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Macroeconomic Variables and Malaysia House Price Index

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Abstract

Malaysia is one of the developing countries facing an upward trend in demand for housing. However, the increasing trend in housing prices has become worrying. This study aims to examine the macroeconomic determinants of the housing price in Malaysia. The house price index and macroeconomic data on gross domestic product growth, consumer price index, and money supply were collected quarterly over the period from 2000 to 2019. The Autoregressive Distributed Lag (ARDL) model was used to investigate the effects of long-run and short-run estimates of the proposed econometric model based on the selected macroeconomic variables mentioned above. The results from the Augmented Dickey-Fuller and Phillips-Perron tests of stationarity indicated that all the variables were non-stationary at the level, I(0) but stationary at the first difference, I(1). The long-run coefficient estimates showed that the gross domestic product and money supply are significant and positively influenced the house price index in Malaysia. In addition, the consumer price index was also significant but had a negative relationship with the house price index in the long run. Further analysis using causality tests revealed that statistically, only gross domestic product and money supply were found significant in influencing the house price index in the short run.

Keywords: House Price Index, Macroeconomic Variables, ARDL, Malaysia

Introduction

According to Banks et al (2010), housing is the primary marketable asset in most people's household portfolios. For instance, in the United States, housing equity is a significant component of household wealth. Homeowners accumulated wealth for their families through capital gains over the value of their homes. The majority of households in the United States plan to use their home equity to finance the second half of their lives. However, Mankiw and Weil (1989); Hoynes and McFadden (1994) argued that a significant decline in house prices over the next few decades would result in capital losses for homeowners. As a result, changes in house prices will affect household wealth. In the long run, house prices have sustained housing market growth, and their recurrent fluctuation along the growth path has been a common occurrence throughout the world.

Malaysia's housing market has performed admirably since the country gained independence from the British. The residential property market largely determines Malaysia's housing market performance. Since residential property forms the backbone of the Malaysian property market, any change in house prices will significantly impact the property market and, consequently, the Malaysian economy. As Malaysia's property market, particularly in the residential sector, has evolved, the various determinants have also evolved. Thus, this study aims to ascertain the factors that influence house prices in Malaysia.

Financial crises may impact the Malaysian real estate market. According to Shukor et al. (2016), Malaysia was affected by the Asian financial crisis (1997–1998) and the global financial crisis (2007–2008). During the Asian financial crisis, the house price index in Malaysia decreased by 18.78 percent; nonetheless, the country's recovery was slower than in Singapore, where the index only rose by 10.20 percent between 1999 and 2005. Malaysia's housing market was adversely affected by the economic recession in 2007. Figure 1 shows the Malaysian house price index changes between the years 2000 and 2016. In the meantime, the slowdown in the economy may have affected macroeconomic indicators, which in turn affected property values. When the financial crisis hit, export demand dropped, and foreign direct investment dwindled. For example, Malaysia's GDP shrank (Rasiah & Abidin, 2009).

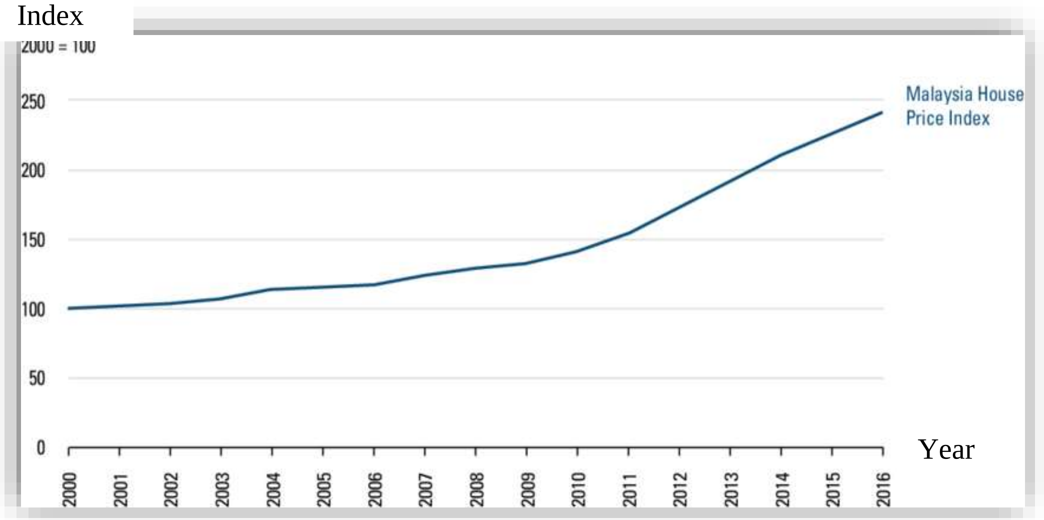

Figure 1: Malaysian Housing Price Index, 2000 – 2016.

Literature Review

House Price Index

The discrepancy in property prices is reflected in the house price index. Aside from these uses, it can also be utilized as a tool for determining mortgage-backed securities' rent (MBS), debt and overall risk levels. According to the house price index, the housing market has a strong positive link with economic growth (Lizam et al., 2014). The long-term movement of housing prices is also influenced by macroeconomic factors (Pinjaman and Kogid, 2020). Malaysians used to call the average house price in Malaysia the Malaysian House Price Index (MHPI), published quarterly by the National Property Information Centre and set up by the Department of Valuation and Property Services (VPSD). According to NAPIC, base year adjustments represent changes in house prices in response to buyer preferences emerging market trends and efforts to contain housing prices in Malaysia.

Gross Domestic Product
According to Qing (2010), investment growth would raise GDP. It demonstrates the link between property investment and GDP. GDP is considerably and positively related to the MHPI, according to (Ong, 2013). According to Chioma (2009), A growth in consumer spending causes GDP to rise, which in turn causes property values to climb. Housing prices and GDP have a statistically significant positive. (Grum & Govekar, 2016). Other researchers, such as Zhu (2004), found that the price of a house and the housing market in Asia have a very strong positive relationship with the GDP rate. House price and GDP rates have a negative correlation, according to some researchers.

Gross domestic product measures an economy's growth (Divya & Devi, 2014). The increased gross domestic product indicates that the economy is doing better. As a result, each country strives to maximize its gross domestic product growth rate. According to Razali (2016), GDP growth was the most important factor affecting housing prices. According to Zandi et al.(2015), house prices harm GDP growth. It is because an increase in income can significantly affect housing demand. As a result, demand for housing increases, increasing housing prices. Besides, according to Ong (2013), housing investment is a component of GDP. Increased household consumption may increase housing investment as the wealth value of housing increases due to GDP growth. Additionally, Ong (2013) and Miller (2009) discovered a positive and significant relationship between GDP and housing prices, similar to Razali.

Consumer Price Index
Inflation is a term that refers to the phenomenon in which the price of goods or services continues to rise. In theory, an increase in inflation may increase the cost of living, requiring people to spend more money on specific goods or services. On the other hand, the inflation rate can be defined as the rate at which prices increase over time. The Consumer Price Index (CPI) was included in this study as a determinant of housing price because it is a component of the consumer price index. Numerous studies, including Pillaiyan (2015); Hao (2015); Zhou (2013); Haibin (2004) and Kamal et al., discovered a significant relationship between inflation and housing prices (2016). However, Ong (2013) discovered that inflation negatively but non-significant relationship with house prices. Belej and Cellmar (2014) noted that while inflation was not significant in influencing housing prices, the study explained that as lag values increased, the inflation rate shifted from a stimulating to a destimulating influence variable. In other words, inflation may not affect housing prices in the short run but may in the long run.

Money Supply
Theoretically, an increase in the money supply will raise house prices. According to Adalid and Detken (2007), in several industrialized countries, vast money expansion has a negative impact on property prices. They found a strong connection between the general increase in money and the price of housing. This connection was most pronounced during price increases. If urbanization and economic growth are linked, then it's possible that market efficiency is being questioned. Ball (2016) examined this relationship and found that money supply has a lag influence on current housing returns. Aside from monetary policy and

nominal interest rates, money shocks have a big impact on real estate prices, causing investors to be extremely volatile.

Data and Method

In this research, the following model was adopted as follows:

HPI = f(GDP, CPI, M3) (1)

where HPI = House Price Index; GDP = Gross Domestic Product; CPI = Consumer Price Index; M3 = Money Supply.

To test the stationarity of each variable, the log form of the variables was used. Log transformation can reduce the problem of heteroscedasticity because it compresses the scale in which the variables are measured, thereby reducing a tenfold difference between two values to a twofold difference (Gujarati, 2012).

$$LNHPI_t = \alpha + \beta_1 LNGDP_{it} + \beta_2 LNCPI_{it} + \beta_3 LNM3_{it} + \varepsilon_t \quad (2)$$

ARDL has numerous advantages. Firstly, unlike the widest method used for testing cointegration, the ARDL approach can be applied regardless of the stationarity properties of the variables in the samples and allows for inferences on long-run estimates, which is not possible under the alternative cointegration procedures. In other words, this procedure can be applied irrespective of whether the series is I(0), I(1), or fractionally integrated (Pesaran, 1997); and (Bahmani-Oskooee & Ng, 2002), thus avoid problems resulting from non-stationary time series data (Laurenceson & Chai, 2003). Secondly, the ARDL model takes sufficient numbers of lags to capture the data generating process in a general-to-specific modelling framework (Laurenceson & Chai, 2003). The short and long-run dynamic relationships between the house price index and other variables are estimated by using the ARDL bound testing approach, which was initially introduced by Pesaran (1997). It estimates (p+1)k number of regressions to obtain optimal lag length for each variable, where p is the maximum lag to be used, k is the number of variables in the equation. Finally, the ARDL approach provides robust results for a smaller sample size of cointegration analysis.

ARDL Model

The model was transformed into a Bound Testing approach

$$\Delta LNHPI_t = \alpha + \theta_1 LNHPI_{t-1} + \theta_2 LNGDP_{t-1} + \theta_3 LNCPI_{t-1} + \theta_4 LNM3_{t-1} + \sum_{i=1}^{a} \beta_{1i} \Delta LNHPI_{t-i} + \sum_{i=0}^{b} \beta_{2i} \Delta LNGDP_{t-i} + \sum_{i=0}^{c} \beta_{3i} \Delta LNCPI_{t-i} + \sum_{i=0}^{d} \beta_{4i} \Delta LNM3_{t-i} + \upsilon_t \quad (3)$$

Where Δ is the first difference operator and vt is a white-noise disturbance term. The final model represented in equation (3.0) above can also be viewed as an ARDL model. The model indicates that house price index performance (HPI) tends to be influenced and explained by its past values, involving other disturbances or shocks. From the estimation of UECM, the long-run elasticities are the coefficient of the one lagged explanatory variable (multiplied by a negative sign) divided by the coefficient of the one lagged dependent variable. The short-run effects are captured by the coefficient of the first differenced variables. The null and alternative hypotheses of long-run relationship is defined by:

$H_0: \theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$ (No cointegration or long-run relationship)
$H_0: \theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq 0$ (Cointegration or long-run relationship exist)

For a small sample size study ranging from 30 to 80 observations, Narayan (2004) has tabulated two sets of appropriate critical values. One set assumes all variables are I(1), and another assumes that they are all I(0). However, the asymptotic distribution of this F-statistics is non-standard irrespective of whether the variables are I(0) or I(1). The null hypothesis cannot be rejected if the F-statistic falls below the bound level. On the other hand, if the F-statistic lies exceed the upper bound level, the null hypothesis is rejected, indicating cointegration. If, however, it falls within the band, the result is inconclusive.

The short-run dynamic relationship is then tested by applying the causality test to examine the causal relation from macroeconomic variables to the house price index as in the following equation:

$$\Delta LNHPI_t = \alpha + \sum_{i=1}^{a} \beta_{1i} \Delta LNHPI_{t-i} + \sum_{i=0}^{b} \beta_{2i} \Delta LNGDP_{\ t-i} + \sum_{i=0}^{c} \beta_{3i} \Delta LNCPI_{\ t-i} + \sum_{i=0}^{d} \beta_{4i} \Delta LNM3_{\ t-i} + \delta ECT_{t-1} \upsilon_t \quad (4)$$

where ECT is the error correction term. The null and alternative hypotheses for the causality test are defined by:

$H_0: \beta = 0$ (No causality)
$H_1: \beta \neq 0$ (Causality exist)

Source of Data

The world bank database obtains all independent variables, while NAPIC is used to obtain the dependent variable (HPI) and analyze time-series data based on it. The total number of observations for both dependent and independent variables ranges from 2000 to 2019. The sample size comprises 20 years of quarterly data.

Results

The analysis begins with testing the unit root of every variable for Malaysia. Unit root tests such as Dickey-Fuller (DF) or Augmented Dickey-Fuller (ADF) and the Phillip Perron (PP) tests are carried out to determine the order and stationarity of the series variables and the results shown in Table 1.

Based on the ADF unit root test, it is found that LNHPI, LNGDP, LNCPI and LNM3 are non-stationary at a level I(0). However, at the first difference I(1), all the variables are stationary. The unit root test tested by Phillips-Perron (PP) showed that at a level I(0), all variables are non-stationary except for LNGDP, which is stationary when only intercept was included in the test equation. On the other hand, all variables are stationary at the first difference, I(1).

Table 1
ADF and PP Unit Root Test for Model of Housing Price Index

Level I(0)	**ADF Unit Root**		**PP Unit Root**	
	Intercept	**Intercept and Trend**	**Intercept**	**Intercept and Trend**
LNHPI	-2.1117	-2.2062	-2.5570	-2.6157
LNGDP	-4.1530	-4.2263	-3.0269 **	-3.0333
LNCPI	-0.2045	-2.7659	-0.1723	-2.9856
LNM3	-1.8516	0.3422	-1.8516	-0.2458
First Difference I(1)	**ADF Unit Root**		**PP Unit Root**	
	Intercept	**Intercept and Trend**	**Intercept**	**Intercept and Trend**
LNHPI	-10.6601 ***	-10.5976 ***	-10.6333 ***	-10.5712 ***
LNGDP	-6.8747 ***	-6.8321 ***	-6.7175 ***	-6.6688 ***
LNCPI	-7.6962 ***	-7.6446 ***	-7.7561 ***	-7.6860 ***
LNM3	-6.9913 **	-7.2710 ***	-6.8960 ***	-7.2461 ***

Notes: *** and ** denote 1% and 5% of significant levels, respectively. The optimal lag length is selected automatically using the Schwarz Information Criteria (SIC) for the ADF test, and the bandwidth was selected using the Newey–West method for the PP unit root test.

Detecting the Long-Run Relationship

This tested model must pass the detection of long-run cointegration before proceeding to the short and long-run elasticities. The variables were tested using the ARDL cointegration, and the result of this analysis is displayed in Table 2. As a result, the maximum lag was set equal to (6, 6), and the optimum lag order was (2, 4, 1, 5) obtained by Akaike Information Criteria (AIC). Based on the result, the long-run exists in the variables in this model. The critical value must be compared with the F-statistic, which is if the F-statistics are below the bound level, the null hypothesis cannot be rejected. Still, if the F-statistic is greater than the upper bound level, the null hypothesis is rejected, and it shows signifying the existence of cointegration. The finding in Table 2 shows that F-statistics are greater than upper (1) critical bound at the 1%, 5%, and 10% level of significance. This shows that rejection of the null hypothesis of no cointegration considering LNGDP, LNCPI, and LNM3 is a dependent variable.

The null hypothesis of no cointegration for housing price index (4.123 > 3.862) is rejected at a 5% significant level, given that the F-statistic value was greater than the upper bound critical value and shows the long-run relationship exist between the variables.

Table 2
F-statistic for Testing the Existence of Long Run Equation

Model	**Max Lag**	**Lag Order**	**F-Statistics**
ARDL(LNHPI|LNGDP, LNCPI, LNM3)	(6, 6)	(2, 4, 1, 5)	4.123**
Critical Values for F stat		Lower I(0)	Upper (1)
10%		2.482	3.334
5%		2.946	3.862
1%		4.048	5.092

Note: 1. # the critical values are based on Pesaran *et al.* (2001), case III: unrestricted intercept, and no trend. 2. k is several variables, and it is equivalent to 3. 3. *, **, and *** represent 10%, 5%, and 1% level of significance, respectively.

Diagnostic Checking

Before the result was analyzed, it is important to check the robustness of the model by adopting several diagnostic tests such as Breusch-Godfrey serial correlation LM test, ARCH test, Jacque-Bera normality test, and Ramsey RESET specification test. All tests showed that the model has the desired econometric properties. Namely, it has a correct functional form, and the model's residuals are serially uncorrelated and homoscedastic, given that the probability value of the t-test is all above 10% significant.

Table 3

Diagnostic Tests for Model of Housing Price Index

Model	(A) Serial Correlation [p-value]	(B) Functional Form [p-value]	(C) Normality [p-value]	(D) Heteroscedasticity [p-value]
ARDL(LNHPI| (LNGDP, LNCPI, LNM3)	0.44 (0.57)	0.75 (0.39)	2.95 (0.23)	3.26 (0.07)

Note: The diagnostic test performed as follows A. Lagrange multiplier test for residual serial correlation; B. Ramsey's RESET test using the square of the fitted values; C. Based on a test of skewness kurtosis of residuals; D. Based on the regression of squared fitted values. 2.

Long-Run Coefficients and Short-Run Dynamic

After detecting the long-run relationship for Malaysia, both short-run and long-run models were estimated from equation (3), and the maximum order of lag chosen was four. From this, the lag length that minimizes Schwarz Bayesian criterion is selected. The ARDL lag order selected for Malaysia is 2, 4, 1, 5.

Table 4 present the long-run coefficients. The table shows the empirical verdicts of the long-run relationship between the regressors of the proposed ARDL model. There was a positive and significant relationship between gross domestic product (LNGDP) and housing price index (LNHPI). With a 1% increase in LNGDP, the LNHPI increased by 0.322%. This finding aligns with Ong (2013) that found that GDP is significant and positively related to the HPI. Besides, according to Razali (2016), GDP growth was the most important factor affecting housing prices. It is because an increase in income can significantly affect housing demand. As a result, demand for housing increases, increasing housing prices.

A negative relationship was also detected between the consumer price index (LNCPI) and the house price index (LNHPI). With a 1% increase in LNCPI, the LNHPI decreased by 21.205%. Inflation may affect the housing price in Malaysia as it will affect people's expenditure for consumption and thus influence their demands for housing. It means that when the country's price of goods and services continues to increase dramatically, people will decrease their demand for housing, although it is an important and basic need to individuals. Also will lead to a decrease in house prices, as supported by the finding of (Kamal et al., 2016).

Table 4
Long-run Coefficient Estimates

Dependent Variable = LNHPI				
Selected Model: ARDL(2,4,1,5)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LNGDP	0.3221	0.1793	-1.7968	0.0775
LNCPI	-21.2045	11.0092	-1.9261	0.0589
LNM3	6.9762	3.1224	2.2342	0.0293
C	1.7351	9.5920	0.1809	0.8571

Notes: Std. Prob. denotes the probability value. Error is standard error of the coefficient estimates.

The relationship between the money supply (LNM3) and the house price index (LNHPI) was also found to be significant and positive. With the 1% increase in LNM3, the LNHPI increased by 6.976%. This result is supported by the study done by Ball (2016) and Adalid and Detken (2007), which looked at the impact of broad money growth on property prices in many developed countries. They discovered a strong link between the broad money growth and housing prices.

Table 5
Short-run Error Correction Model Estimates

Dependent Variable = LNHPI				
Selected Model: ARDL (2, 4, 1, 5)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
$\Delta LNHPI_{t-1}$	-0.2593	0.0975	-2.6605	0.0100
ΔLNGDP	0.0401	0.0300	1.3375	0.1862
$\Delta LNGDP_{t-1}$	0.1431	0.0302	4.7365	0.0000
$\Delta LNGDP_{t-2}$	-0.0059	0.0300	-0.1971	0.8444
$\Delta LNGDP_{t-3}$	0.0967	0.0295	3.2788	0.0018
ΔLNCPI	4.2192	5.1661	0.8167	0.4174
ΔLNM3	9.4266	2.7461	3.4327	0.0011
$\Delta LNM3_{t-1}$	7.8871	2.7772	2.8399	0.0062
$\Delta LNM3_{t-2}$	0.1138	2.9433	0.0387	0.9693
$\Delta LNM3_{t-3}$	7.3382	2.7902	2.6300	0.0109
$\Delta LNM3_{t-4}$	-3.7733	2.6697	-1.4134	0.1628
ECT	-0.2539***	0.0541	-4.6919	0.0000

Notes: Std. Error is standard error of the coefficient estimates. Prob. denotes the probability value. Δ denotes difference operator.

Table 5 shows the result of the Error Correction Model. The Error Correction Term (ECT) was recorded as -0.2539 and significant. It means the speed of adjustment from disequilibrium is 25.39 percent to return to the equilibrium level in the next period. The result of the causality test based on Wald test statistic to identify the significance of individual macroeconomic variables in influencing the house prices in the short run is shown in Table 6. By referring to the probability value of the F-Statistics, the null hypothesis of no causal relation between house prices and both the LNGDP and LNM3 were rejected at 1 percent significance level. It indicates that changes or behavior significantly influenced the changes in the house price index in the gross domestic product and money supply in the short run.

Table 6
Short-run relationship between house price and individual macroeconomic movement

Macroeconomic Factor	Wald Test F-statistics (Probability)
ΔLNGDP	6.7113 (0.0001)
ΔLNCPI	2.24 (0.1154)
ΔLNM3	4.9439 (0.0004)

Notes: Probability values are shown in parenthesis. Δ denotes difference operator.

Conclusion

This study aims to investigate the macroeconomic determinants of Malaysian housing prices. The Autoregressive Distributed Lag (ARDL) model was used to investigate the effects of long-run and short-run estimates of the proposed econometric model based on the selected macroeconomic variables. On the one hand, the empirical findings indicate that the gross domestic product, consumer price index and money supply are all significant long-run determinants of the house price index in Malaysia. The finding shows that gross domestic product and money supply have significant relationships and positive impact and the consumer price index was also significant but had a negative relationship with the house price index. In the short run, however, it is discovered that both the gross domestic product and money supply have a causal effect on the house price index.

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