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Fundamental Analysis and Stock Price Forecasting Using the Autoregressive Integrated Moving Average Method at PT AKR Corporindo Tbk

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Abstract: *This research basically aims to see where AKRA's stock price will move in the future, and the tool chosen to answer that is the ARIMA statistical method, which stands for Autoregressive Integrated Moving Average. The research has two goals: first, to build the most suitable model, and second, to use that model to predict AKRA's stock price, so investors aren't too in the dark when making decisions. The data used is sourced from Yahoo Finance, specifically the daily closing prices of AKRA stock ranging from 2021 to 2026. That time span is actually enough to capture various dynamics that occur, and the format in the form of a time series is perfect to be used as material for analyzing this model. The preparation steps themselves are not short; there are several stages that must be passed one by one and cannot be skipped carelessly. Initially, the data is checked to see if it is stationary or not through the ADF test. From there, the ACF and PACF charts are examined to read patterns and determine a reasonable model structure. To determine which model is the best, the reference is the AIC value. After selecting the model, the residuals are not immediately ignored; they are checked again through diagnostic tests to ensure nothing is overlooked. All of this is done in RStudio. The hope is that from this rather convoluted process, this study can provide a fairly clear picture of future AKRA price trends, through a valid ARIMA model that can be relied upon for projections over several upcoming periods.*

Keywords: Stock Price Forecasting, ARIMA, Fundamental Analysis

A. INTRODUCTION

The capital market currently plays a significant role in the Indonesian economy. Investors choose from a variety of instruments, including money, land, gold, and stocks. Currently, the most popular instrument among investors is stocks. Stocks are a long-term financial instrument available on the capital market and are securities issued by companies as proof of ownership. The stock market plays a crucial role in the global and national economy, serving as a key indicator of economic well-being and a crucial instrument for investors in formulating strategic investment decisions [1].

The rise and fall of stock prices has become a common occurrence in the capital market world. Those fluctuations are what actually open two doors at the same time for investors: opportunities for profit on one hand, and threats of loss on the other. Therefore, having a strategy that can mitigate risk is not merely a suggestion,but an imperative that cannot be ignored [2].

One of the issuers enlivening the trading floor is PT Akra Corporindo Tbk, commonly known as AKRA. more familiarly known as AKRA. This company is not a small player; it is headquartered in Jakarta, and its main business revolves around the trade and distribution of petroleum products and various basic chemicals. It boasts significant market capitalization and robust business performance. Fundamentally, under the leadership of President Director Haryanto Adikoesoemo, the company has consistently increased its net profit, with a compound annual growth rate of 31% for the 2019-2023 period [3].

Stock price analysis is a method for predicting the future. One method that can be used in this analysis is ARIMA (Autoregressive Integrated Moving Average). This time series method is based on the assumption that observed data has certain patterns that can be used to predict future values [4].

In processing time-series data on PT AKR Corporindo Tbk (AKRA) stock prices, the commonly used model is Autoregressive Integrated Moving Average (ARIMA) to model the average price movement [14]. This study applies ARIMA to forecast AKRA's future stock price based on historical patterns reflected in trading data [5].

In predicting stock price movements in the financial market, Rusminto, Wibowo, and Wahyuni (2024) used the ARIMA method. Based on the results of technical testing, the best model obtained was ARIMA (0,2,1) with a low level of forecasting error as indicated by the Mean Absolute Percentage Error (MAPE) value of 1.31% [6]. This finding proves that the fewer lags used in the short-term period can produce more optimal forecast [7].

The application of ARIMA also lies in the research conducted by Triyawan and Harris (2023) on creating a model and predicting the future price of the Jakarta Islamic Index Stock. The results of the study showed that the JKII stock price for 365 periods did not meet the stationary assumption, so a differencing process was carried out so that the data became stationary [8]. The resulting ARIMA model is ARIMA (1,0,0) and this model is suitable for predicting the JKII stock price. In addition, the results of the analysis with ARIMA show that the stock price for the next 10 periods will increase slowly [9].

Furthermore, Kakambohi, Prang, and Salaki (2024) in predicting stock prices for the next 7 periods using the ARIMA-GARCH Model, produced an ARIMA(2,1,1)-GARCH(0,1) model. This proved to be the best model, providing confidence to investors that data analysis can help in making intelligent investment decisions [10].

For this case, the researchers chose to apply the Autoregressive Integrated Moving Average (ARIMA) machine learning model, which is believed to be able to analyze time- series data patterns more accurately [11]. Thus it is hoped that this research can provide the best model and predict AKRA stock prices to help investors in making investment decisions [12].

A. METHODS

1. Data Collection Method

This research uses a quantitative method utilizing secondary data. Quantitative is defined as an approach that uses numerical data, percentages, and frequencies to test a research hypothesis. This type of numerical data can be classified as primary or secondary based on how it is obtained. Secondary data is obtained through media not directly related to the research object, such as journals, datasets, reports, or reliable statistical sources [13].

1. Sample Determination Method The data used in this study is secondary data in the form of closing share prices of PT AKR Corporindo Tbk for the period May 3, 2021, to May 4, 2026 [14]. The data was obtained from the official website *https://www.investing.com/equities/akr-corporindo* and will be further analyzed to ensure relevance to the research objectives. The total data processed was 726 observations arranged in a time series format [15].

2. Research Methods

This study uses a quantitative approach with a time series forecasting method to analyze the stock price forecasting of PT AKR Corporindo Tbk. This study adopts the AutoRegressive Integrated Moving Average (ARIMA) method, which integrates a moving average algorithm and an autoregressive model to predict phenomena basedon historical time-series data. This hybrid model is projected to have a high level of accuracy due to its comprehensive process and ability to adapt to available data patterns. The following are the research stages:

a. Data preprocessing includes cleaning the data of missing values, converting date formats using the Lubridate library, and sorting the data chronologically.
b. Descriptive analysis calculates key statistics such as mean, median, standard deviation, skewness, and kurtosis to understand the characteristics of stock price distributions.
c. Stationarity testing involves visual inspection of time series graphs and the formal Augmented Dickey-Fuller (ADF) test.
d. Model identification determines the order of p and q based on the graph patterns of the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF).
e. Model estimation and selection compare the AIC values of several candidate ARIMA (p, d, q)

B. RESULT AND DISCUSSION

The results of the descriptive analysis of the daily closing price data of PT Akra Corporindo Tbk shares for the period May 3, 2021 to May 4, 2026 are presented in the following table:

1. Descriptive Statistics

PT Akra CorporindoTbk's stock price data is presented in Table 1. Based on the table, the lowest stock price was recorded at Rp608, while the highest stock price reached Rp1,850. The average stock price during the observation period was Rp1,241.11.

models to select the most efficient model.

a. Diagnostic testing examines model residuals using the Ljung-Box test to ensure the absence of autocorrelation (white noise).
b. Forecasting projects prices for future periods with 80% and 95% confidence intervals.
c. Accuracy evaluation calculates MAPE, RMSE, and MAE values to validate forecast precision.

The following graph displays the results of the AKRA stock price forecast for the next 20 periods, where the solid black line represents historical data on the stock's closing price movements. The forecast results are indicated by the short blue line at the end of the period, which tends to move steadily or horizontally, indicating the predicted stock price for the future based on the model that has been built.

Furthermore, there is a light blue area around the forecast line, which is the confidence interval, which illustrates the level of forecast uncertainty; the wider the area, the greater the potential variation or risk of stock price movement from the predicted value. Visually, this model projects that AKRA's stock price will remain at its recent high in the short term.

1. Data Stationarity Test

The stationarity testing of the data along with its mean value was carried out using the Augmented Dickey-Fuller approach, abbreviated as ADF.

the Augmented Dickey-Fuller test yielded a probability value of 0.0100 for the stock price data of PT AKR Corporindo Tbk. This figure still exceeds the 5% significance threshold, which means that Ho was not successfully rejected, and the conclusion is that the data is not stationary with respect to the mean. To address this issue, a first-order differencing process was applied so that the data could reach a stationary condition. Once the differencing was completed, the stationarity of the data was re-examined using the same ADF test.

the results of the Augmented Dickey-Fuller (ADF) test show a probability value for BBCA's stock price data of 0.0100. This value is smaller than the 5% significance level, so Ho is rejected. These results indicate that BBCA's stock price data is stationary with respect to its mean.

1. ARIMA Model Identification

After the data is declared stationary, the process continues to the stage of identifying the ARIMA (p,d,q) model. This is done by observing the ACF plot or Autocorrelation Function to capture the MA order, while the PACF plot or Partial Correlation Function is used to read the AR or MA order. From these two graphs, the most appropriate values of p and q for the (p,d,q) model can be determined more systematically.

the Autocorrelation plot shows that the MA(q) component has lag 1 that crosses the Bartlett significance line. A similar pattern is also seen in the partial correlation plot representing the AR(p) model, where lag 1 also passes the same significance line limit. Based on the readings of these two plots, several candidate ARIMA models were successfully identified, namely ARIMA (0,1,2), ARIMA (2,1,0), ARIMA (2,1,2), ARIMA (2,1,1), and ARIMA (1,1,2).

2. ARIMA Model Parameter Estimation

After the ARIMA model candidates have been successfully mapped, the next stage shifts to parameter estimation for each of the previously identified models, namely ARIMA (0,1,2), ARIMA (2,1,0), ARIMA (2,1,2), ARIMA (2,1,1), and ARIMA (1,1,2). This estimation is not merely a formality; its main purpose is to determine which model is most feasible to choose. The selection process itself is carried out by comparing the AIC, SIC, and Adjusted R-Squared values of each model. The benchmark is quite clear: the superior model is the one that presents the smallest AIC and SIC values, while simultaneously having the largest Adjusted R-Squared value among all candidates.

The choice falls here not without reason; its AIC value is recorded as the lowest at 11591.22, which reflects the most appropriate balance between prediction accuracy and model structure

3. efficiency. Beyond that, the variance value or σ^2 produced is also the smallest, only 918.6, meaning the forecast error rate is lower compared to other tested models. From this series of statistical evidence,ARIMA(1,1,2) is considered the most appropriate and efficient choice for forecasting this stock price data
4. Residual Histogram
   The Residual Histogram plot shows the distribution of residuals generated by the model. Visually, its shape quite resembles a bell curve that is relatively symmetrical, with the peak clustered around zero. This suggests that the residuals visually approximate a normal distribution. However, when compared with the results of previous formal tests, the story is slightly different. For example, the Shapiro-Wilk test produced a very small p-value. This histogram also shows a number of residuals spreading fairly far to the left and right, with the distribution tails appearing somewhat heavy. This condition explains why, statistically, the data does not truly meet the assumption of a normal distribution even though it appears to be close at first glance.

5. ARIMA Model Diagnostic Test
   In the ACF plot, the vertical line (lag) is significantly broken or exits the dashed blue line at lag 1. After this lag, the line pattern tends to decrease or stays within the significant limits. This indicates that the MA component or recommended q value is 1.

   The Partial ACF plot shows a similar pattern, with a significant line crossing the dashed blue boundary appearing at lag 1, followed by some smaller fluctuations at subsequent lags. This indicates that the AR component, or the suggested p-value, is 1.
6. Annual Return Bloxplot Data Visualization
   The distribution of AKRA's daily stock returns (2021-2026) tends to be stable around 0%, with a consistent median each year. Although there are uniform fluctuations, several outliers (extreme movements) were found
7. due to market sentiment, with the highest positive spike occurring in 2025. Overall, AKRA's stock returns are considered stable, although they still carry the risk of high volatility at certain times.

8. Forecasting
   The graph below displays the results of the AKRA stock price forecast for the next 20 periods, where the solid black line represents historical data on the stock's closing price movements. The forecast results are indicated by the short blue line at the end of the period, which tends to move steadily or horizontally, indicating the predicted stock price for the future based on the model. Furthermore, there is a light blue area around the forecast line, which represents the confidence interval,

which illustrates the level of forecast uncertainty; the wider the area, the greater the potential variation or risk of stock price movement from the predicted value. Visually, this model projects that AKRA's stock price will remain at its recent high in the short term.

9. Final Evaluation

The accuracy evaluation results show an impressive performance of the ARIMA model in matching historical data patterns during the training phase. This is illustrated by the following three error indicators :

a) RMSE or Root Mean Square Error was recorded at 30.29535. This figure reflects the average deviation of predictions from actual values, with a heavier penalty assigned to larger errors.
b) MAE or Mean Absolute Error stands at 21.31536, which represents the average absolute difference between actual prices and predicted results in a more stable manner and is less sensitive to outliers.
c) MAPE or Mean Absolute Percentage Error only reaches 1.750273%. This value is very small, well below the 10% threshold commonly used as a benchmark. This means the model's average prediction error is only about 1.75% of the actual price, indicating a fairly solid level of accuracy for forecasting purposes.

Overall, these low error values demonstrate that the model has a high level of precision in following the AKRA stock price movement patterns in the sample. from this table. The further the projection period moves from 1201 to 1220, the wider the gap between the lower and upper bounds becomes. This is not a coincidence, but rather a signal that forecast uncertainty indeed increases as the time horizon becomes longer.

C. CONCLUSION

Based on the data analysis, it can be concluded that the opening stock price data for PT AKR Corporindo Tbk from May 3, 2021, to May 4, 2026, was initially non-stationary. However, using the first- level differencing technique (d = 1), the data successfully achieved stationary conditions, validated by a significant p value in the Augmented Dickey-Fuller Test. Through the identification of ACF and PACF graphs and comparison of information criterion values, the ARIMA (0,1,2) model was determined to be the best model due o its lowest AIC value compared to other candidate models. Diagnostic testing indicated that this model was suitable for use because its residuals met the white noise criterion based on the Ljung-Box Test, meaning there were no remaining information patterns in the model residuals. Finally, the forecasting accuracy evaluation showed very precise results with a MAPE (Mean Absolute Percentage Error) of 1.42%, indicating that the model's average prediction error was very low and it had high reliability for short-term forecasting.

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