ARIMA METHOD MODELING IN PREDICTING THE DAILY STOCK PRICE OF PT GARUDA INDONESIA DURING THE COVID-19 PANDEMIC

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Abstract

The main purpose of this research is to create a predictive model of the ARIMA method on the daily stock price of PT. Garuda Indonesia, Tbk during the Covid-19 pandemic. This study uses daily secondary data from April 22, 2019, to April 20, 2020. The results of research using the ARIMA model shows that data from April 22, 2019, to April 20, 2020, can be used to predict stock closing prices from April 21, 2020, to July 13, 2020. The ARIMA model obtained the results of daily stock price predictions of PT. Garuda Indonesia, Tbk on the Indonesia Stock Exchange from 21 April 2020 to 13 July 2020 tend to experience a decline. This is presumably because investors tend to hold back their capital due to the government's prohibition on going home, which resulted in the cessation of operations in the aviation sector.

Keywords: ARIMA method, Covid-19, Garuda Indonesia, Stock price

INTRODUCTION

The capital market facilitates various facilities and infrastructure for buying and selling activities and activities other related matters, which include funding facilities for companies and other institutions (eg government) and facilities for investment activities carried out by investors (Darmaji and Fakhruddin, 2006). The stock price sale and purchase transaction are one of the favorite forms of investment made by many investors because of promising profits. In this case, investors must choose investments that are profitable for them with a small level of failure or risk (Pandji, et al. 2019). This will depend on each price on each share price which often changes from time to time, commonly known as time-series data.

One of the issuers or companies engaged in the capital market is PT. Garuda Indonesia, Tbk or commonly known as the issuer code GIAA. PT Garuda Indonesia, Tbk is a provider of aviation or air transportation services and services existing in Indonesia. PT Garuda Indonesia, Tbk is one of the state-owned enterprises whose shares currently owned by the Government of Indonesia by 60.53% and the rest by the public. In year in 2020, PT Garuda Indonesia, Tbk has received sharp attention from investors regarding prices stock tends to be unstable. This is due to the Covid-19 pandemic which affects all economic sectors in the world, including the transportation sector.

Covid-19 (Corona Virus Disease 2019) is a disease caused by the attack of the SARS Cov-2 (Severe Acute Respiratory Syndrome Coronavirus 2) or better known as term Corona Virus. Coronavirus cases appeared and attacked humans for the first time in Wuhan province,

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China. Initially, it was suspected to be pneumonia, with flu-like symptoms in general. These symptoms include cough, fever, fatigue, shortness of breath, and no appetite. However, unlike influenza, the coronavirus can progress rapidly to lead to more severe infection and organ failure. Condition This emergency mainly occurs in patients with previous health problems (Mona, 2020).

This virus is transmitted to humans and can cause minor disturbances to the system respiratory infections, severe lung infections, and even death. Even if you attack more elderly this virus can attack anyone, from toddlers to adults, including pregnant and lactating women. Due to the very fast transmission of the coronavirus, the Organization The World Health Organization (WHO) declared the coronavirus a pandemic on March 11, 2020. The status of a global pandemic or epidemic indicates that the spread of COVID-19 is ongoing so fast that almost no country in the world can ensure that it is protected from the coronavirus (Widiyani, 2020). It is for this reason that governments in some countries decide to implement a lockdown or total isolation or quarantine.

Quarantine according to the Law of the Republic of Indonesia Number 6 of 2018 concerning Health Quarantine is the restriction of activities and/or separation of a person exposed to an infectious disease as stipulated in the legislation even though he has not shown any symptoms to prevent the possibility of spreading to people around him (Law No. 6 of 2018). Several countries that have implemented a lockdown to prevent the spread of the corona virus are China, Spain, Italy, and Malaysia. The country's government decided to lock down, by closing all access to public facilities and transportation. Residents are advised to stay at home and isolate themselves, with the hope that the virus does not spread more widely, and healing efforts can run optimally (Perdana, 2020; Kottasova, 2020).

Indonesia itself enforces a policy of Large-Scale Social Restrictions (PSBB) To suppress the spread of this virus by physical distancing. The application of this PSBB have an impact on the cessation of mass transportation activities such as buses, trains, and planes fly. The Ministry of Transportation prepares efforts to rescue airlines namely by limiting the occupancy rate of commercial airplane seats to a maximum of 50%. Not a few passengers who cancel travel plans by air along there is a change in operating hours. This led to a decrease in ticket sales which have a direct impact on the financial condition of airlines, one of which is PT. Garuda Indonesia, Tbk. Daily shares of PT. Garuda Indonesia, Tbk. tends to decrease during PSBB period is during March-April 2020.

With the PSBB implemented by the government, it makes investors think again about whether to invest in PT. Garuda Indonesia, Tbk or not. By Therefore, an in-depth analysis is needed to predict this stock price to the next level front, one of which uses the ARIMA method. ARIMA model is widely used widely in doing time series forecasting and many studies mention that the ARIMA model is very good at forecasting the next few periods (Kamruzzaman, 2003). In general, this model is formulated as ARIMA (p, d, q), p is the order of Autoregressive (AR), d is the difference, and q is the order of moving average (MA). AR model is a model that describes that the dependent variable influenced by the dependent variable in the previous period (time lag of the dependent variable as an independent variable), while in the MA model, which is a variable independent is the residual value (error) in the previous period. AR models and MA models combined to produce the ARIMA model (Makridakis, 1999)

Several previous studies used the ARIMA method in predicting prices shares of an issuer or company. Lilipaly, et al (2014) used the ARIMA method for predict the stock price of PT. BRI, Tbk. The result is the ARIMA model for stock prices the maximum is ARIMA (2,1,3) and the minimum share price is the model (2,1,3) that can used to predict November 2014 data with valid predictions taken in October 2014. Another study was conducted by Sadeq (2008) regarding JCI prediction analysis using ARIMA method. The forecasting results of this

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model show that this model is quite accurate in forecasting with the error percentage absolute average of 4.14%. Based on this, the researcher wants to predict how is the estimated stock price of PT. Garuda Indonesia, Tbk for approximately 2 months especially during the Covid-19 pandemic.

RESEARCH METHOD

The type of data used in this study is secondary data in the form of stock prices and daily PT. Garuda Indonesia, Tbk for the period 22 April 2019 to 20 April 2020 (255 days). The source of data in this study was obtained through historical price searches and daily shares of PT. Garuda Indonesia, Tbk on the official website of yahoo finance and the Stock Exchange Indonesia.

This research uses technical analysis. The first technical analysis was carried out by Charles H. Dow in 1884, where Dow invented the metric of market calculations of his shares based on time series data. It is stated that the Dow theory aims to identify market prices in the long term based on data on historical market prices in the past (Tandelilin, 2001). According to Rode, Friedman, Parikh, and Kane (1995), the basic theory of technical analysis is a trading technique that uses data from a certain period that can be used for making investment decisions by good. So the object of technical analysis is to predict from a time series data with accurate forecasting and calculation methods. The advantage of this technical analysis is that able to obtain information faster so that with the ability of analysts and sharp instincts will be able to directly translate it into the act of selling and buying shares to gain share profits (Taswan and Soliha, 2002).

One type of indicator used for technical analysis derived from data sequential stock prices is moving average indicators using the method Autoregressive Integrated Moving Average (ARIMA). ARIMA is a method that produces forecasts based on the synthesis of historical data patterns (Arsyad, 1995). ARIMA model is a time series model that is used based on assumptions that the time series data is stationary meaning the mean and variance (σ^2) a time series data constant (Mulyono, 2000).

$$\Phi_p(B)\nabla^d Z_t = \mu + \varepsilon_t - \theta_q(B)\varepsilon_t$$

with,

Z_t : Observation value at time t

Φ_p : Parameters autoregressive (autoregressive)

θ_q : Moving average parameters

B : Back slide operator

d : Parameter of differentiation (differencing)

μ : Constant parameters

ε_t : Residual value (error)

p : Degree of autoregressive (AR)

q : Degree of moving average (MA)

Data analysis was carried out using the ARIMA method with the help of statistical software, namely SPSS version 26. The steps for implementing the ARIMA model in succession were as follows.

1. Data Retrieval

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2. Data Plot
3. Data Stationary Check
4. Determination of Parameters p, d, and q in ARIMA
5. Determination of the ARIMA model equation
6. Prediction

RESULT AND ANALYSIS

Data retrieval

Daily stock price data of PT. Garuda Indonesia, Tbk which is used to predict stock prices during the covid-19 pandemic is taken from IDX: GIAA. The data is in the form of data time series. The data used to predict is the daily stock price data of PT. Garuda Indonesia, Tbk. from April 22, 2019, to April 20, 2020 (255 days).

Data Plot

It can be seen that the plot of daily stock price data of PT. Garuda Indonesia, Tbk since April 22 2019 to April 20, 2020, shows an up and down graph.

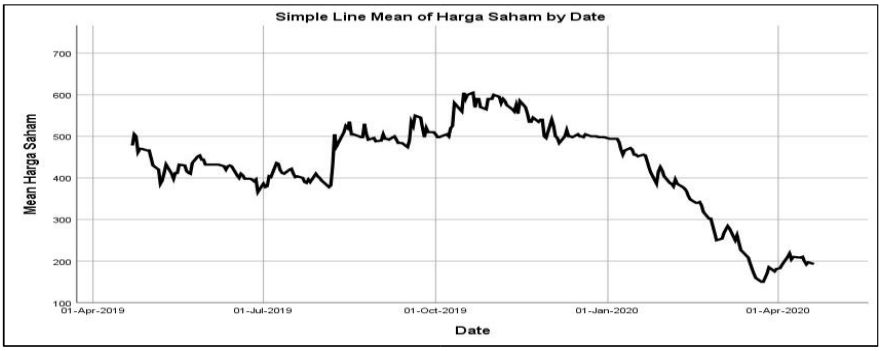

Figure 1. Plot of Daily Stock Price Data of PT. Garuda Indonesia, Tbk 22 April 2019 - 20 April 2020.

Data Stationary Check

Stationary data is needed to minimize model error. From Figure 1, it can be seen that the plot of daily stock price data of PT. Garuda Indonesia, Tbk. tends to fluctuate, meaning that the data is not stationary. It can also be seen from the ACF (Auto Correlation Function) and PACF (Partial Auto Correlation Function) plots as shown below.

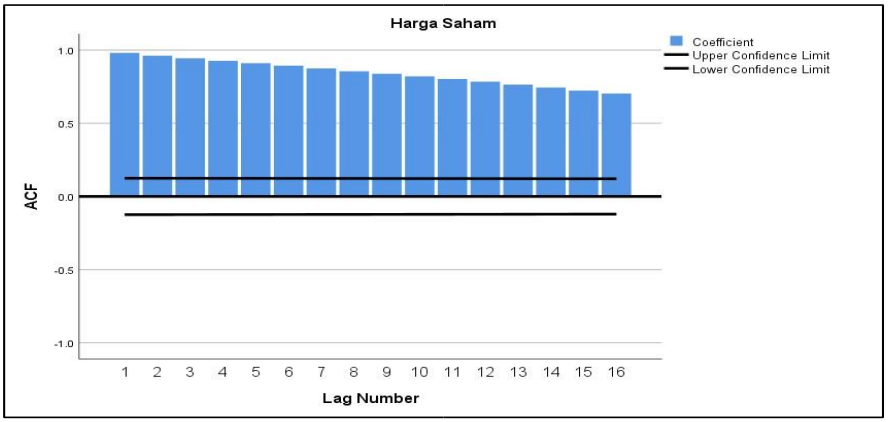

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Figure 2. ACF Plot of Daily Stock Price Data of PT. Garuda Indonesia, Tbk 22 April 2019 - 20 April 2020

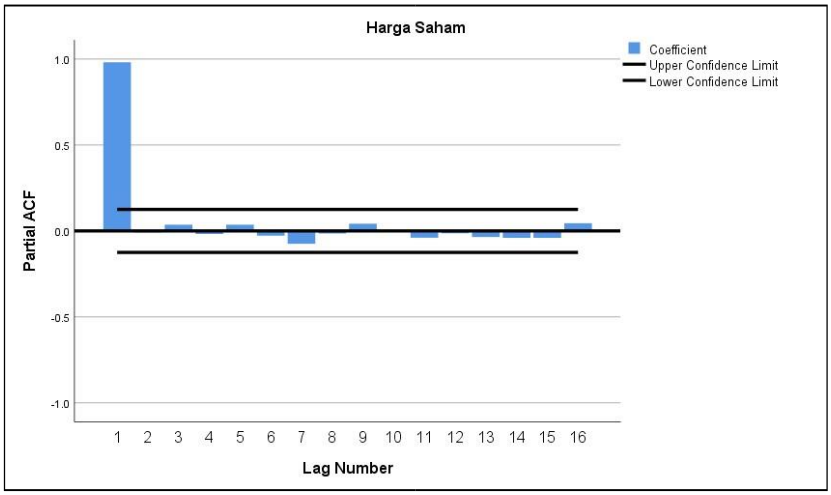

Figure 3. Plot of PACF Daily Stock Price Data of PT. Garuda Indonesia, Tbk 22 April 2019 - 20 April 2020.

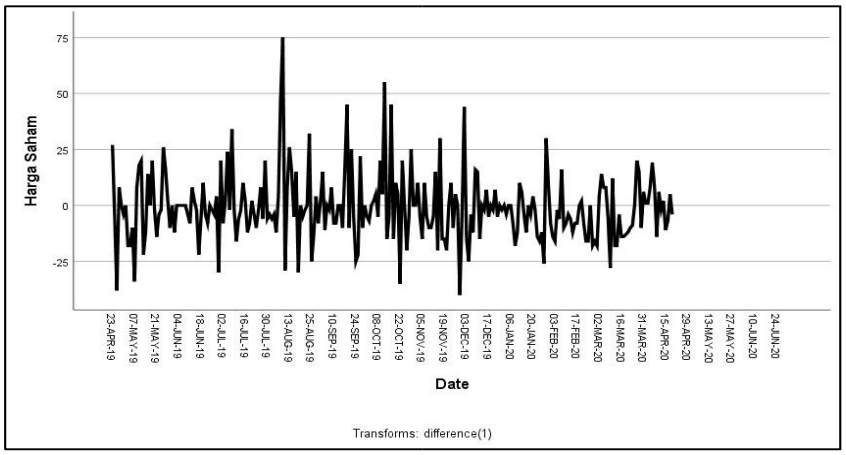

Figure 4. Sequence plot of Daily Stock Data of PT. Garuda Indonesia, Tbk 22 April 2019 - 20 April 2020 with Difference of Order 1.

The ACF plot which tends to decrease indicates that the data is not stationary in the mean, while the nearly alternating PACF plot indicates that the data is not stationary in the variance. Therefore, it is necessary to carry out a differentiation process so that it becomes data which is stationary. In Figure 4 it can be seen that after the differentiation process with level 1 is carried out, the daily stock data of PT. Garuda Indonesia, Tbk. moving around the average. From these data, it can be observed that the data is stationary. The differentiation process that has been carried out has identified that the value of d that can be used is d =1.

Determination of Parameters p, d, and q in ARIMA

Next, the parameter/order of the ARIMA model will be selected using the RMSE (Root Mean Squared Error) value with the following formula.

$$RMSE = \sqrt{\frac{\sum (y_i - \hat{y}_i)}{n}}$$

Table 1

Determination of AR(p), I(d), and MA(q) values with RMSE.

Difference (d=1)			
Orde	Nilai RMSE	Orde	Nilai RMSE
(1,1,0)	38,92	(2,1,2)	38,78
(1,1,1)	38,69	(2,1,3)	38,04
(1,1,2)	38,61	(3,1,0)	38,74
(1,1,3)	38,36	(3,1,1)	38,50
(2,1,0)	38,95	(3,1,2)	38,03
(2,1,1)	38,66	(3,1,3)	38,51

There are 12 models that are differentiated once to predict the stock price of PT. Garuda Indonesia, Tbk from 20 April 2019 to 20 April 2020. Based on the theory, the more the smaller the RMSE value produced by a model, the better the model (Dewi and Muslikh, 2013). So that the model with the smallest RMSE is obtained with the order p=3, d=1, and q=2 or ARIMA (3,1,2) with the smallest RMSE value of 38,03 and then used to predict the daily stock data of PT. Garuda Indonesia, Tbk. April 21 2020 to July 13, 2020.

Determination of the ARIMA Model Equation

Based on the results of the determination of the order obtained ARIMA (3,1,2) and the output Parameter table, the coefficients are obtained as follows.

ARIMA Model Parameters

					Estimate	SE	t	Sig.
Harga Saham-Model_1	Harga Saham	No Transformation	Constant		-7.506	2.887	-2.600	.010
			AR, Seasonal	Lag 1	.542	.088	6.152	.000
				Lag 2	-.848	.088	-9.581	.000
				Lag 3	.142	.072	1.963	.051
			Seasonal Difference		1			
			MA, Seasonal	Lag 1	.543	.448	1.212	.227
				Lag 2	-.996	1.638	-.608	.544

Figure 5. Parameter Table Output

Parameter coefficient AR 1: 0.542, AR 2: -0.848, AR 3: 0.142, MA 1: 0.543, MA 2: -0.996, and the constant -7.506, then the ARIMA equation is made into

$$Z_t = -7.506 + 1.542Z_{t-1} - 1.39Z_{t-2} + 0.99Z_{t-3} - 0.142Z_{t-4} - 0.543Z_{t-1} + 0.996Z_{t-2}$$

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Prediction

ARIMA model (3,1,2) is used to predict the daily stock price of PT. Garuda Indonesia, Tbk. April 21, 2020, to July 13, 2020 (during the Covid-19 pandemic). The stock price prediction chart is as follows.

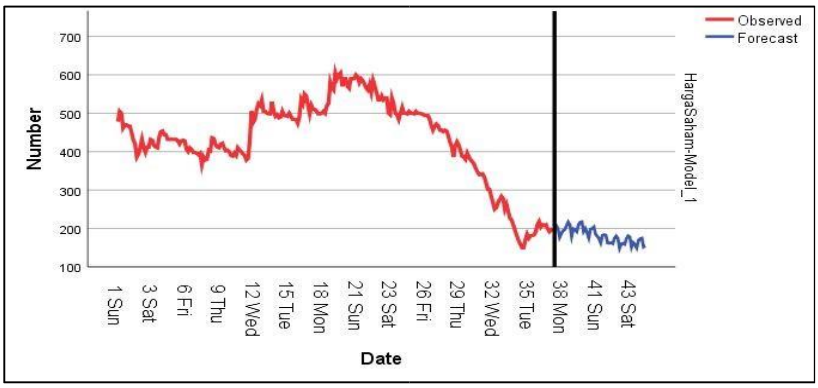

Figure 6. Graph of Daily Stock Price Prediction of Bank Indonesia Date 21 April 2020 - 13 July 2020

The red line shows the plot of the daily stock price data of PT. Garuda Indonesia, Tbk. From April 22, 2019, to April 20, 2020. While the blue line is a prediction (forecast) of the share price of PT. Garuda Indonesia, Tbk from April 21 2020 to July 13, 2020, which tends to fall.

CONCLUSION

The model to predict the stock price of PT. Garuda Indonesia, Tbk. on April 21, 2020 to July 13, 2020, namely ARIMA (3,1,2) with the equation

$$Z_t = -7.506 + 1.542Z_{t-1} - 1.39Z_{t-2} + 0.99Z_{t-3} - 0.142Z_{t-4} - 0.543Z_{t-1} + 0.996Z_{t-2}$$

The predictions for the nominal daily share price of PT. Garuda Indonesia, Tbk as of April 21, 2020, to July 13, 2020, are as follows.

Date	Stock price	Date	Stock price	Date	Stock price	Date	Stock price	Date	Stock price
21/04/2020	204	08/05/2020	200	28/05/2020	197	15/06/2020	163	30/06/2020	175
22/04/2020	208	11/05/2020	198	29/05/2020	201	16/06/2020	159	01/07/2020	149
23/04/2020	201	12/05/2020	192	02/06/2020	182	17/06/2020	173	02/07/2020	161
24/04/2020	178	13/05/2020	209	03/06/2020	178	18/06/2020	178	03/07/2020	157
27/04/2020	187	14/05/2020	215	04/06/2020	173	19/06/2020	173	06/07/2020	149
28/04/2020	195	15/05/2020	215	05/06/2020	161	22/06/2020	148	07/07/2020	167
29/04/2020	198	18/05/2020	190	08/06/2020	180	23/06/2020	159	08/07/2020	171
30/04/2020	207	19/05/2020	198	09/06/2020	181	24/06/2020	161	09/07/2020	172
04/05/2020	217	20/05/2020	188	10/06/2020	180	25/06/2020	158	10/07/2020	149
05/05/2020	209	26/05/2020	175	11/06/2020	161	26/06/2020	172	13/07/2020	153
06/05/2020	180	27/05/2020	196	12/06/2020	161	29/06/2020	179		

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