MODELLING MALAYSIAN GOLD PRICES USING BOX-JENKINS APPROACH

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CONTENTS

Introduction

- Nowadays, gold is an excellent choice of investment for many reasons. It can be used as a hedge against inflation, the function of money and it will always be valuable because of rarity. The Malaysian Kijang Emas is Malaysia's official gold bullion coin, and it is an alternative form of investment.

- The gold bullion coins come in three sizes; 1 oz, ½ oz and ¼ oz. Price movement for gold is determined by the international gold market.

Objectives

The objectives of this study are:

1. To describe the trend of Kijang Emas prices.
2. To find the best-fitted model to forecast the Kijang Emas prices.

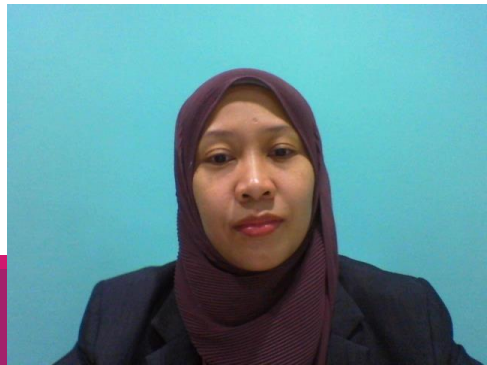
Literature Review

- According to Choong et al. (2012) gold is one of the best ways to save for the future and prepare for the worst. Some people are making money by buying gold at a low price and selling it later at a higher price.
- Tripathy and Naliniprava (2017) mentioned that one of the widely used models for predicting the gold price nowadays is the ARIMA model by assuming the future values of time series have a functional relationship with current and past values.
- Guha and Bandyopadhyay (2016) also use the Box-Jenkins method to predict the future values of gold prices. The estimated ARIMA models, which is ARIMA (1,1,1) and ARIMA (0,1,1) are selected. The result showed that ARIMA (1,1,1) was selected as the best model because it has the lowest value of AIC and BIC.
- Ali et al. (2016) found that, both models for ARIMA (0,1,1) and (1,1,0) have very close values of AIC and BIC to each other after model estimation. As a result, ARIMA (0,1,1) is more appr model than ARIMA (1,1,0) by comparing the values of MAE, MAPE and RMSE.

Methodology

- Data Description

This data is available on the Central Bank of Malaysia (BNM) website. This study focuses on the buying price of bullion coin Kijang Emas for 1 troy ounce collected in daily terms starting from 1st September 2016 until 30th September 2020.



Box-Jenkins Methodology

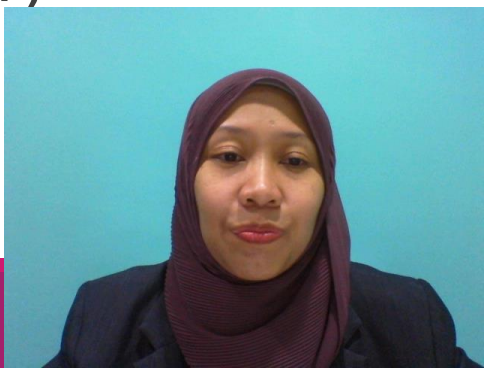
- Autoregressive Integrated Moving Average (ARIMA) model.

A simple model case ARIMA (p,d,q) can be written as,

$$w_t = \mu + \emptyset_1 w_{t-1} + \cdots + \emptyset_p w_{t-p} - \theta_1 \varepsilon_{t-1} - \cdots - \theta_q \varepsilon_{t-q} + \varepsilon_t$$

where,

- p is the number of significant spikes in the Partial Correlation Function (PACF)
- *d* denotes the number of times the variable buying prices need to be differenced to achieve stationary.
- q is the number of significant spikes in the Autocorrelation Function (ACF)



Results and Discussion

- The Overall Trend of Kijang Emas Gold Bullion Coins

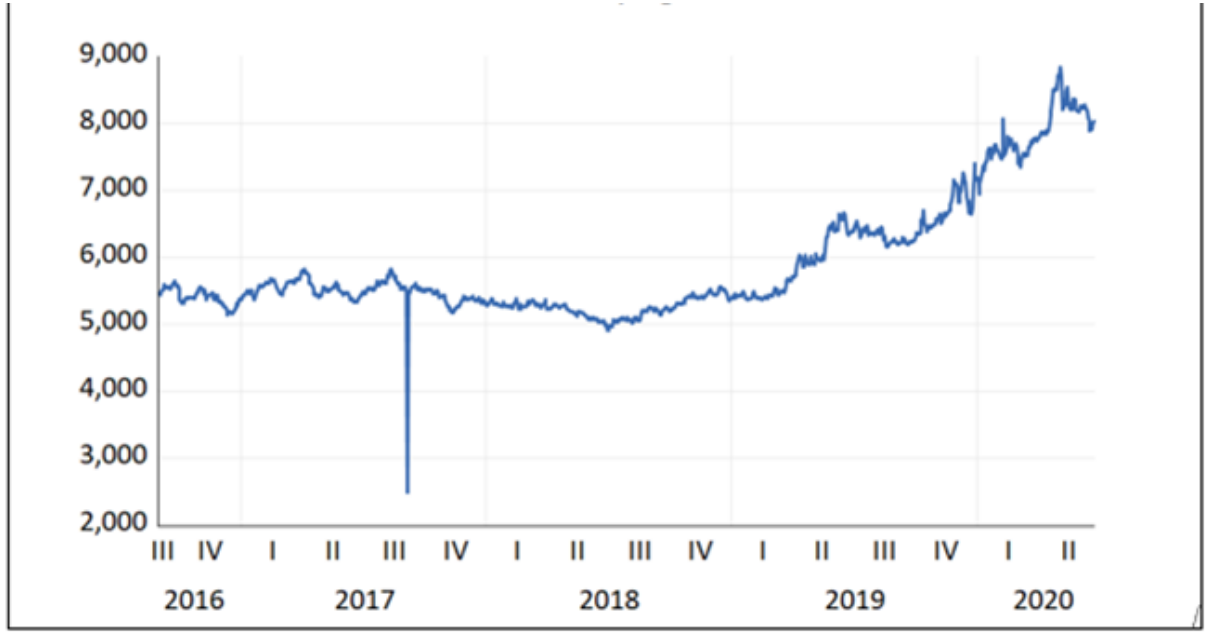


Figure 1: Historical Plot of Buying Price of Kijang Emas Bullion Gold Coins

The graph indicates an upward trend over the four years which began a steady climb in 2019 to 2020 for Kijang Emas. The average 1 troy ounce gold price is RM 5404 in 2016 and jumped to RM 7492 in 2020.

Results and Discussion

- Analysis of ARIMA (p, d, q) Model

The application of the Box-Jenkins lies in the assumption that the data series is stationary.

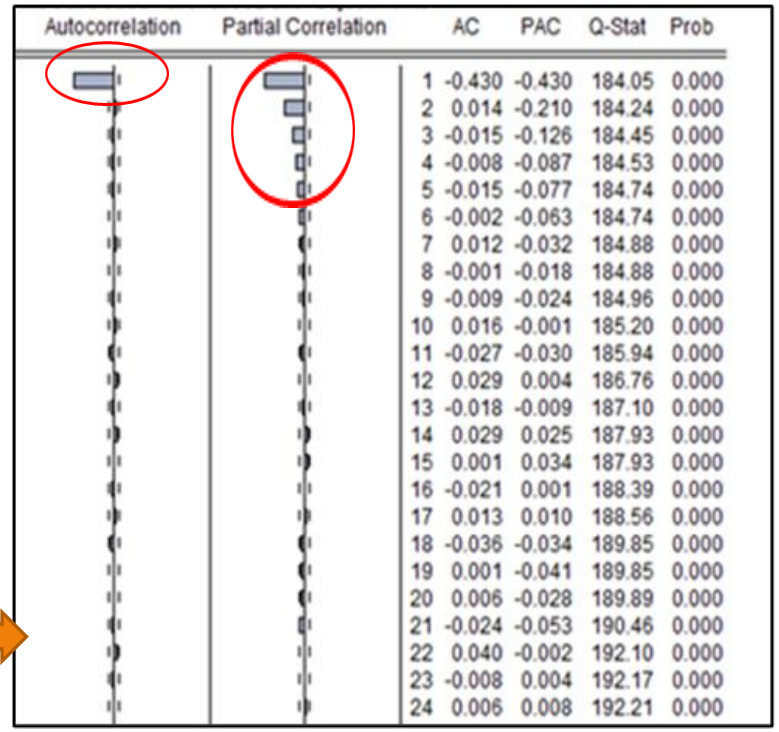
Table 1: The Unit Root Test of Actual Series

	t-Statistic	Probability value
Augmented Dickey-Fuller test statistic	-1.435817	0.8501

Table 2: The Unit Root Test After First Order Differencing

	t-Statistic	Probability value
Augmented Dickey-Fuller test statistic	-21.79584	0.0000

After the data is stationary, the order of d = 1 for the ARIMA (p, 1, q) model. The order of p and q are chosen based on observing the lags of PACF and ACF, respectively.



	AC	PAC	Q-Stat	Prob
1	-0.430	-0.430	184.05	0.000
2	0.014	-0.210	184.24	0.000
3	-0.015	-0.126	184.45	0.000
4	-0.008	-0.087	184.53	0.000
5	-0.015	-0.077	184.74	0.000
6	-0.002	-0.063	184.74	0.000
7	0.012	-0.032	184.88	0.000
8	-0.001	-0.018	184.88	0.000
9	-0.009	-0.024	184.96	0.000
10	0.016	-0.001	185.20	0.000
11	-0.027	-0.030	185.94	0.000
12	0.029	0.004	186.76	0.000
13	-0.018	-0.009	187.10	0.000
14	0.029	0.025	187.93	0.000
15	0.001	0.034	187.93	0.000
16	-0.021	0.001	188.39	0.000
17	0.013	0.010	188.56	0.000
18	-0.036	-0.034	189.85	0.000
19	0.001	-0.041	189.85	0.000
20	0.006	-0.028	189.89	0.000
21	-0.024	-0.053	190.46	0.000
22	0.040	-0.002	192.10	0.000
23	-0.008	0.004	192.17	0.000
24	0.006	0.008	192.21	0.000

Results and Discussion

Five models have been identified and estimated using EViews software.

Table 4: The AIC and BIC of the ARIMA Model

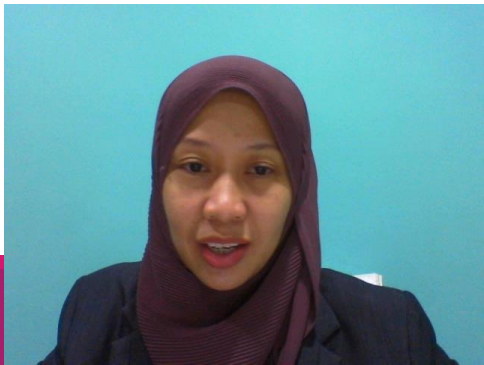
Model	Akaike Info Criterion (AIC)	Bayesian Information Criteria (BIC)
ARIMA (1,1,1)	12452.44	12467.15
ARIMA (2,1,1)	12452.42	12472.03
ARIMA (3,1,1)	12472.03	12478.78
ARIMA (4,1,1)	12456.22	12485.63
ARIMA (5,1,1)	12457.86	12492.16

Table 5: The RMSE and MAE of the ARIMA Model

ARIMA Model	Root Mean Square Error (RMSE)	Mean Absolute Error (MAE)
ARIMA (1,1,1)	128.2214	50.7927
ARIMA (2,1,1)	128.0901	50.6864

Conclusions

The Kijang Emas price data examined in this study can be characterized with the ARIMA (2,1,1) model. ARIMA (1, 1,1) and ARIMA (2, 1, 1) were selected based on five different model parameters, as it provides the best model that meets all the criteria of the fit statistics. However, the lower value of RMSE and MAE for ARIMA (2,1,1), when compared to that of ARIMA (1,1,1), showed that ARIMA (2,1,1) is the more appropriate model in predicting the future values of Kijang Emas price.



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