MODELLING AN ECONOMIC RELATIONSHIP FOR MACROECONOMIC DETERMINANTS OF MALAYSIAN HOUSING PRICES

Marziah Mokhtar[1], Sabariah Yusoff[2] and Muhammad Danial Samsuddin[3]

[1]Centre of Foundation Studies, Universiti Teknologi MARA,
Dengkil, Selangor, Malaysia.
marzi742@uitm.edu.my*

[2,3]Centre of Economics and Finance, Faculty of Business and Management,
Universiti Teknologi MARA, Puncak Alam,
Selangor, Malaysia.
sabariahy@uitm.edu.my[2]

(Corresponding author)*

Received: 30 March 2021 Revised from: 16 April 2021 Accepted:16 May 2021
Published: 31 May 2021

Abstract

The issue of housing affordability is increasingly becoming a phenomenon as property prices in Malaysia have risen beyond the reach of most people. Hence, the objective of the study is to investigate key macroeconomics determinants that trigger the upward movement of housing prices in Malaysia. The paper also seeks to establish the best fit economic model, that represents the relationship between housing prices and its macroeconomics determinants. Four economic models are proposed in depicting the economic relationship between house price index, which acts as proxy for housing prices, and macroeconomic determinants namely gross domestic product (GDP), interest rate (INT), inflation rate (INF) and exchange rate (ER). The Exponential Model is selected to be the most fit model for the data of 30-year period covering 1989 till 2018. Diagnostic tests are conducted to identify the existence of statistical problem of multicollinearity and autocorrelation, and hence steps are taken to rectify them accordingly. The analytical results show that gross domestic product (GDP), interest rate (INT) and exchange rate (ER) are all positively significant macroeconomic variables that explain the volatility of housing prices in Malaysia. However, the inflation rate (INF), which negatively affect the housing prices is not a significant variable.

Keywords: Housing prices, Gross domestic products, Inflation rate, Interest rate, Exchange rate

1. INTRODUCTION

Housing prices, lately, appears to be a significant subject which attract much discussion in Malaysia. The Malaysian national housing policy is to ensure all Malaysians, particularly the low-income groups, have access to adequate and affordable shelter and related facilities through housing programs and strategies as outlined in the country's development plan. Generally, housing prices are influenced by the market forces of demand and supply that exist in the housing market. Given that the country's economy is growing at an average rate of 7% per annum, the purchasing power of Malaysians are expected to rise with an anticipated increase in the level of income per capita from RM6,099 in 1990 to RM14,788 in 2000 and projected to reach RM25,000 in the year 2020 indicating a substantial proportion of Malaysian society will become more affluent and will be able to demand more houses.

With regard to the supply side of houses, based on past experiences private sector is more interested in delivering medium and high cost houses as it is more profitable. On the other

hand, public sector performance in supplying houses especially the low-cost housing is affected by problems ranging from planning to implementation, such as frequent changes in the scope and location of projects, high development standards, delays in the issuance of loans, difficulties faced in the retrieval of instalments from buyers, high prices of land and provision of infrastructure. As an alternative, the Government has sought the cooperation of the private sector to address the housing needs of the lower income groups (Ministry of Housing and Local Government, 2020).

The local housing market had experienced few occasions of imbalances between demand and supply that led to an excessive increase in housing prices beyond what is supported by economic fundamentals (Pillaiyan, 2015). Malaysia experienced housing bubble for a duration of three-year period from 2011 to 2013. Based on the report by the National Property Information Centre, the number of unsold residential properties has been rising since 2011 and peaked sharply in 2017 (Abdul Latiff, Majid & Salleh, 2020). Despite that, there has been an upwards trend in the pricing of houses in Malaysia. Various factors have been found to contribute to the rise of housing prices such as gross domestic product (GDP), population and real property gains tax (RPGT) were the key determinants of housing prices (Ong, 2013). Other factors which had been also pointed out as affecting housing prices, including interest rates, excessive liquidity, strong income, and credit growth (Ciarlone, 2015).

Therefore, it is of our interest to explore the mismatch in the housing market by taking into account the macroeconomics determinants namely gross domestic product (GDP), interest rate (INT), inflation rate (INF) and exchange rate (ER) in influencing housing prices in Malaysia by using the best fit economic model. This paper is organized as follows: introduction, literature review, methodology, findings and discussion and conclusion.

2. LITERATURE REVIEW

2.1 House Price Index

The House Price Index (HPI) represents the general movement of house prices, thus serves as a broad indicator and a reliable source for the performance of the housing market. In Malaysia, under Valuation and Property Services of the Ministry of Finance, Malaysian House Price Index (MHPI) report is released quarterly by the National Property Information Center (NAPIC). According to Rosen (1974) the HPI is computed based on the hedonic regression model with the underlying hypothesis that the price of a particular good (in this case is the house) can capture significant determinants by considering both the spatial and structural attributes of the good. Moreover, according to Pillaiyan (2015), The price index of the house shall be used for calculating price changes which do not change the quality or quantity of the goods measured.

In 1997, the Department of Valuations and Property Services created the Malaysian house price index. According to Valuation and Property Service Department of Malaysia (2001), the MHPI consists of 70 sets of sub-indices including national house price indices, state house price indices and five house type sub-indices (terraced, semi-detached, detached, high-rise unit and other houses). The MHPI covers the housing market for 13 states and 2 federal territories and the MHPI can show the long- term trends in Malaysian house prices and analyze Malaysian housing market conditions.

2.2 Gross Domestic Product

Gross domestic product (GDP) is one of the important macroeconomic indicators for the economic situation (Maclennan & Pryce,1996). The GDP formula is equivalent to gross income, production, and government expenditure, plus export value minus import value. According to De Wit & Van Dijkb (2003) it was found that GDP has a positive relationship with house prices. Hii & Huu (1999), noted that fluctuations in the GDP were significantly related to the number of terraced, semi-detached, and long houses constructed in Sarawak. Their results also show that demand for terraces houses increased when GDP was growing while demand for detached houses was found not to be significantly affected by changes in GDP. That means buyers are not influenced by the GDP when making their buying decision. However, Zandi, Supramaniam, Aslam, & Theng (2015) found that gross domestic income (GDP) was a strong factor influencing real estate prices in Penang.

2.3 Inflation Rate

Inflation (INF) is often defined as a sustained increase in prices for a broad range of goods. Inflation has been identified as the major driver of house prices in several industrialized economies. In addition, the public perceived houses as an asset that strong inflation hedge. As such, during times of higher levels of uncertainty regarding future expected returns on investment in high inflation-related bonds and equities, real estate investment served as a more attractiveness long-term savings mechanism. Consequently, inflation would lead to increased demand for housing, thus rising domestic prices.

There is a mixture of results regarding the relationship between inflation and housing prices. Tan (2011) and Ong (2013) noted that inflation rate is not a significant determinant of housing price. Debelle (2004) on the other hand found that higher inflation leads to a decrease in the demand for housing, hence negatively impact the house prices. Likewise, according to Yeap & Lean (2017), there has been extensive examination of the relationship between house prices and inflation, but the evidence is always inconclusive. According to Piazzesi & Schneider (2009), he pointed out that higher inflation tends to lead to higher housing prices.

2.4 Interest Rate

Interest rate (INT) is the cost of borrowing of the assets provided by the creditor to the borrower. Thus, it has a significant impact on the mortgage costs which is the key determinant of property prices. A study by Shi, Jou, & Tripe (2014) found that interest rate is significantly and positively connected to real house prices which suggest that policy rate increases may not be effective in reducing real house prices.

This is contradicted by the findings of few other studies such as Trofimov (2018), Kok (2018), Kamal *et al.* (2016), Guo and Wu (2013), and Tan (2010) as it were discovered that there was a negative relationship between interest rate and housing prices. A decrease in interest rate reflects cheaper borrowing costs which would drive up the demand for housing that eventually leads to an increase in housing prices. Similarly, Ibrahim and Law (2014) found that positive interest rate shock negatively affect both housing prices and bank credit.

2.5 Exchange Rate

In principle, the capital market and the foreign exchange market (ER) are interrelated. The return on investment in assets is expected to increase when a home country's exchange rate appreciates. Mahalik & Mallick (2011) found that due to imports and purchasing power efficiency, the exchange rate could have a negative impact on house prices. Generally, if the exchange rate were higher, the cost of raw materials, equipment and labor imports would be decreased hence cost of construction of houses will be lower that can contributes to lower housing prices. Similarly, Glindro (2008) concluded in their research that the real effective appreciation of the exchange rate is expected to have a negative impact on the property market rates.

According to Kok, Ismail, & Lee (2018), the exchange rate could influence the house price through construction costs which means as domestic currency depreciation would result in higher import costs and increase overall construction costs and thus higher house prices. According to Miller et. Al. (1988), they observed a co-movement between the appreciation of Yen against US dollar and housing price. They found that the Japanese buyers accounted for 30% of home sales which demonstrates that foreign investors' investment activity also plays an important role in deciding the price of housing.

3. PROBLEM STATEMENT

Malaysia's house prices continue to rise throughout the years. Majority of Malaysian is unable to afford newly launched houses as the average price of new properties is almost 4.8 times higher than Malaysia's affordable house price of RM282,000 (Bernama, 2019). Thus, getting a house is harder hence raise the possibility of housing surplus, which in turn cause an adverse impact on the economy. Logically, based on economic theory, as supply of houses exceeds demand for houses, gradually housing price would be pushed downward. However, this is not happening accordingly. Therefore, it is the objective of the paper to explore key determinants that cause the housing price to remain excessively expensive despite the existing housing surplus.

4. METHODOLOGY

This study investigates key macroeconomic determinants, which are chosen based on literature reviews, such as gross domestic product (GDP), inflation rate (INF), interest rate (INT) and exchange rate (ER), that affect housing prices (HPI) in Malaysia. The time series data of 30 years between 1989 and 2018 are used (World Bank Database). The identification of the most suitable equation of economic relationship, between the dependent variable and independent variables is conducted through Multiple Regression Analysis using four types of econometric models, namely Linear Model, Power Model, Exponential Model and Logarithmic Model. Diagnostic tests in identifying the problem of multicollinearity and autocorrelation are carried out. The VIF test and Breusch Godfrey (BG) test are used to identify the problem of multicollinearity and autocorrelations respectively. The significant effect of each independent variable in explaining dependent variable is also being assessed based on the selected model. The collected data is analysed using E-Views. Figure 1 presents the theoretical framework between the dependent variable HPI and independent variables GDP, INF, INT and ER.

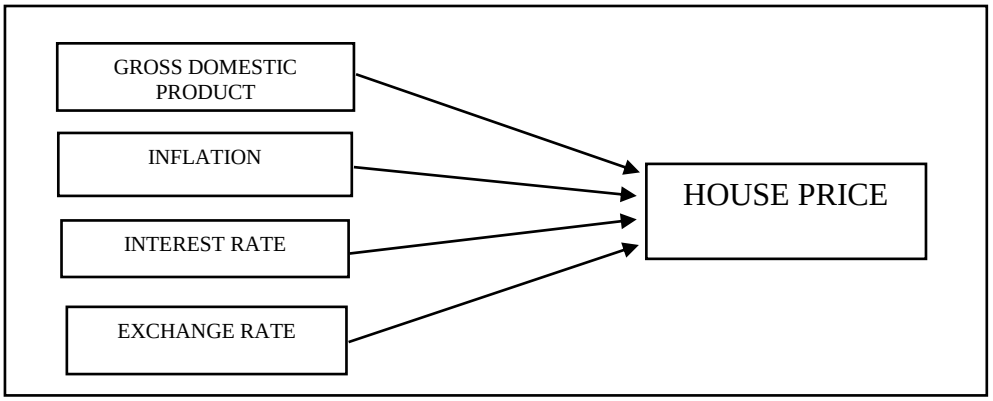

Figure 1: Theoretical Framework

5. FINDING AND DISCUSSION

Table 1 showed the summary results of Ordinary Least Squares (OLS) on the four models. The goodness of fit of the model highlighted the important elements such as coefficient of determination ($R2$), adjusted $R2$ ($\bar{R}$ 2), F-test and t-test in selecting the most appropriate model. Additionally, a diagnostic test to determine whether the problem of multicollinearity and autocorrelation arise were also conducted. The equation of the four proposed models are as below.

Linear Model

$HPI_t = \beta_1 + \beta_2 GDP_t + \beta_3 INT_t + \beta_4 INF_t + \beta_5 ER_t + e_t$ .....Model 1
$HPI_t = -438.342 + 0.021 GDP_t + 17.508\ INT_t - 4.508\ INF_t + 1.924\ ER_t$

Power Model

$\ln HPI_t = \beta_1 + \beta_2 \ln GDP_t + \beta_3 \ln INT_t + \beta_4 \ln INF_t + \beta_5 \ln ER_t + e_t$ ..... Model 2
$\ln HPI_t = -8.267 + 1.152 \ln GDP_t + 0.192 \ln INT_t + 0.014 \ln INF_t + 0.481 \ln ER_t$

Exponential Model

$\ln HPI_t = \beta_1 + \beta_2\ GDP_t + \beta_3\ INT_t\ \beta_4 INF_t + \beta_5 ER_t + e_t$ .....Model 3
$\ln HPI_t = 4.026 + 0.00005 GDP_t + 0.044 INT_t - 0.012 INF_t + 0.004\ ER_t$

Logarithmic Model

$HPI_t = \beta_1 + \beta_2 \ln GDP_t + \beta_3 \ln INT_t + \beta_4 \ln INF_t + \beta_5 \ln ER_t + e_t$ ..... Model 4
$HPI_t = -4988.476 + 441.524 \ln GDP_t + 48.091 \ln INT_t + 9.986 \ln INF_t + 179.688 \ln ER_t$

5.1 Comparison of Economic Models

The detail information of all four proposed models are being presented by Table 1 below. Model 3 (Exponential Model) is the most suitable model for the 1989-2018 data, as it fulfills the main criteria of highest values of R^2 (0.946921) and $\bar{R}^2$ (0.938428). Therefore, the Exponential Model is selected to be the 'best model' that represents the economic relationship for the macroeconomic determinants of housing price that is being explored.

Table 1: Summary of OLS Results on the Four Models

IV \ Model		Model 1 (Linear Model)	Model 2 (Power Model)	Model 3 (Exponential Model)	Model 4 (Logarithmic Model)
P-value of t- statistic (Value in parentheses)	GDP	0.021015 (0.0000) *	1.151687 (0.0000) *	0.000050 (0.0000) *	441.5238 (0.0000) *
	INF	-4.507592 (0.3950)	0.013595 (0.6925)	-0.011552 (0.2914)	9.856427 (0.6027)
	INT	17.50784 (0.0022) *	0.192027 (0.0883)	0.043722 (0.0003) *	48.09091 (0.4272)
	ER	1.924090 (0.0005) *	0.480789 (0.0519)	0.003998 (0.0146) *	179.6883 (0.1780)
R^2		0.930781	0.897389	0.946921	0.828345
$\bar{R}^2$		0.919706	0.880971	0.938428	0.800881
DW		0.548165	0.437049	0.839871	0.243253
F-statistic		84.04363 (0.0000) *	54.65956 (0.0000) *	111.4985 (0.0000) *	30.16035 (0.0000) *
Centered VIF	GDP	4.441915	5.346510	4.449351	5.346510
	INF	1.449351	1.333983	1.449351	1.333983
	INT	4.342920	4.573391	4.342920	4.573391
	ER	2.926807	3.213684	2.926807	3.213684
BG-test		18.14779 (0.0001) *	19.49661 (0.0001) *	12.83129 (0.0016) *	23.67062 (0.0000) *

Note: *Significant at 5% significance level.

5.2 Selected Model (Exponential Model)

Based on Table 2, there is a serial correlation between dependent variable (HPI) and independent variable (GDP) as the correlation coefficient is more than the rule of thumb of 0.8. However, there is no severe multicollinearity in the model as has been validated by VIF test that the values of centered VIF is less than the rule of thumb of 5.

Table 2: Correlation Analysis between Variables and Value of Centred VIF

Variable	ln HPI	GDP	INF	INT	ER	Centered VIF
ln HPI	1.000000	0.938149	-0.235615	-0.654793	-0.645995	-
GDP	0.938149	1.000000	-0.321270	-0.830999	-0.797392	4.441915
INF	-0.235615	-0.321270	1.000000	0.518609	0.349802	1.449351
INT	-0.654793	-0.830999	0.518609	1.000000	0.744025	4.342920
ER	-0.645995	-0.797392	0.349802	0.744025	1.000000	2.926807

The model somehow has autocorrelation issue which is commonly found for time series data. The results of BG test (0.0016) are presented by Table 1, shows that it is significant at 5% level, which means the model has autocorrelation problem. Autocorrelation can be rectified by correcting the standard error. Thus, Newey-West Standard Errors is applied to fix the problem. Newey-West standard errors which have been calculated specifically to avoid the consequences of pure first-order serial correlation, is presented in Table 3.

As the problem of autocorrelation has been rectified, based on Table 3, the model 3 equation can thus be written as:

$$\widehat{\ln HPI}_t = 4.026394 + 0.00005GDP_t - 0.011552INF_t + 0.043722INT_t + 0.003998ER_t$$

Table 3*:* Summary of OLS Regression and Newey-West Errors

	OLS REGRESSION			**NEWEY-WEST STD. ERRORS**		
Variable	**Coef.**	**Std. Error**	**t-stat**	**Coef.**	**Std. Error**	**t- statistic**
C	4.026394	0.227742	17.67962 (0.0000) *	4.026394	0.201937	19.93890 (0.0000) *
GDP	0.00005	0.0000034	14.56266 (0.0000) *	0.00005	0.0000031	15.92111 (0.0000) *
INF	-0.011552	0.010718	-1.077781 (0.2914)	-0.011552	0.012412	-0.930731 (0.3609)
INT	0.043722	0.010561	4.140099 (0.0003) *	0.043722	0.009841	4.443072 (0.0002) *
ER	0.003998	0.001524	2.623637 (0.0146) *	0.003998	0.003998	3.256826 (0.0032) *
R^2			0.946921			
$\bar{R}^2$			0.938428			
DW			0.839871			
F-statistic			111.4985 (0.000000) *			

Note: *Significant at 5% significance level. Values in the parentheses are the p-value

5.3 Coefficients Interpretation Of Selected Model

Based on Model 3, the slope of coefficient for each of the variables can be interpreted accordingly

$$\frac{\delta \ln\hat{HPI}}{\delta\, GDP_t} = 0.00005$$

When the GDP increased by 1 million while holding other variables constant (*ceteris paribus*), the HPI will be increased by 0.00005%.

$$\frac{\delta \ln\hat{HPI}}{\delta\, INF_t} = -0.011552$$

When the INF increased by 1% while holding other variables constant (*ceteris paribus*), the HPI will be increased by 0.012%.

$$\frac{\delta \ln\hat{HPI}}{\delta\, INT_t} = 0.043722$$

When the INT increased by 1% while holding other variables constant (*ceteris paribus*), the HPI will be increased by 0.044%.

$$\frac{\delta \ln \hat{HPI}}{\delta ER_t} = 0.003998$$

When the ER increased by 1% while holding other variables constant (*ceteris paribus*), the HPI will be increased by 0.004%.

Based on the selected model as well, coefficient of determination R^2 = 0.946921 which means about 94.69% of the variation in HPI is explained by the changes in all the independent variables (GDP, INF, INT, ER) as a group. While the adjusted $\bar{R}^2$ = 0.938428 which is interpreted as around 93.84% of the variation in HPI is explained by the changes in all the independent variables (GDP, INF, INT, ER), adjusted for degrees of freedom. The F-test is statistically significant at 5% significance level, at least one of the partial slope coefficients is non-zero. Through the analysis of t-statistic, all the variables except INF are statistically significant with HPI at 5% significance level.

6. CONCLUSION

This research has studied the determinants of housing price in Malaysia for a 30-year period, from 1989 to 2018. The proposed macro economic determinants are GDP, INF, INT, and ER, while the dependent variable is the HPI which acts as a proxy for housing price. The collected data are analyzed by using OLS. A few diagnostic tests are conducted to assess the problems of multicollinearity and autocorrelation. Both t-test and F-test are evaluated to see the significance and the relevancy of all independent variables. The selected Exponential Model has multicollinearity problem but not that severe as the Centered VIF of the variables are less than rule of thumb which is 5. The model is also found to have the autocorrelation problem when the Breusch Godfrey (BG) is used. The application of Newey-West estimator has been used to solve the autocorrelation problem through fixing the standard error. Based on the results, it shows that GDP has a positive relationship with the HPI and is significant at 5 percent level. In fact, GDP is the most significant macroeconomic determinant that explain the fluctuation in housing price in Malaysia. According to Ong (2013), when real GDP rates rise, people are optimistic about the economic situation which leads to an increase in demand for housing and thus push up the housing prices.

The results also show that there is a positive significant relationship between INT and HPI. Higher interest rate suggests a higher housing price. Subsequently, from the demand side, as the cost of borrowing increases, the demand for housing will decrease and eventually it would bring down the housing prices (Gan and Hill, 2009). The same result is noted as far as the ER is concerned. There is a positive and significant relationship between the ER and the HPI. ER may influence the housing market because of the rapid credit expansion through the wealth effect, liquidity effect, expected effect and spillover effect. This has been outlined in the study done by Liu and Zhang (2013). However, with regards to the INF, the result pointed out that it is not a significant determinant and it affects the HPI negatively. Generally, when inflation rate rises, the real value of mortgage repayment will increase. Hence the demand for houses will reduce which consequently will lead to reduction in house prices (Debelle, 2004). In another word, as inflation

decreases, an upward pressure on housing prices would be created as demand for housing is stimulated (Brunnermeier and Julliard, 2008).

In conclusion, the analytical results show that gross domestic product (GDP), interest rate (INT) and exchange rate (ER) are all positively significant macroeconomic variables that explain the volatility of housing prices in Malaysia. However, the inflation rate (INF), which negatively affect the housing price is not a significant variable. For further studies, more macroeconomics variable such as population growth, investment and personal income could be included as independent variables in order to better capture the volatility of housing prices in Malaysia.

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