Forecasting : Bitcoin Price with the ARIMA method to help swing traders made decision
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Abstract: The economic situation is greatly affected by the pandemic. It causes people to look for ways to keep their money safe even if they can make a profit. One of the answers to that question is various investment products such as stocks, bonds, mutual funds, and cryptocurrency. Cryptocurrency or commonly called Cryptocurrency is a digital asset used to exchange. Cryptocurrency today has become a very remarkable phenomenon, especially since entering the era of the COVID 19 pandemic. Bitcoin is a digital currency created in 2009 by Satoshi Nakamoto. Cryptocurrency price movements have patterns and are predictable. The effort to make this prediction is called forecasting. Methods research on this paper using ARIMA methods. The forecasting results for the next five periods of the Bitcoin price show a linear line at the price of USD 48065.1.

Keywords: Cryptocurrency; Bitcoin; ARIMA

1. Introduction

The pandemic forced everyone to lock themselves in the house. Employees do work from home (WFH) while students do distance learning. This makes access to the internet more common than before entering the pandemic era. In addition, the economic situation is greatly affected by the pandemic. It causes people to look for ways to keep their money safe even if they can make a profit. One of the answers to that question is various investment products such as stocks, bonds, mutual funds, and cryptocurrency.

Cryptocurrency or commonly called Cryptocurrency is a digital asset used to exchange. Cryptocurrency today has become a very remarkable phenomenon, especially since entering the era of the COVID 19 pandemic. Cryptocurrency is becoming increasingly popular and in demand by young people. Cryptocurrency has a decentralized nature so it is different from a centralized digital currency. Cryptocurrency is not protected by a central bank so it can be dangerous if not sorted properly. There is a risk of losing money, but it certainly has great profit potential. One form of cryptocurrency is bitcoin.

Bitcoin is a digital currency created in 2009 by Satoshi Nakamoto. Bitcoin is one of the earliest cryptocurrencies in the world. Bitcoin is currently the most expensive cryptocurrency per unit. As reported by cnbcindonesia.com, on Sunday, December 27, 2020, the price of Bitcoin rose by more than $ 28,400 (Rp400 million). The price increase exceeds the expectations of experts that the price of Bitcoin will reach the range of US $ 20,000 or Rp300 million by the end of 2020 [1]. According to [2] one of the advantages of Bitcoin is Blockchain technology. Bitcoin operates based on a system of market supply and demand. The price of Bitcoin is very fluctuating because supply and demand are very fast.

Fluctuating prices are an excellent means for a trader to make money. A trader is someone who conducts trading or selling and buying activities. Trading is a form of business, which is a buying and selling activity, like people buying and selling in a fruit market or supermarket. If in the fruit
market that is traded in the form of fruits, then in the trade that is traded are stocks, foreign currencies, commodities, and so on [3]. One type of trader is the swing trader. Swing trader is a trader who sells and buys investment products, then held for several days until it touches the desired price. In a matter of days a swing trader can generate large returns even up to hundreds of percent. The potential for high returns is enormous when compared to stocks, bonds, and deposits. However, big profits certainly have big risks.

Significant risks can be minimized by conducting analysis. Analysis is divided into two, namely fundamental analysis and technical analysis. Technical analysis is an analysis that studies market movements such as price movements and trade volume [4]. Technical analysis is an analysis that is usually used by traders. Traders believe that events that have happened in the past can be repeated. Cryptocurrency price movements have patterns and are predictable. The effort to make this prediction is called forecasting. If price movements are well predicted there is a possibility of minimizing the occurrence of losses. There are various types of ways to do forecasting, one way to do forecasting is to use ARIMA.

Autoregressive Integrated Moving Average model or commonly called ARIMA is one of the forecasting methods. ARIMA ignores independent variables and focuses only on dependent variables. ARIMA uses past and present values of dependent variables to produce accurate short-term forecasts [5]. This method is a combination of autoregressive and moving average models.

2. Related Works

The autoregressive model is a model commonly used in the process of applying time series data analysis using special methods and procedures. Autoregressive model with order p is abbreviated AR(p) or ARIMA (p,0,0) and is formulated as follows [6]:

\[ Z_t = \varphi_1 Z_{t-1} + \varphi_2 Z_{t-2} + \ldots + \varphi_p Z_{t-p} + a_t \]

Information:
\( \varphi_1, \ldots, \varphi_p \) = Autoregressive parameter coefficient at p
\( Z_{t-1}, \ldots, Z_{t-p} \) = Independent variable
\( a_t \) = Remaining at time t

The moving average model is a forecasting method that is carried out by taking a group of observed values, looking for the average value as a forecast for the future period [7]. Moving Average (MA) model with order q is written MA (q) or ARIMA (0,0,q) and is formulated as follows [6]:

\[ Y_t = a_t - \theta_1 a_{t-1} - \theta_2 a_{t-2} + \ldots + \theta_q a_{t-q} \]

Information:
\( \theta_1, \ldots, \theta_q \) = Moving average parameter coefficient at q
\( a_t \) = Remaining at time t

Model Autoregressive Moving Average or commonly called ARMA model is a mixture of the Autoregressive model which assumes that the current data is influenced by the previous data and the Moving Average which assumes that the current data is influenced by the residual value of the previous data [8]. Autoregressive Moving Average (ARMA) model with order p and q is written ARMA (p,q) or ARIMA (p,0,0,q) and is formulated as follows [6]:

\[ Z_t = \varphi_1 Z_{t-1} + \varphi_2 Z_{t-2} + \ldots + \varphi_p Z_{t-p} + a_t - \theta_1 a_{t-1} - \theta_2 a_{t-2} + \ldots + \theta_q a_{t-q} \]

Information:
\( \varphi_1, \ldots, \varphi_p \) = Autoregressive parameter coefficient at p
\( Z_{t-1}, \ldots, Z_{t-p} \) = Independent variable
\( \theta_1, \ldots, \theta_q \) = Moving average parameter coefficient at q
\( a_t \) = Remaining at time t
Autoregressive Integrated Moving Average or commonly called ARIMA is a method that produces forecasts based on the synthesis of historical data patterns. ARIMA only focuses on the dependent variable and ignores the independent variable. The ARIMA model is generally described by ARIMA \((p,d,q)\). \(P\) is the value of the dependent lag, \(d\) is the level of differentiation, and \(q\) is the residual lag.

3. Experiment and Analysis

This study uses quantitative research methods by examining secondary data on Bitcoin commodity prices in the period January 1, 2017 - December 30, 2022. Secondary data on Bitcoin prices is obtained from www.finance.yahoo.com. Other secondary data were obtained from various literatures such as articles, databases, and text books published on Google, Pubmed, NCBI, Elsevier, and others. In this study, the author uses quantitative analysis of the results of the Bitcoin data tabulation, then proceeds with inferential analysis on data processing. Quantitative research is research using data in the form of numbers or numbers commonly referred to as quantitative data [9]. The quantitative data in this study were analyzed using statistical data which would then be described into a paragraph.

The data processing in this study uses Minitab 16 software. The method used in data analysis is ARIMA to forecast a Bitcoin price for the next five monthly periods. The following is a framework for thinking about the ARIMA procedure:

![FlowChart ARIMA Model](image)

Figure 1. FlowChart ARIMA Model
The author does forecasting on the monthly Bitcoin price (Time series). The historical data that the author uses and processes for testing there are 61 monthly historical data. To get the purpose of this writing, the author uses the ARIMA Test in the process which is assisted by Minitab software.

Bitcoin is one of the digital currencies. Bitcoin became the pioneer of digital currency called cryptocurrency and currently has the most expensive price by unit. However, cryptocurrencies have very volatile price movements, very different when compared to other investment media such as stocks, bonds, deposits. The movement (fluctuation) of cryptocurrency prices is influenced by various factors, one of which is cryptocurrency fundamentals and there is still very little literature in Indonesia that identifies the variables that cause cryptocurrency price movements themselves [10]. Fluctuating prices greatly affect swing traders' decisions to sell or buy on the exchange.

It can be seen from figure 2. Bitcoin price has an upward trend from the initial period of the study. It can be stationary. Bitcoin experienced a price increase in 2017-2018. Then continued the uncertainty of the market because the price of Bitcoin is quite stagnant and relatively sideways. In mid-2020, precisely in August, Bitcoin experienced a significant increase. Beside from figure 2. the volatile in Bitcoin prices looks extreme from USD 11681 to USD 58919 in March, 2021. It was followed by a temporary decline and continued to rise towards an all time high of USD 61319. In response to this, a forecasting process was carried out to help swing traders make choices to sell and buy their assets on Bitcoin.

Furthermore, the data were examined for the stationarity of the mean and variance. If it does not meet stationarity in the mean, it is necessary to do differencing and if it does not meet stationarity in variance, it is necessary to transform. Stationarity is done in the Box-Cox transformation. If the rounded value or lamda ($\lambda$) is equal to 1 we can say that the data remains within the variance. However, if lamda ($\lambda$) is not 1, the conversion must be carried out until the return value in BoxCox is 1 [11].
In figure 3, the data is not stationary with respect to variance. The Box-Cox output in part a) gets a value of 0.00 and it is concluded that it is not stationary. Therefore, a transformation is needed to get the rounded value or lamda (λ) equal to 1. Meanwhile in part b) after performing the data transformation, the output value is 1.00 and it is concluded that the variance is stationary.

To test the stationarity of the means, it can be seen from the ACF (Autocorrelation Function) plot. If there is an element of trend in it, or in the ACF plot it drops to close to 0, it can be said that the data is stationary with respect to the means [11].

In figure 4, part a) it is known that there are 4 data that are outside the red line, which means that they are outside the significance line. So that the data is declared not stationary with respect to the means. Data differencing is required. Furthermore, the authors observed from the output plots of ACF (Autocorrelation Function) and PACF (Partial Autocorrelation Function) to see the stationarity of the variance.
Figures 5. a) and b) show that there is an exponential and rapid decline, this indicates that the ARIMA model that can be used is the ARIMA model \((p,d,q)\) [12]. To find out the ARIMA parameter values in more detail, the parameters \(p\), \(d\) and \(q\) are determined. Prediction accuracy can be measured by the minimum MSE (Mean Square Error) value to be able to make a decision whether a model is feasible to use [12]. In figures 5 a) and b) there is no lag value that comes out, so it can fill the \(p\) and \(q\) values with a value of 1. With three possibilities, namely: \((1,1,0)\), \((0,1,1)\), and \((1,1,1)\).

After processing the data, the optimum value is \((1,1,0)\) with the smallest MSE. The following are 3 possibilities that occur in the processed data:

<table>
<thead>
<tr>
<th>Type</th>
<th>Coef</th>
<th>SE Coef</th>
<th>T-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 1</td>
<td>0.9644</td>
<td>0.0525</td>
<td>18.37</td>
<td>0.000</td>
</tr>
</tbody>
</table>

After getting the optimum value, the forecasting process is continued.

Figure 6 Output Data Forecasting dengan 5 Periode

<table>
<thead>
<tr>
<th>Period</th>
<th>Forecast</th>
<th>Lower</th>
<th>Upper</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Januari</td>
<td>48065,1</td>
<td>38363,7</td>
<td>57766,5</td>
<td></td>
</tr>
<tr>
<td>Februari</td>
<td>48065,1</td>
<td>32193,3</td>
<td>63936,9</td>
<td></td>
</tr>
<tr>
<td>Maret</td>
<td>48065,1</td>
<td>27823,7</td>
<td>68306,4</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>48065,1</td>
<td>24242,6</td>
<td>71887,5</td>
<td></td>
</tr>
<tr>
<td>Mei</td>
<td>48065,1</td>
<td>21133,6</td>
<td>74996,6</td>
<td></td>
</tr>
</tbody>
</table>
Based on Table 2, the forecasting results for the next five periods of the Bitcoin price show a linear line at the price of USD 48065.1. The author realizes that the Bitcoin price time series data shows a fairly large fluctuation and causes the price to remain linear at that number. If you go back a few years, starting from January 2017 to December 2021 Bitcoin has increased by 4800%. This allows unreasonable price spikes to make modeling less effective which should be a recommendation for further research studies.
References


