

A Relationship among Interest Rate, Inflation, Population and House Price Index

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ABSTRACT

The Financial Stability Review Second Half 2021 of Bank Negara Malaysia's (BNM) has reported that the number of unsold houses in Malaysia remained elevated at 180,702 units in the third quarter of 2021 (Q3'21). This has attracted the researcher to explore more on House Price Index (HPI) in Malaysia. HPI measures volatility prices of residential housing in Malaysia over time. The objective of this study is to identify whether there is a relationship among interest rate, inflation rate, population, and house price index in Malaysia by using STATA software. The annual time series data spanning from 2003 to 2021 is used to achieve the objective of this research. The analysis of such times series data was made through the Johansen Test and it was discovered that all explanatory variables were related to HPI in a long run; in which it is negatively related to interest rate, inflation rate and population. However, when the Granger Causality Test was applied to the same time series data, HPI was found to be affected by both the interest and the inflation. Population, on the other hand, does not influence HPI in the short run dynamics. Therefore, it is concluded that most variables used in the study are significant in determining HPI. It is recommended that more independent variables such as real GDP per capita, real domestic credit, construction costs and land supply that can influence HPI should be added for future studies.

Keywords: Housing price index, Population, Interest rate, Inflation

1. Introduction

We have witnessed our economy expansion in second quarter of 2022 by 8.9% as compared to 5% in the first quarter for the same year. The domestic demand is said to be strengthened, aided by relentless recovery in the labour market condition. As Malaysia is moving towards post-pandemic future and the reopening of its international borders, normalization of economic activities has also contributed to the growth of the nation. Still, its export is dominated by electrical and engineering (E&E) products. Its property market, however, recorded more transactions in the first half of 2022 compared to the same period a year before.

In its Budget 2022, Malaysian government has announced several initiatives to improve the property market activities by allocating RM1.5 billion just for low-income group housing projects (Rumah Mersa Rakyat), lifting the imposition of Real Property Gains Tax and assisting farmers, gig and small enterprises workers as well as those who are ingenuities to obtain their home financing by

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adding another RM2 billion guarantees scheme via Skim Jaminan Kredit Perumahan (SJKP). Such scheme is one of the schemes and campaigns introduced by the Malaysian government in its continuous effort to promote house ownership for its citizens. The scheme is introduced to mitigate the problem faced by the mentioned group. For academic purposes, there is a theory of economic that states that the house price appears to be different in certain regional demographic and regional economics [1]. Thus, the housing sector has become an important aspect especially for the small economic nation with high density of population [2]. This significance was clearly disclosed within the contributed value to the nation income by sub-sectors for the second half of 2022 as shown in Figure 1.

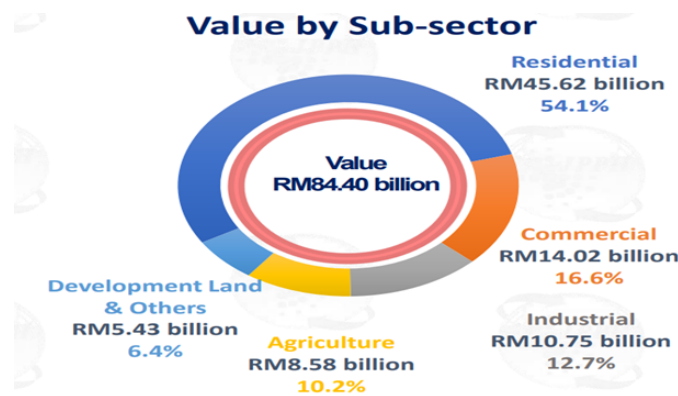


Fig. 1. Property market activity, second half of 2022
 Source : National property information Centre (NAPIC)

Figure 1 indicates that residential sector has contributed 54.1% or RM45.62 billion to the property market while agriculture represents only 10.2% or RM8.58 billion of RM84.40 billion total value for the second half of 2022.

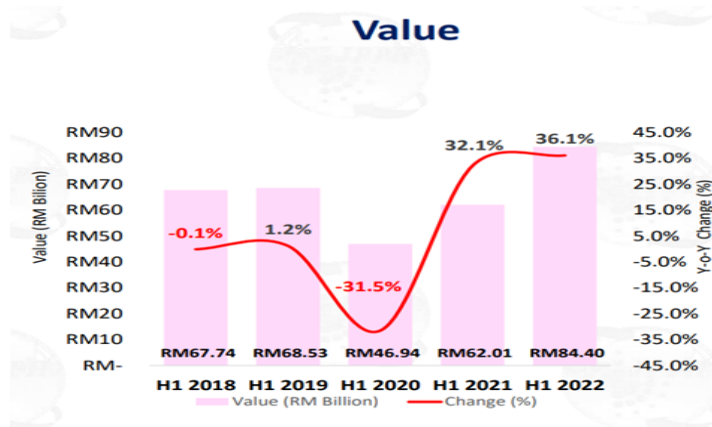


Fig. 2. Trend of property market activity in Ringgit value
 Source : National property information Centre (NAPIC)

Thus, Figure 2 indicates the upward trend of the property market since second half of 2020 regardless of that the drop by 31.5% in the first half year of 2020 which is be due to COVID-19 pandemic. However, the value has subsequently increased to RM84.40 billion or 36.1% in 2022.

Continuous increment of house pricing in Malaysia gives negative impact to those with lower income who cannot afford to buy a house. As a result, the demand for available houses in the market

becomes low. This is supported by Bank Negara Malaysia throughout its report on the financial stability of the nation for the second half period of 2021. The report recorded that there were 180,702 units of unsold houses identified in the third quarter of 2021 compared to 181,462 unsold units in the second quarter of that year. Overhang units contributed to 31.4% while another 68.6% are units under construction and such units become one of the reasons that contributed to the great volume of unsold properties. Besides, unaffordable price is another reason for such houses unable to be sold since they were mainly priced above RM300,000.00 per unit [3]. Both unsold houses and low demands for them resulted in unsustainable economic growth since the government of Malaysia unable to obtain a yield from property purchases.

Besides having least opportunity to buy their own houses because of the demanding prices, another negative impact to these people is they will be forced to become forever renters. Since possessing house is now becoming an alarming issue, it is, therefore, very crucial to investigate possible macroeconomic factors that influence the housing price. The findings of this study are crucial as it can give a sense to industry player and authorities to plan their future action. Therefore, the study is conducted to examine a relationship among interest rate, inflation, population and HPI in Malaysia and its significance. The research questions for this study are:

- i. Is there any relationship among interest rate, inflation, population and HPI in Malaysia?
- ii. What is the most significant factor that influenced HPI in Malaysia?

Reflecting the research questions of this study, the research objectives are:

- i. To find out whether there is relationship among interest rate, inflation, population and HPI in Malaysia.
- ii. To identify the most significant factor that affects HPI in Malaysia.

Thus, all the data gathered will be categorized as dependent and independent and process is explained in next chapter.

2. Literature Review

2.1 House Price Index (HPI)

The issues pertaining to the continuous increment in the property price in has always been a major concern among the property investors, the buyers and the government of Malaysia. Since HPI is the dependent variable for this study, prior findings about it were referred to the previous studies performed. According to [4], it is recommended that HPI to be determined based on the existed interaction between supply and demand by consumer on particular goods and services. In contrast, Lossifov. et al [5] stated that the determinants for residential housing prices are inclusive of household income and wealth, the rate of unemployment, short-term and long-term interest rates, inflation, return on other assets, availability and terms of mortgages financing, tax incentives and demographic factors meanwhile Farkas [6] claimed that the responsiveness factors of the volatility of house prices are likely to be income or interest rates and demographic change.

2.2 Interest Rate (IR)

Real interest rate is the lending interest rate that is adjusted for inflation as measured by the GDP deflator is one of the indicators of house price. The information on real interest rate is retrieved from World Bank: World Indicator 2022 [7]. According to [8], IR was determined to have positive

relationship with HPI by using panel data. It was found that whenever the IR increased, HPI was found to increase simultaneously. Furthermore, the empirical result of the study conducted by [8] showed that IR was determined to have positive impact on house prices based on the analysis conducted to quarterly data. The finding on IR by Tupenaite *et al.* [9], were similar to the findings of the study performed by [8], which both arrived at a conclusion that there was a significant relationship between IR and the house price. Ting [10] found the similar finding as others about the positive relationship between the IR and the house price.

2.3 Inflation (INF)

Inflation is measured by the annual growth rate of the GDP implicit. The was a study conducted by [11] who examined the housing price volatility for eight capital cities in Australia over the period of 1987 to 2007. She came out with finding that showed a positive significant relationship between INF and the housing price volatility in Australia. Another study was conducted by [12] who examined the housing price volatility for six European countries namely France, Germany, Sweden, Greece Italy and the UK over the period of 1996 to 2019. He found that there was a positive significant relationship between INF and the housing price volatility in those countries. The same finding goes to [13] who revealed the same finding and trend that there is positive relationship between INF and the house price volatility in three urban areas of Malaysia.

2.4 Population (POP)

Throughout this study, it is expected that population (POP) becomes the key indicator that will affect the house price in Malaysia. This was made based on the empirical work completed by [1] who studied the relationship between macroeconomic variables and housing price and she claimed that there was a significant positive effect between those two variables. Her study was conducted in Malaysia based on monthly basis of the period of 2001 to 2010. Throughout it, she concluded that the increased number of POP in Malaysia led to an increasing housing demand resulted in higher housing price nationwide. Another study conducted by [4] who made analysis based on the data obtained from the first quarter of 2005 until the fourth quarter of 2013 and he too, confirmed that population does significantly influence the house prices in Malaysia.

Since the study aims to look for any relationship existed among the interest rate, inflation, population and HPI in Malaysia, therefore, these three hypotheses are developed to be tested throughout this study:

- i. Hypothesis 1 :
H0 : There is significant relationship between Interest Rates (IR) and HPI.
H1 : There is insignificant relationship between Interest Rates (IR) and HPI.
- ii. Hypothesis 2 :
H0 : There is significant relationship between Inflation (INF) and HPI.
H1 : There is insignificant relationship between Inflation (INF) and HPI.
- iii. Hypothesis 3 :
H0 : There is significant relationship between Population (POP) and HPI.
H1: There is insignificant relationship between Population (POP) and House Price HPI.

3. Methodology

Secondary data is utilized in this study so that it can be analysed statistically. The dependent variable is HPI and the independent variables are inclusive of the IR, the INF, and the POP of Malaysia. This study tested on how those independent variables would impact the dependent variable. Since data collection method of time series data was employed for the purpose of the study, the annual data ranged from 2003 to 2021 were obtained to be for the analysis. All the data inserted on yearly basis which include the dependent variable in lin-lin model processed using STATA 10 software. The lin-lin model was used as estimated coefficient to explain of each independent variable. The series of two-tails T-test at 1%, 5% and 10% level of significant were assessed on each independent variable. Furthermore, secondary data such as journals, articles, websites, and other relevant secondary data will also be applied in this study. After the model has been justified, the relationship between each independent variable and dependent were explained based on the coefficient value estimated from the region.

3.1 Model Estimation

The estimation can be explained by the relationship between the dependent variable and the independent variables which is :

$$\text{HPI} = \alpha + \beta_1 \text{INT} + \beta_2 \text{INF} + \beta_4 \text{POP} + \varepsilon$$

Equation descriptions are as follows:

HPI= House Price Index

IR = Interest Rate

INF= Inflation

POP = Population

α = constant variables

β = beta coefficient of the independent variables

ε = error terms

Hypothesis 1 : (HPI and Interest)

Ho There is relationship between interest rate

To achieve the objective, several test will be tabled such as descriptive statistics, augmented Dickey–Fuller (ADF) root test,

4. Results

Descriptive statistics are used to describe the basic features of the data obtained for the study. The statistics provide summaries about the sample and the measures. Together with simple graphics analysis, it forms the basis of virtually every quantitative data analysis.

Table 1 shows the detail of the descriptive statistics of this study. The statistics is related to HPI with the determinants of Interest Rate, Inflation Rate and Population. This statistic also indicates the maximum, minimum, mean, variance, and coefficient of variation (CV) of the study. Thus, the table indicates that the coefficient of variation (CV) is a normalized measure of dispersion of a probability distribution. The CV for both HPI and POP is 0.284265 and 0.1609501 respectively. It means that both

variables have less variability. However, those two generate higher consistency and stability. Meanwhile, the CV for inflation rate is 0.8966672. It indicated that both the interest and the inflation rate have higher variation than house price index and population, thus generate lower consistency and stability. The common rule is the higher the CV, the greater the dispersion in the variable.

Table 1
 The Descriptive Statistics of HPI, IR, INF and POP

stats	hpi	interest	Inflation	Population
max	216.8	12.9	10.2083	5.380651
min	92.2	-3.9	-6.6633	3.226372
mean	137.0696	4.165217	3.784822	4.347826
cv	.284265	.8817253	.8966672	.1609501
variance	1518.2	13.48783	11.51737	.4896966

The Unit Root Test was also conducted in this study in observing the stationary status of each series of variables.

Table 2
 The Unit Root Test on House Price Index

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. dfuller hpi
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pickey-Fuller test for unit root					Number of obs = 19
----- Interpolated pickey- Fuller -----					
	Test	1% Critical	5% Critical	10% Critical	
	Statistic	Value	Value	Value	
z(t)	-1.655	-3.750	-3.000	-2.630	
Mackinnon approximate p-value for z(t) = 0.4542					

Based on Table 2, the Mackinnon approximate p-value for Z(t) for HPI is more than 5% significance level. It means that the null hypothesis of unit root test cannot be rejected, and the alternate hypothesis (H_1) can be rejected. Therefore;

- H_0 : HPI is not stationary at 5% significance level
- H_1 : HPI stationary at 5% significance level

Table 3
 ADF Unit Root Test on Interest Rate

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. dfuller interest
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pickey-Fuller test for unit root					Number of obs = 19
----- Interpolated pickey- Fuller -----					
	Test	1% Critical	5% Critical	10% Critical	
	Statistic	Value	Value	Value	
z(t)	-6.180	-3.750	-3.000	-2.630	
Mackinnon approximate p-value for z(t) = 0.000					

Refer to Table 3, since interest is less than 5% significance level, it means that the null hypothesis of the unit root is rejected and go for H_1 which is interest is stationary at 5% significance level.

- H_0 : Interest is not stationary at 5% significance level

H₁: Interest stationary at 5% significance level

Table 4
 ADF Unit Root Test on Inflation Rate

. dfuller inflation				
pickey-Fuller test for unit root				
Number of obs = 19				
----- Interpolated pickey- Fuller -----				
	Test	1% Critical	5% Critical	10% Critical
	Statistic	Value	Value	Value
z(t)	-8.078	-3.750	-3.000	-2.630
Mackinnon approximate p-value for z(t) = 0.000				

Table 4 described while inflation is less than 5% significance level means that the null hypothesis of the unit root is ejected and go for H₁ which is inflation is stationary at 5% significance level.

H₀: Inflation is not stationary at 5% significance level

H₁: Inflation stationary at 5% significance level

Table 5
 ADF Unit Root Test on Population

. dfuller population				
pickey-Fuller test for unit root				
Number of obs = 19				
----- Interpolated pickey- Fuller -----				
	Test	1% Critical	5% Critical	10% Critical
	Statistic	Value	Value	Value
z(t)	-1.246	-3.750	-3.000	-2.630
Mackinnon approximate p-value for z(t) = 0.6536				

Based on Table 5, the Mackinnon approximate p-value for Z(t) for population is more than 5% significance level. It means the null hypothesis of unit root test cannot be rejected and the alternate hypothesis (H₁) can be rejected.

H₀: Population is not stationary at 5% significance level

H₁: Population stationary at 5% significance level

Table 6
 Johansen Test for Cointegration

Johansen Test for Cointegration						
Trend : constant						Number of obs = 20
Sample: 2003 - 2021						Lags = 3
maximum				trace	5%	
rank	parms	LL	eigenvalue	statistic	Critical	value
0	36	-103.18355	-	83.3187	47.21	
1	43	-77.708569	0.92172	32.3687	29.68	
2	48	-66.507274	0.67376	9.9661*	15.41	
3	51	-63.298633	0.27448	3.5488	3.76	
4	52	-61.524212	0.16259			

The table 6 above shows the results of the Johansen Cointegration Test based on the maximum eigenvalue and trace statistics. The value of trace statistics is smaller than 5% critical value when r is two (2). It implies that two cointegrating relations exist between all variables. Indirectly, it means that house price index and other explanatory variables in the model move closely to achieve the long

run equilibrium. It is important to identify the relationship between dependent variables with independent variables. Nevertheless, we will proceed to estimate the VECM model.

Table 7
 Vector Error Correction Model (VECM) Estimation

Cointegrating equations						
equation		Parms	Chi2	P>chi2		
_cel		3	783.1845	0.0000		
Identification : beta is exactly identified						
Johansen normalization restriction imposed						
	beta	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
_cel	hpi	1
	interest	-46.55407	1.8885993	-24.68	0.000	-50.25055 -42.85759
	inflation	-58.80435	2.356728	-24.95	0.000	-63.42345 -54.18525
	population	-89.99009	4.799168	-18.75	0.000	-99.39629 -80.58389
	_cons	737.0189

As Table 7, the long run relationship between interest rate, inflation rate and population for two cointegrating vector for the Malaysia in the period 2003-2021 is displayed below (standard errors are displayed in parenthesis)

$$HPI = 737.0189 - 46.55407 (\text{Interest}) - 58.80435 (\text{Inflation}) - 89.99009 (\text{Population})$$

In the long run, 1 unit increment in interest will decrease the HPI of 46.55407 units. This negative relationship found between interest rate with HPI is supported by [14] who prove that real interest rate and house price is negative correlation. It is consistent with the economic theory that indicates HPI will be decreased whenever the interest rate is increased and vice versa. Nowadays, Malaysians buy houses only when they found out that the interest rate is low, and the monthly commitment is manageable. This happens since Malaysians who wanted to buy a house need to apply a housing loan from a bank in order to do so. However, in the end, they chose not to buy the house they preferred since they found that the bank charged them with higher interest on the financing loan, they made even though the HPI is declined. They would rather rent a house for their family instead of paying monthly instalment.

From the above table, the result of interest is significant on HPI in the long run relationship. It means the null hypothesis of unit root test can be rejected and go for alternate hypothesis.

Based on Table 8, this test is used to test the autocorrelation test. According to [15], autocorrelation refers to the correlation of a time series with its own past and future values. Autocorrelation too, sometimes is referred as 'lagged correlation'; a correlation between members of a series of numbers arranged in time. Table 3.8 shows the results of the autocorrelation. It is stated that there is no autocorrelation at lag order. The null hypothesis cannot be rejected and H1 can be rejected.

H₀ : There is no autocorrelation problem at lag order

H₁ : There is an autocorrelation problem at lag order

Table 8
 Normality and Stability Test
 Lagrange – multiplier test

Lag	Chi2	Df	Prob > chi2
1	11.4491	16	0.78096
2	21.3142	16	0.16675
3	18.3469	16	0.30398
4	23.1759	16	0.10911
5	19.7135	16	0.23340
6	21.7815	16	0.15039
7	17.2791	16	0.36776
8	14.6779	16	0.54834
9	8.4827	16	0.93318
10	13.5771	16	0.63019

Ho : no autocorrelation at lag order

Table 9
 Granger Causality Test

(1) [D_hpi] LD.interest = 0
(2) [D_hpi] L2D.interest = 0
Chi2 (2) = 23.74
Prob > chi2 = 0.0000
(1) [D_hpi] LD.inflation = 0
(2) [D_hpi] L2D.inflation = 0
Chi2 (2) = 24.74
Prob > chi2 = 0.0000
(1) [D_hpi] LD.population = 0
(2) [D_hpi] L2D.population = 0
Chi2 (2) = 24.74
Prob > chi2 = 0.3918

The Granger causality test is a statistical hypothesis test conducted in determining whether one time series is useful in forecasting another. Table 9 indicates that interest does influence HPI. The null hypothesis can be rejected and go for alternate hypothesis. This is because the p-value is significant at five percent (5%) of the significance level. Therefore, interest and HPI in Malaysia do have significant influence on each other. Apart from that, it also proven that inflation influences HPI since the p-value is 0.000. The null hypothesis can be rejected and go for alternative hypothesis. The result of the test on the influence of POP and HPI also shows that the computed p-value is more than 5% significance level, meaning that null hypothesis cannot be rejected and reject H_1 hypothesis.

4. Conclusions

The findings of this study show that all its independents' variables are significance at 5% significance level with house price index in Malaysia. Therefore, the study clarifies that interest rate; inflation rate and population are the most important variables that can explain differences occur in house price index. Those variables too, were found to affect give the property price volatility since the house price index will be decrease when interest rate is increased and vice versa. It can be concluded that interest rate is the most important variable that can influence the volatility of house price index since the index will be increased when inflation rate is increased. However, the findings of the study too show that they do follow the economy theory It is because an increasing inflation rate decreases people's incentive to invest in real estate, which in turn decreases housing demand. Moreover, population growth is widely viewed to be an important driver of house prices since high population growth rates lead to increment in house prices [16] The result, however, is not consistent with the economic theory. This is because the number of households in a country tend to change when its citizens decided to immigrate to other countries due to their job's requirement. In return, this decreases the housing demand and; thus, the housing price as well. Furthermore, the period of the study which cover only 18 years plus covid-19 pandemic is believed to have an influence the finding. Thus, it can be concluded that there is negative relationship among interest rate, inflation rate, population and house price index in Malaysia in the long run. In addition, it is believed that there are other uncovered factors that may also affect house price index in Malaysia in different manners.

Hence, it has recommended for future researchers to include other independent variables such as real GDP per capital, real domestic credit, construction costs and land supply that can influence the house price index in Malaysia. The researcher should choose variables that are following with the economic theory and the result is recommended to be significant. In this study, the researchers used annually data. For improvement to future researcher, they can use data in weekly and monthly basis for more accurate data. It is recommended for government to extend the existing programme to target income group and at the same time the citizen should grab the support with truthful.

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