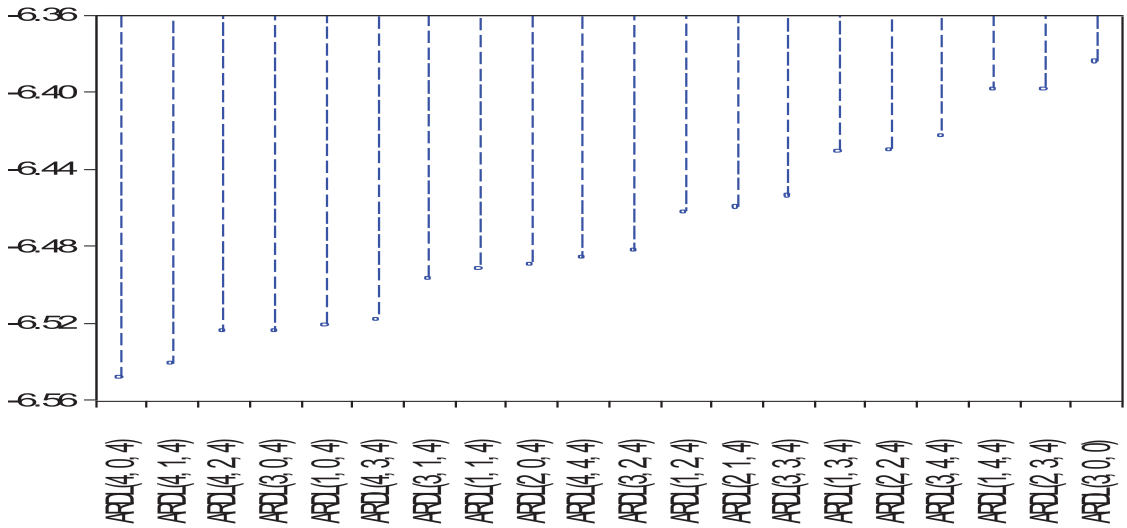

Figure 1 : The top 20 models based on AIC

From the outputs in Table 3, the long-run elasticities of the independent variables are generated and presented in the Table 4. The results show that only the residential properties loans and the global financial crisis have statistically significant impact on the residential price at the 1% and 10% significance level, respectively. In particular, one percent increases in the residential properties loan rises the residential price by 0.99%. On the other hand, the global financial negatively affects the residential price by decreasing it by 0.42%. Particularly, an increase in the loan supply could raise the ability to own a property through bank borrowing, which subsequently pushes up the residential price level if the house supply is inelastic. This is also in accordance to the demand-pull inflation contributed by credit supply. The occurrence of economic crisis is expected to arouse negative sentiment among the properties buyers and investors. This inevitably reduces their appetite for the properties, including residential dwellings, which is in accordance with the risk aversion hypothesis. Finally, the error correction terms (ECT) term indicates the adjustment of deviation back to long-run relationship is small (3.9%).

The next discussion focuses on the error-correction model from the ARDL (4,0,4) model where short-run elasticities can be obtained. According to Table 5, there is only one variable that is statistically significant in the short-run. In the short-run, the residential price will be affected by the residential loans only. The absence of short-term impact from the subprime mortgage crisis implies that the negative effect of that crisis is emanated from weaker economic conditions and the bank performances in the long-run. The ECT also has a negative statistically significant sign. However, the speed-of-adjustment is rather slow. The error correction model also passes the diagnostic tests of normality (Jarque-Bera normality test), autocorrelation (Breusch-Godfrey) and heteroscedasticity (Breusch-Pagan-Godfrey). The model also fails to reject the null hypothesis of Ramsey RESET test at the 5% significant level. Finally, the dynamic stability of the model is confirmed when all the inverse roots are inside the unit circle.

Table 3: ARDL (4,0,4) model

Variable	Coefficient	Std. Error
LRP(-1)	0.925***	0.132
LRP(-2)	0.290*	0.157
LRP(-3)	-0.038	0.168
LRP(-4)	-0.213*	0.125
LGDP	-0.028	0.017
LLOAN	0.138	0.087
LLOAN(-1)	-0.277	0.187
LLOAN(-2)	0.285**	0.126
LLOAN(-3)	-0.272***	0.094
LLOAN(-4)	0.161***	0.041
CRISIS	-0.015***	0.005
C	0.095	0.094

Note: Heteroskedasticity and Autocorrelation consistent standard errors are reported. ***, **, * represent the statistical significance of 1%, 5%, and 10%, respectively.

Table 4: Long-run elasticities from ARDL (4,0,4)

Variable	Coefficient	Standard Error
LGDP	-0.807	0.515
LLOAN	0.999	0.385***
CRISIS	-0.421	0.220*
C	2.703	2.316

Note: ***, * represent the statistical significance of 1%, and 10%, respectively.

Table 5: Error correction model from ARDL (4,0,4)

Variable	Coefficient	Std. Error
ECT(-1)	-0.039***	0.01
D(LRP(-1))	-0.07	0.121
D(LRP(-2))	0.145	0.113
D(LRP(-3))	0.271**	0.117
D(LGDP)	-0.03	0.052
D(LLOAN)	0.136	0.095
D(LLOAN(-1))	-0.177*	0.091
D(LLOAN(-2))	0.097	0.072
D(LLOAN(-3))	-0.164***	0.044
CRISIS	-0.005	0.006
C	0.001	0.007
Jarque-Bera normality test	0.0789 (0.9613)	
Breusch-Godfrey (AR2)	3.7602 (0.1526)	
Breusch-Godfrey (AR4)	4.4011 (0.3544)	
Breusch-Pagan-Godfrey	12.1444 (0.2755)	
Ramsey RESET	3.4885 (0.0618)	
Inverse roots of the associated characteristic equation		
0.801667, -0.379974 ± 0.567706i, 0.683132		

Note: ***, **, * represent the statistical significance of 1%, 5%, and 10%, respectively. The values in the parentheses are the p-values of respective tests.

The robustness of the results is tested by using the adjusted R-squared criterion to determine the lag length of the ARDL (p, p1, p2) where the highest adjusted R-squared will be selected. It is possible that the different lag length will affect the long-run and short-run elasticity of the variable. The adjusted R-squared criterion proposes that ARDL (4,1,4) is suitable. According to Table 6, the sign of the estimated coefficients is the same with the first estimation. However, only the properties loans have a statistically significant coefficient. This confirms the findings that the residential properties prices are linked to residential properties loans.

Table 6: Long-run elasticities from ARDL (4,1,4)

Variable	Coefficient	Standard Error
LGDP	-1.131	0.799
LLOAN	1.217***	0.607
CRISIS	-0.310	0.212
C	3.908	2.896

Note: *** represents the statistical significance of 10%.

Next, the error correction model from ARDL (4,1,4) is estimated and presented in Table 7. It is found that the error correction term is negative and statistically significant with the size of speed-of-adjustment that is similar to that of ARDL (4,0,4). Furthermore, the dynamic linkages among the variables are also detected in this error correction model. In short, the results from ARDL (4,0,4) are largely supported by ARDL (4,1,4) and the ECT is also similar to the initial estimation (3.6%). The null hypothesis of the RESET test where the model is fit is again not rejected at 5% significance level. Normality and the non-existence of autocorrelation and heteroscedasticity are confirmed by Jarque-Bera normality test, Breusch-Godfrey and Breusch-Pagan-Godfrey, respectively. The model also fails to reject the null hypothesis of Ramsey RESET test at the 5% significant level. Finally, the inverse roots show the model is stable.

Table 7: Error correction model from ARDL (4,1,4)

Variable	Coefficient	Std. Error
ECT (-1)	-0.036***	0.009
D(LRP(-1))	-0.072	0.12
D(LRP(-2))	0.179	0.11
D(LRP(-3))	0.271**	0.116
D(LGDP)	-0.013	0.05
D(LLOAN)	0.162*	0.096
D(LLOAN(-1))	-0.165*	0.091
D(LLOAN(-2))	0.101	0.072
D(LLOAN(-3))	-0.168***	0.044
CRISIS	-0.005	0.006
C	0.002	0.007
Jarque-Bera normality test	0.0005 (0.9998)	
Breusch-Godfrey AR(2)	3.2028 (0.2016)	
Breusch-Godfrey AR(4)	3.5432 (0.4727)	
Breusch-Pagan-Godfrey	11.1333 (0.3472)	
Ramsey RESET	3.3632 (0.067)	
Inverse roots of the associated characteristic equation		
0.801667, -0.379974 ± 0.567706i, 0.683132		

Note: ***, **, * represent the statistical significance of 1%, 5%, and 10%, respectively. The values in the parentheses are the p-values of respective tests.

5. Conclusion

The objective of this paper is to estimate the impact of residential properties loans on the residential price index. In addition, income level and the occurrence of subprime mortgage crisis are also included in the model as independent variables. There are three conclusions that can be drawn. First, there is a positive long-run linkage between residential properties loans and the residential properties prices. Second, the subprime mortgage crisis causes a reduction in the residential properties prices in the long-run. Third, dynamic short-run linkages are found with the detection of negative and statistically significant error correction terms. Except for the second conclusion, the other two conclusions are supported by the robustness test. From the results, policymakers should intervene through the properties loan market if they intend to control residential properties prices. Excessive price speculation in the residential properties segment could be contained if the approval of residential properties loans is monitored.

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