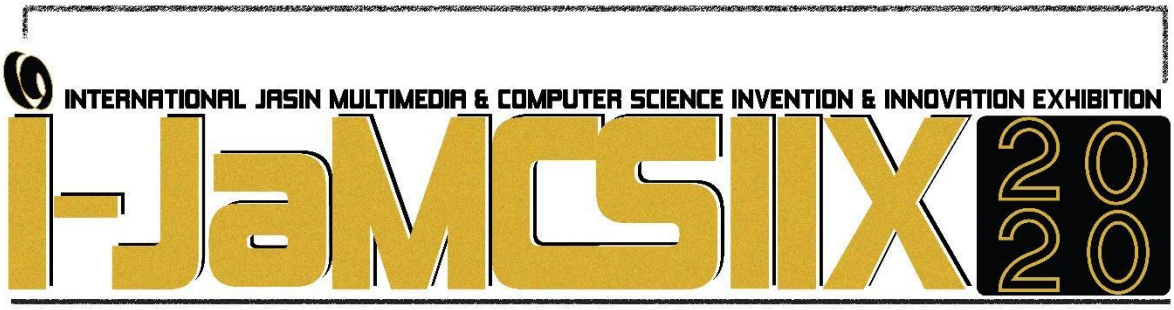

Modelling of Malaysia House Price Index

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ABSTRACT

In Malaysia, house price is considered high at a certain part of the country causing the lower and middle groupsunable to purchase a house. The aim of this study is to study the trend of the House Price Index and to identify the suitable model of the Malaysia House Price Index. The data was obtained from the Valuation and Property Services department (JPPH), Department of Statistics Malaysia and Bank Negara. The data was collected over 10 years from 2010 to the first quarter of 2019. Box-Jenkins methodology is applied in determining the best Autoregressive Integrated Moving Average (ARIMA) model of the House Price Index (HPI) in Malaysia. The general finding of this study is that the HPI shows an upward trend for the past nine years but slightly drops in the first quarter of 2019. This study has found out that ARIMA (1,2,1) is the best model for the HPI since it has the smallest value of AIC, BIC and Hannan-Quinn.

KEYWORDS: House Price Index, Stationary, Box-Jenkins, ARIMA

1 INTRODUCTION

House is one of the important elements in basic human needs. However, one will consider the price of a house before purchasing it. This scenario happens because the offered price of a house is too expensive to be afforded by an average person. For that reason, some individuals and families choose to rent a house instead of buying a house since it will cost less. Consequently, many ready-made houses are not sold. According to [1], the price of residential properties is expected to continue to deteriorate over the next one to two years following the dumping of the unsold house in Malaysia which now stands at RM29.47 billion. As a result, the developer will suffer a loss since there are no home buyers. In a study done by [3], stated that the Malaysian housing market is overpriced as a result of fragmented and inefficient construction business systems. The government has taken an initiative by lowering the house price to reduce the number of unsold houses but the house price is still above the affordability of the low class and the middle class of household income level in some states such as Kuala Lumpur, Selangor, Sabah, Sarawak, and Penang. In order to help Malaysians to own a house, the sixth Prime Minister Datuk Seri Najib Tun Razak launched housing programs to help Malaysians solve this crisis as stated in the journal "Exploring the Elements of Housing Price in Malaysia", [2].

Moreover, the rapid development of Malaysia also contributes to the house price. Thus, the supply for the construction will also rise proportionately to the development of Malaysia. Forecasting price index would enable users to make important and appropriate decision to reduce the risk of loss. Therefore, the purpose of this study is to determine the best model of HPI in Malaysia.

2 OBJECTIVE

The objectives of this study are to study the trend of the House Price Index in Malaysia and to determine the best ARIMA model of HPI in Malaysia.

3 SIGNIFICANCE (S)

This study will give beneficial information for investors, home buyers and housing developers. As for the investors, a better investment plan that involves fluctuations of the Malaysian house pricing index can be done. The home buyers will make the right decision to reduce the risk of loss contributing to house prices. Thus a future planning can be made on the budget so that the buyer can afford to buy a house. As for the housing developers, the price of a house by considering a few factors that have a significant cost can be set.

4 METHODOLOGY/TECHNIQUE

4.1 Box-Jenkins Methodology

Box-Jenkins method is a widely-used process to find out the best model for a time series data. The Box-Jenkins approach is identical to the general ARIMA modeling. This method is used to fulfil the second objective which is to determine the best ARIMA model of HPI in Malaysia. The term ARIMA is in the short stands for the combination that comprises the Autoregressive Integrated Moving Average, model. The Box-Jenkins method is referred to as a stochastic and iterative process to select a standard statistical model. The three main stages of Box-Jenkins modelling are model identification, model estimation and diagnostic testing, and model application.

5 RESULT

5.1 The Overall Trend of House Price Index in Malaysia

This section presents the overall trend of Malaysia HPI from the first quarter of 2010 to the first quarter of 2019.

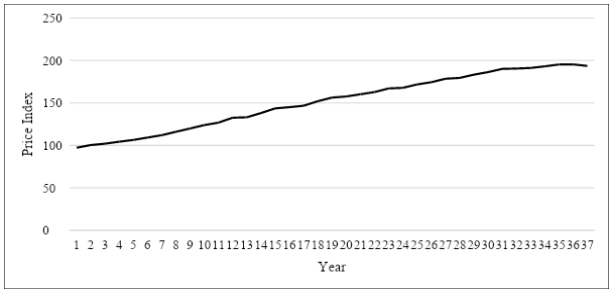

Fig. 1 Graph of Malaysia House Price Index (HPI)

Based on Fig. 1, the HPI shows an upward trend with a significant increase in HPI between 2010 and 2018. However, the HPI fell slightly in the first quarter of 2019. This also has been stated in The Star (2019) where HPI for the first quarter of 2019 dropped by 0.9 percent on a quarter-on-quarter (q-o-q) basis.

5.2 The Box-Jenkins Methodology

Before acquiring ARIMA (p, d, q) model, the p of AR, d (number of differencing) and also q of MA needs to be deduced. The 'd' in the ARIMA model can be obtained by performing the Unit Root Test (Table 1). Meanwhile, the p and q value can be obtained from the correlogram by identifying the AR in the partial correlation column and MA in the autocorrelation column.

Table 1: Unit Root Test after second differencing

Null Hypothesis: D(HOUSE_PRICE_INDEX,2) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.359388	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Firstly, the unit root test at level is conducted but HPI is not stationary. The application of the Box-Jenkins methodology lies in the assumption that the data series is stationary. To be specific, stationarity means no growth or decline over time. As a result, the HPI variable is integrated into the first differencing and unit root test is applied. However, HPI still not stationary. Table 1 shows that the HPI is stationary at second differencing. As the probability shows that 0.0000 is less than level of significance which is 5%, this explained the data is stationary and there is no unit root detected in the data.

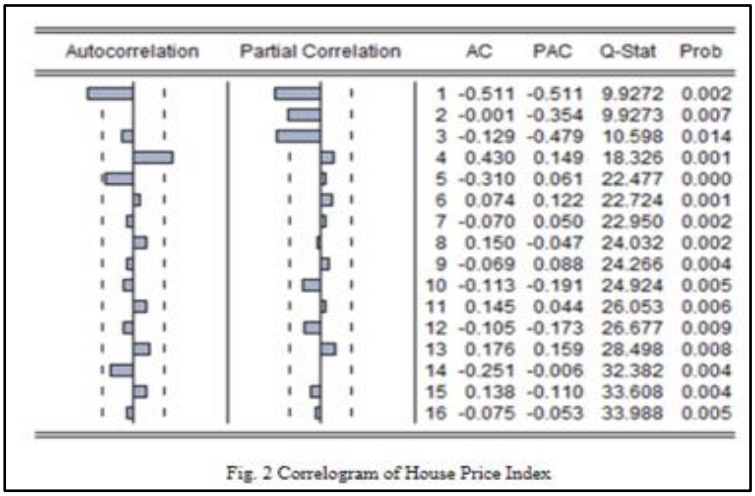

Fig. 2 Correlogram of House Price Index

Fig. 2 shows the correlogram of the HPI variable up to 16 lags. The data is not stationary at level phase and also after the first differencing phase. Therefore, the data is then proceeding to second differencing. From Fig. 2, ACF and PACF refer to the column label autocorrelation and partial correlation respectively. It shows that ACF and PACF have significant spikes. Based on the PACF column, three significant spikes are seen at lag 1, 2 and 3. Therefore, AR is 3. For the ACF column, two significant spikes present at lag 1 and 4 hence it can be concluded

that MA is 2. There are five ARIMA models that are obtained from the correlogram which are ARIMA (3,2,2), ARIMA (2,2,2), ARIMA (1,2,1), ARIMA (2,2,1), and ARIMA (1,2,2).

Based on Table 2, the results show a summary of the five ARIMA models. A process to choose which model is the best need to be conducted. The process is done by comparing the AIC (Akaike's Information Criteria), BIC (Bayesian Information Criterion) and Hannan-Quinn Criterion. AIC, BIC and Hannan-Quinn criterion are important elements in choosing the best value of p and q where all the criterion's value needs to be the smallest out of all the models shown in Table 2. From the table, the smallest AIC is ARIMA (1,2,1) where the value is 4.0353. For BIC and Hannan-Quinn, the smallest value is 4.1686 and 4.0813 respectively. Both values are from the ARIMA (1,2,1) model.

Table 2 Summary of ARIMA model

Model	AIC	BIC	Hannan-Quinn
ARIMA (3,2,2)	4.5952	4.7285	4.6412
ARIMA (2,2,2)	4.5674	4.7007	4.6134
ARIMA (1,2,1)	**4.0353**	**4.1686**	**4.0813**
ARIMA (2,2,1)	4.0570	4.1903	4.1030
ARIMA (1,2,2)	4.0428	4.1761	4.0888

6 CONCLUSION

This study employed Box-Jenkins method to produce housing price prediction model in Malaysia. The analysis has shown that ARIMA (1,2,1) is chosen as the best model to predict Malaysia HPI since the values of AIC, BIC and Hannan-Quinn is the smallest among all five models. For further research, it is recommended to include independent variables such as household income, consumer price index and type of house to produce highly accurate results.

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