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Time series forecasting of stock price of AirAsia Berhad using ARIMA model during COVID- 19

Rakesh Kumar Singh [§]
Vijay Kumar Verma [†]
Magadh University
Gaya
Bihar
India

Nitendra Kumar *
Priyanka Agarwal [‡]
Amity Business School
Amity University
Noida
Uttar Pradesh
India

Sadhana Tiwari [@]
Sharda School of Business Studies
Sharda university
Greater Noida
Uttar Pradesh
India

Abstract

Since the beginning of time, scholars have been interested in developing more precise predictive models because of the significance of stock price prediction in banking and economics. In this study, the price of AirAsia's shares is predicted using the ARIMA model, a time-series analytic tool included in prediction algorithms. The technique of AirAsia's stock price forecasting utilising the ARIMA model is demonstrated in the current study paper. Stock price forecasting using the ARIMA model has been done using historical stock data

[§] *E-mail:* **rakeshsinghdev@gmail.com**
[†] *E-mail:* **verma.vijay017@gmail.com**
* *E-mail:* **nkshukla.kumar4@gmail.com (Corresponding Author)**
[‡] *E-mail:* **pagarwal5@amity.edu**
[@] *E-mail:* **sadhanahi@rediffmail.com**

(July 2021) and it run them under Monte Carlo Simulation from Covid-19. It demonstrates that the ARIMA model's results are more accurate for short-term forecasting and may be supported by current strategies for stock price redaction during COVID-19.

Subject Classification: *68T07.*

Keywords: *Time series analysis, Forecasting, ARIMA model, COVID-19.*

Introduction

The novel coronavirus (COVID-19), which originally emerged from China in December 2019, has infected millions of people worldwide. The COVID-19 virus is extremely infectious and has a large potential for mutation. People with this virus endure severe respiratory problems, and they are more likely to get ill if they have a compromised immune system, a chronic illness like diabetes or cardiovascular disease, or if they are older. On March 11, 2020, the World Health Organisation (WHO) proclaimed the COVID-19 outbreak to be a pandemic. The Auto Regressive Integrated Moving Average (ARIMA) model performs better for short-term prediction than the majority of intricate structural models. Many investors desire to develop any kind of forecasting model that could boost their revenue and lower the risk involved in trading stocks. To predict stock market values, numerous models and techniques have been developed in recent years. This is because it is vital for researchers to adapt and develop any necessary predictive models. This article outlines a detailed process for creating ARIMA models for predicting short-term stock prices. The steps in building an ARIMA predictive model are model identification, parameter estimation, and diagnostic evaluation. Determining whether autoregressive integrated moving averages (ARIMA) may be used to estimate AirAsia Berhad's stock market price index for the COVID-19 period (July 2018 to July 2022) is the purpose of this study. This study will probably inspire future researchers to employ the ARIMA model for forecasting and to further the field of forecasting literature.

Literature Review

To forecast the spread movements across the 15-nation COVID-19 timeframe, Singh et. al. (2020) employed the ARIMA model. The analysis used the model to predict the spread of the virus and related mortality during the ensuing two months. The conclusions recommended reducing the two incidents and related fatalities in China, Germany and Switzerland.

However, it was predicted that the spread of the infection and the number of associated fatalities will increase in nations including the United States, Spain, Italy, France, and the United Kingdom (Singh et. al., 2020).

To replicate inflation in Kenya, Nyoni (2018) used annual time series data from 1960 to 2017 together with the ARIMA and GARCH models. He discovered that the best models to use for inflation prediction are the ARIMA (2, 2, 1), ARIMA (1, 2, 0), and AR (1)-GARCH (1, 1) models. According to Nyoni and Nathaniel (2018), who most recently researched inflation using data for Nigeria from 1960 to 2016, the ARIMA (1, 0, 2) is the best model to forecast inflation rate. According to the authors of the article (Sasi, A., Subramanian, T., 2022; Maheshwari, R., and Kapoor, V. 2022) the ARIMA model has been found to be helpful for investors as well as forecasters in estimating stock values. For forecasting stock price, a statistical model like ARIMA is frequently employed. ARIMA has been used to create a variety of forecasts, including those regarding agri-food prices, among others (Mishra, 2021). The objective of this study to forecast stock price of AirAsia Berhad to make better investment decision during COVID-19.

Research Methodology

To accomplish the goals and objectives of this study, secondary data is utilised. The NSE website was used to gather the stock data for study. The secondary data was gathered from the NSE website, which had been digitally available for the previous four years. The open, low, high, and close prices are the four components of the stock data, respectively. The closing price is employed in this study since it captures all the activities that took place on that specific trading day. To explore the best ARIMA 93 model, several tests were conducted using the technique described below. The methodology and steps for carrying out any specific investigation are stated in the research design. The goal of this study is to examine and forecast the stock price of AirAsia Berhad, hence an analytical research design was used. The research makes use of the MatLab 2018b tool.

Data analysis and Interpretation

The concept of autocorrelation serves as the foundation for ARIMA's structure. A stationary time series or a non-stationary time series that can become stationary by differentiation can be modelled using ARIMA model. The form of the ARIMA model is denoted by the universal notation

ARIMA (p, d, q). Regression order is denoted by the letter p, differentiation order is denoted by the letter d, and moving average order is denoted by the letter q. The Box-Jenkins approach may be used to divide the ARIMA model construction process into three steps. The investigated time series' features are examined in the first phase, identification. It is decided that the data must be transformed and differentiated to stabilise the series' mean, variance, and covariance. This is accomplished by running the statistical Dickey-Fuller and Augmented-Dickey-Fuller tests, as well as by looking at the autocorrelation function (ACF) and partial autocorrelation (PACF). The parameters of the chosen models are computed in the second step, which consists of testing. The diagnostic examination comes next. Numerous model residuals' characteristics are examined. If not, an alternative model should be chosen, and the estimating and testing processes should be redone. It could be required to go back to the identification stage in some circumstances. The model is utilised to provide a forecast in the third step. The provided dataset is divided between an out-of-sample period to assess predicting ability and an in-sample period for initial parameter estimates and model selection All of the input data was logarithmized to achieve the appropriate level of stationarity for the series.

For more details, see https://finance.yahoo.com/quote/5238.KL/history/. The time-series data were gathered from Yahoo Finance between December 2018 and 2022. To predict stock prices, ARIMA, a supervised machine learning model, was applied. The Box and Jenkins methodology's ARIMA Models The models proposed by Box and Jenkins (1970) on the ARIMA framework, as stated in (Mishra, 2021), give us:

$$X_t = \beta_0 + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \ldots\ldots + \beta_p x_{t-p} + \varepsilon_t (\text{"}AR\text{"}) \tag{1}$$

$$X_t = \beta_0 + \beta_1 e_{t-1} + \beta_2 e_{t-2} + \ldots\ldots + \beta_p e_{t-p} + e_t (\text{"}MR\text{"}) \tag{2}$$

$$X_t = c + \gamma_1 x_{t-1} + \gamma_2 x_{t-2} + \ldots + \gamma_p x_{t-p} + e_t - \theta_1 e_{t-1} - \theta_2 e_{t-2} - \ldots \theta_q e_{t-q} (\text{"}ARMA\text{"}) \tag{3}$$

$$(1-\gamma_1 B)(1-B)\gamma_t = c + (1-\theta_1) e_t (\text{"}ARIMA\text{"})(1,1,1) \tag{4}$$

Time series data has been shown in Figure 1. Explicit the data of 2020 for performing exploratory data analysis and transformation it to stationary data and then train the ARIMA model, also conduct fit-of-goodness checks. We have taken the option for this process are as: log,

detrend liner and 1st order differences. Detrend liner and 1st order differences are shown in Figure 2. Testing the stationary data, Egale's ARCH, Ljung-BoxQ test have been performed, wherein the stationary data is extremely low if 1 or else o for accepting/rejection the hypothesis. The whole process done by Econometric Modeller MATLAB toolbox.

Figure 1

Stock Market Price Plot (July, 2018-July, 2022)

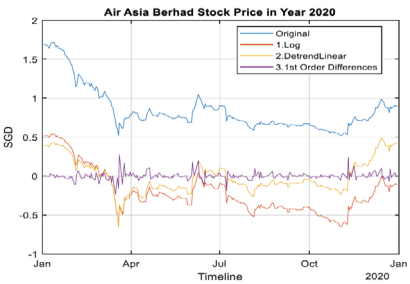

Figure 2

Stock Market Price Plot (July, 2018 -July 2022)

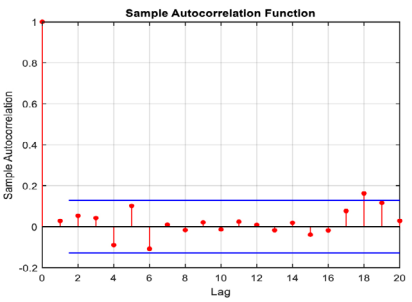

Figure 3

The Autocorrelation Function Graphs

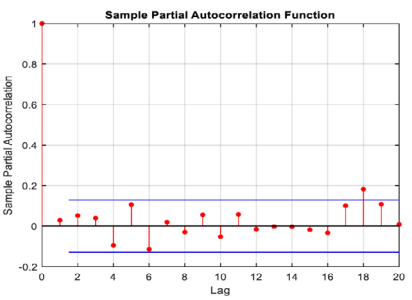

Figure 4

Partial Autocorrelation Function Graphs

Figures 3 and 4 show the autocorrelation and partial autocorrelation function graphs for the SPI series, which show partial autocorrelation in the first lag. Since the values in the other lags fall between the significant lines, there is no autocorrelation. Additionally, the bar is still a long way from zero at delays 5 and 6. In our exploratory data analysis, we used ARIMA(0,1,0). ARIMA(0,1,0) Model (Gaussian Distribution) table shows in Table 1, the Variance and loglikehood 0.00170845, 434.7176 founded

Table 1

ARIMA(0,1,0) Model (Gaussian Distribution)

	Value	Standard Error	T Statistic	P Value
Constant	-0.0032128	0.0026438	-1.2152	0.22428
Variance	0.0017084	7.8286e-05	21.823	1.4006e-105

respectively also the predictive values between original and ARIMA are shown in Figure 5. In Figure 6 representation of histogram (residual) is shown.

Figure 5

Original and ARIMA (0, 1, 0) Stationary Stock Price

Goodness-of-Fit Checks

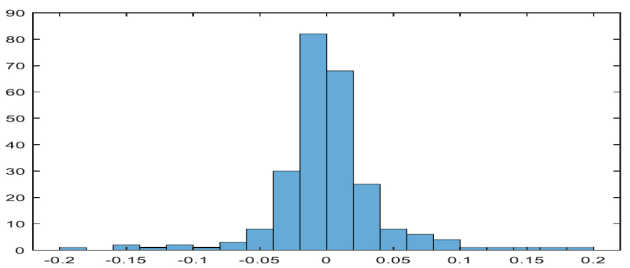

Figure 6

Even if the results of the exploratory study suggest that ARIMA(0, 1, 0) is the best model, it is always wise to evaluate the fitness of other models in case the results of the exploratory analysis are inaccurate. Table 2 compares the outcomes of the best-fit model.

Table 2

Best Fit of ARIMA Model

Var1	Var2	Var3
Arima(0,1,0)	-865.44	-858.39
Arima(1,1,1)	-866.03	-858.99
Arima(1,1,2)	-866.52	-859.47
Arima(1,2,1)	-864.68	-857.64
Arima(1,2,2)	-874.04	-867
Arima(2,1,1)	-866.43	-859.39
Arima(2,1,2)	-872.28	-865.24
Arima(2,2,1)	-864.83	-857.78
Arima(2,2,2)	-874.45	-867.41

Figure 7

Original and ARIMA (1, 2, 1) Stationary Stock Price

Forecasting the Data

During the first Covid-19 (2021-01-01 to 2021-06-30), the statistics were forecasted. Even yet, ARIMA(0,1,0) is still regarded as a forecasting tool in this section. If the ARIMA(0,1,0) model is more accurate than the ARIMA(1,2,1) model, that would be highly intriguing, as mentioned in Table 2 and Figure 7. This section also does a good job of describing why out-of-sample data must be taken into account for back-testing; Figures 8 and 9 illustrates predicting using Monte Carlo.

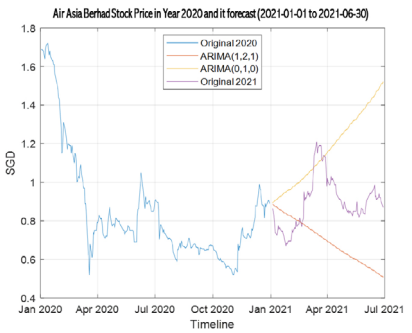

Figure 8

AirAsia Berhad Stock Price in Year 2020 and it forecast (2021-01-01 to 2021-06-30)

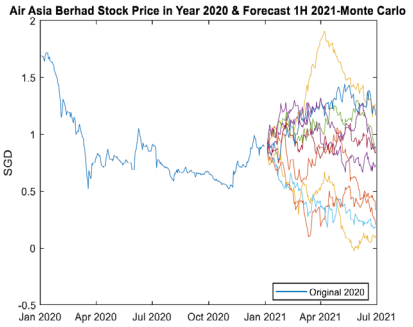

Figure 9

AirAsia Berhad Stock Price in Year 2020 and it forecast (2021-01-01 to 2021-06-30) using Monte Carlo

Discussion and Conclusion

Since COVID-19 has spread to most countries and poses a serious risk to humans, the WHO has classified it as a pandemic. In this study, the stock price of AirAsia Berhad was predicted using the ARIMA model from the Time Series category. This study presents detailed procedures for developing an ARIMA model for predicting stock price. The experimental results generated using the best ARIMA model demonstrated that ARIMA models have a good short-term forecasting capacity for stock values. This might aid investors in the stock market in making wise investing decisions. With the results attained, ARIMA models can effectively compete with new forecasting techniques for short-term prediction.

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