

Stock Price Forecasting of Maruti Suzuki using ARIMA Model

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DOI: 10.23862/kiit-parikalpana/2022/v18/i2/215258

[Article submitted on: 23.5.22; Revised on: 10.10.22; Accepted on: 25.10.22]

ABSTRACT

Forecasting of stock prices is very important subject in financial world and economics it has created lot of interest among investors for many years to make better forecasting models. The ARIMA model short form of Auto Regressive Integrated Moving Average were used previously for time series forecasting. The present research paper shows the process of stock price forecasting of Maruti Suzuki Company using the ARIMA (Auto Regressive Integrated Moving Average) model. Historical stock data for analysis is obtained from National Stock Exchange (NSE) are used with stock price forecasting ARIMA model. It shows that result obtained in ARIMA model is better for short-term forecasting and can prove with existing methods for stock price prediction.

Keywords: Auto Regressive Integrated Moving Average (ARIMA model), Historical Stock data, Short term forecasting, National Stock Exchange, Stock Price.

INTRODUCTION

Forecasting is very important field of study that makes researchers in this field always desiring to perform better from that of previously forecasting technique. Reason for that is institute and individual investors they are willing to make investment choice that requires the plan to build effective model for future decision. Forecasting stock price is regarded as very complex tasks to complete in financial forecasting

because of complexity of stock market. Many investors desire is to make any prediction model that could enhance their profiting and also minimize risk from investing in the stock market. For researcher it is an important factor to change and develop any required predictive models. For the past few years many models and process were developed for prediction of stock market prices. Artificial neural networks (ANNs) are one among them which are

very popular as its ability that it can predict patterns from historical data. Many works have been done using ANNs model for stock price prediction like hybrid approaches was developed to enhance stock price forecasting models by using the desired advantage from each of them.

ARIMA model is from statistical model perspectives. In literature there are two perspective of prediction which are statistical perspective and artificial intelligence perspective. ARIMA models is said to be powerful in financial time series data forecasting for short-term forecasting as compared to very popular ANNs model. It is used widely in economics and financial field.

The Auto Regressive Integrated Moving Average (ARIMA) model was introduced in the year 1970 by Box and Jenkins, and sometimes it is also termed as Box-Jenkin's methodology. It is a set of process to identify, estimate and diagnose ARIMA technique for time series data. ARIMA models are efficient for short term forecast. It also performs better than most complex structural model for short-time prediction. Future value in ARIMA is value of a variable and it linear summation of past values and past errors, which is expressed as follows:

where,

Y_t is the real value and ϵ_t is the arbitrary or random error at t , ϕ_i and θ_j are the coefficients, p and q are integer numbers that are regularly alluded to as autoregressive and moving normal, separately.

To fabricate ARIMA prescient model it comprises of many advances which are model to recognize, assessment of boundary and checking of indicative.

OBJECTIVE

In present scenario investment in financial market is very important for the growth of economy. Due to limited analysis investment can result in loss. As of now investors mainly focus on fundamental data of the company for the investment. So, objective for this study is to forecast stock price of Indian market in order to make better investment decision.

LITERATURE REVIEW

Aparna Nayak, M. M. Manohara Pai and Radhika M. Pai (2016) in the paper titled "Prediction Models for Indian Stock Market" stated that, for past few years, it is seen that many people are showing interest in investing in the stock market. In investing investor may lose all money invested. For this reason, efficient predictive model is required to understand stock market future behaviour. So many forecasting models have been developed about the market trend but very few give good results.

M.Z. Babalet et al (2011) in the paper titled "Forecasting and inventory performance in a two-stages supply chain with ARIMA (0,1,1) demand" stated that, demand model for ARIMA (0,1,1) was analysed extensively by researchers. Forecasting practitioners use ARIMA widely as it has promising theoretical features. They analysed the correlation between the accuracy of forecasting and performance of

inventory. To investigate if there are any benefits of sharing forecast data to retailer and manufacturer.

Seyda Ertekinet (2019) in the paper titled "Improving forecasting accuracy of time series data using a new ARIMA-ANN hybrid method" stated that, it is important to forecast time series data it is also very challenging task. It is used in lot other field of application. Studies has been done on linear individually or a combination with nonlinear. To forecast stationary time series data linear model like ARIMA gives good forecasting accuracy.

The previous examinations additionally order forecasting models as per their imminent: factual and AI (Artificial Intelligence) approaches. Auto Regressive Integrated Moving Average (ARIMA) model connects with the statistical imminent. (Wang et al., 2012). ARIMA model is thought of as a proficient just as prevailing for time series anticipating. Numerous scientists showed that ARIMA method performs transient forecasts better compared to ANNs models. (L.C. Kyungjoo, Y. Sehwan and J. John, 2007), (Merh, P. Saxena and Raj Pardasani, 2010), (J. Sterba and Hilovska, 2010).

Ayodele A., Adebisi (2014) in their research paper depicted the limit of ARIMA model to give commonly exact passing assumptions regarding stock expenses.

Khan (2011) using ARIMA model with occasional patterns anticipated the complete imports of Bangladesh. The concentrate likewise thought about the

anticipated qualities in light of ARIMA with that of the determined qualities acquired from HES occasional model.

Adebayo et al (2014) forecasted securities exchanges for Botswana and Nigeria utilizing ARIMA. The paper presumed that best model is ARIMA (3, 1,1) for Botswana and ARIMA (1, 1, 4) for Nigeria separately.

Singh et al., (2020) used the ARIMA model to anticipate the spread directions as well as mortalities of COVID-19 in the main 15 nations as at April 2020. The review used the model to conjecture the spread of the infection and its related mortalities for the ensuing two months. The discoveries recommended a decrease in the two cases and related mortalities in China, Switzerland and Germany. Nonetheless, it was anticipated that nations like the United States, Spain, Italy France and the United Kingdom will observe expansions in the spread of the infection as well as its related mortalities (Singh et al., 2020).

METHODOLOGY

Detailed process is explained below for ARIMA model. The tool used is Python for implementation of model. Daily historical Stock data are collected from NSE (National Stock Exchange) is used in this research work. The stock data has four constituents which are open, low, high and close price respectively. Closing price is used in this research. It was selected because it shows all the events that happened on that particular trading day. Several experiments performed to examine the best ARIMA

model, following methodology was used.

RESEARCH FRAMEWORK:

The study is based on the stock price of company and forecasting of the stock price.

RESEARCH DESIGN:

The research design shows the methods and procedures for conducting any particular study. Analytical research design applied here as the objective here is to analyse and forecast stock price Maruti Suzuki.

METHOD OF DATA COLLECTION:

The secondary data is used to reach the aims and objectives of this project. The stock data for analysis was collected from NSE website.

The secondary data was collected from NSE website for past 4 years existed on the website in form of digital. I had chosen these sources because of the reliability and suitability of these information which I was also sure about the accuracy of them.

RESEARCH INSTRUMENT:

The research instrument, which is used for the study is daily closing price of the stock price of Maruti Suzuki.

DATA ANALYSIS

ARIMA stands for Auto Regressive Integrated Moving Average is a tool used to forecast stationary time series data. It takes three input parameter ARIMA (p, d, q).

p is used for Autoregressive.

d is used for to make the time series data stationary.

q is used for Moving Average.

ARIMA is able to forecast stationary time series data.

Stationarity Mean: Stationary time series data is stationary when mean and standard deviation remains constant over time. It is required to check the stationarity of data, for this rolling mean and standard deviation is computed and plotted on original time series data.

It is evident from the graph (Fig 2) that

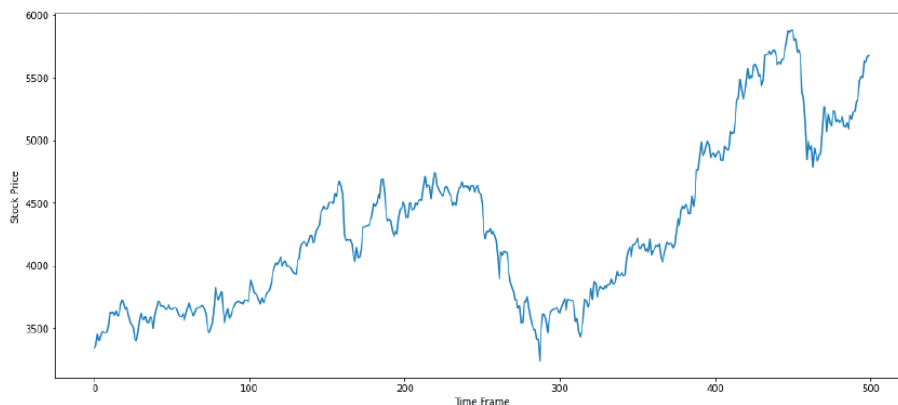


Figure 1 Graph of Collected Data

mean and standard deviation is not constant over time. So, it is required to make the data stationary. To do that, first-order difference of the data was

taken. In simple words, subtract today's price from yesterday's price and plotted again (Fig 3)

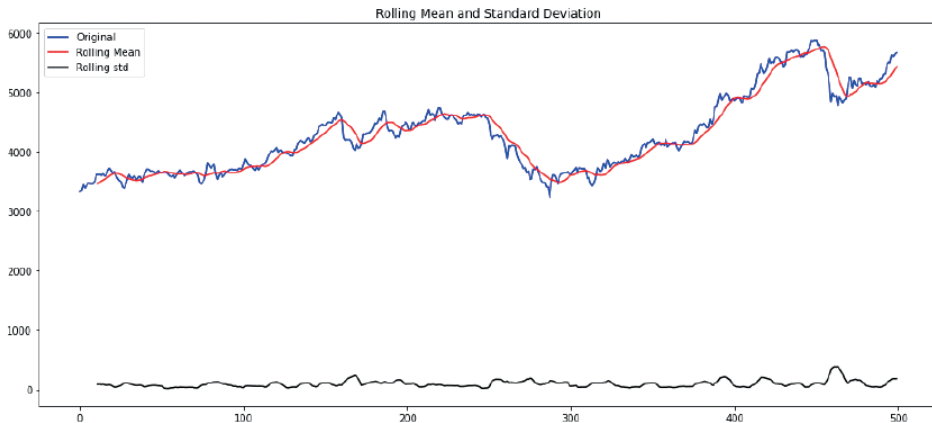


Figure 2 Mean, Standard Deviation and Original Data

From the below graph (Fig 3) it is evident that mean and standard remains

constant. Since stationarity is achieved by differencing one time the d term for ARIMA will be 1.

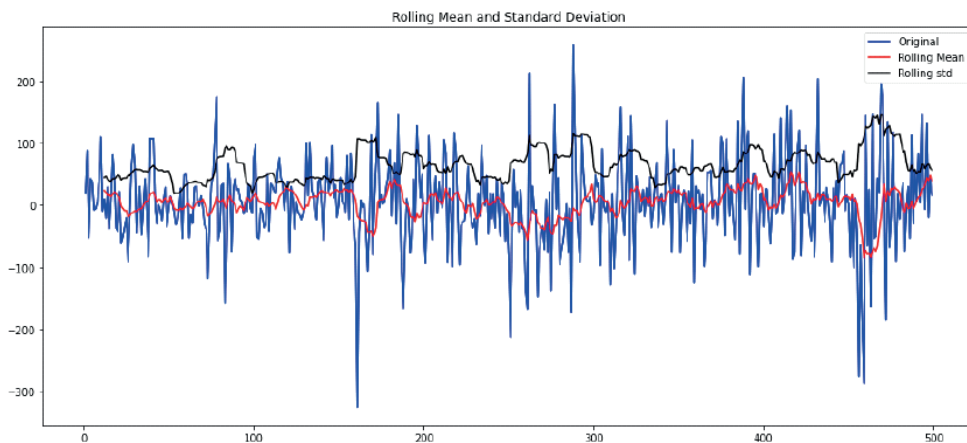


Figure 3 Mean, Standard Deviation and Differenced Data

ACF stands for Autocorrelation and PACF stands for partial autocorrelation plots are usually used for stock price analysis and forecasting.

It shows how strong or weak the observation in a time series with observations at prior time steps are.

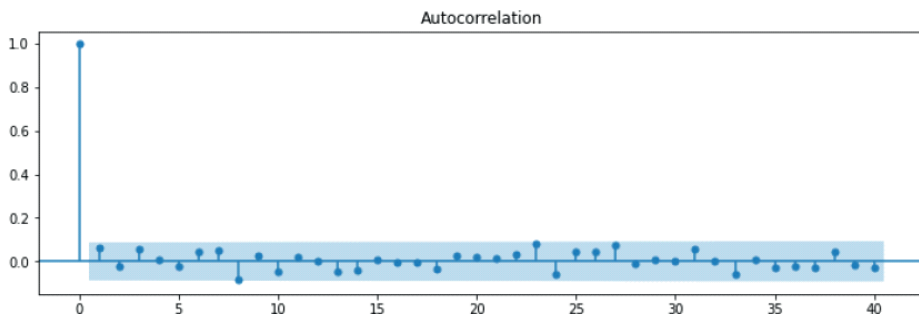
Autocorrelation is the connection between focuses at time t (P_t) and the point at (P_{t-k}) . Fractional autocorrelation is the point at time t (P_t) and the point (P_{t-k}) where k is quite a few slacks. Incomplete autocorrelation overlooks

each of the information in the middle of the two places.

In simple words, Autocorrelation is the relationship between today's stock price and yesterday's stock price. Partial autocorrelation shows the relationship among today's stock price and the price which was a week before. Let's obtain the plots for Autocorrelation and Partial autocorrelation.

P term for ARIMA is computed from autocorrelation plot (Fig 4), from the plot p term is taken that crosses the significance zone. So, p term is 8

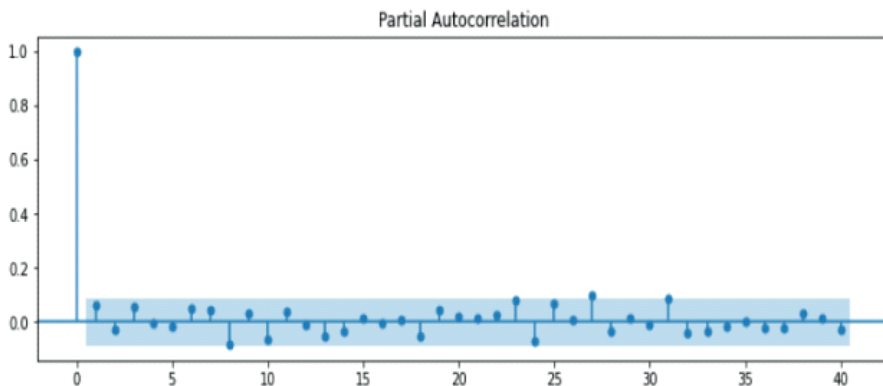
Figure 4 Auto Correlation Plot



q term for ARIMA is computed from partial autocorrelation plot (Fig 5), from

the plot q term is taken that crosses the significance zone. So, q term is 8.

Figure 5 Partial Auto Correlation Plot



RESULT & CONCLUSION

For ARIMA (pdq) model the values obtained are $p = 8$, $d = 1$, $q = 8$. So, the

model is fitted for ARIMA (8 1 8) and result obtained is shown in Table 1 and plotted (Fig 6).

Figure 6 Original data and Forecasted data

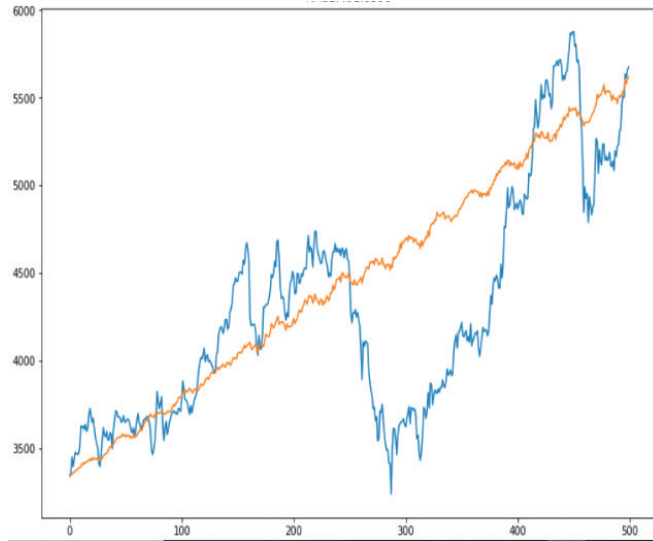


Table 1 Original and Forecasted data

Date	Original	Forecasted
01-01-2015	3340.75	3340.75
02-01-2015	3359.6	3345.301212
05-01-2015	3447.8	3350.69757
06-01-2015	3395.25	3360.127754
07-01-2015	3437.75	3360.905346
08-01-2015	3475.5	3370.026457
09-01-2015	3468.2	3373.658188
12-01-2015	3462.9	3379.478479
13-01-2015	3468.25	3387.753589
14-01-2015	3516	3388.728799
15-01-2015	3625.8	3393.229634
16-01-2015	3616.6	3410.628804
19-01-2015	3626.25	3406.133441
20-01-2015	3605.55	3419.079291

Original time series data is decomposed and plotted (Fig 7). It contains trend, seasonality and residual part of the original time series data. By comparing from the forecasted result, it is evident

that forecasted result contains the trend and seasonality part of the time series data and it least contains the residual part of the original time series data.

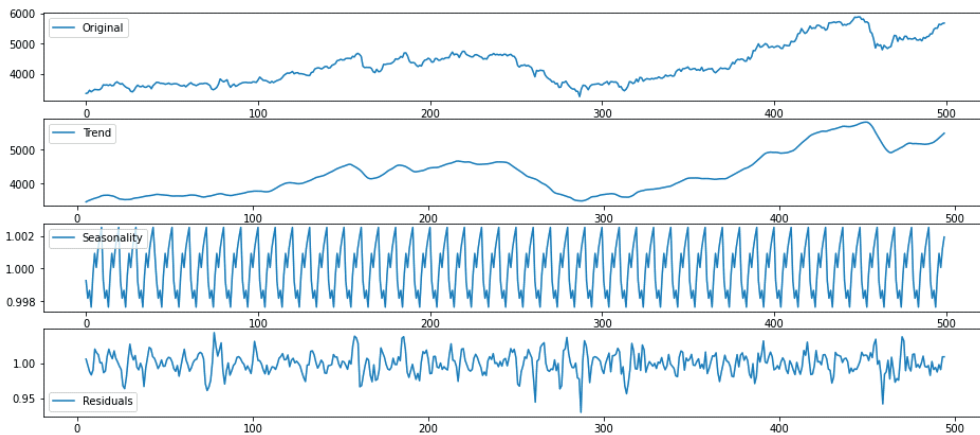


Figure 7 Decomposition of Original Time Series Data

To check the statistical accuracy for the forecasted result Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE) are computed. The value of RMSE is 492.4 and of MAPE is 8.92% which is pretty good. MAPE of 8.92% indicate that our model is 91.08% accurate.

Analysis of Maruti Suzuki stock price for previous 5 years daily traded value on NSE gives us ARIMA (8,1,8) model. ARIMA (8,1,8) is used in predict the future values of Maruti Suzuki stock price. ARIMA (8,1,8) this model was selected which satisfies all criteria of statistics fit.

This paper explored wide process of making ARIMA model to forecast stock price of Maruti Suzuki. The potential of

ARIMA model shown from obtained experimental results. For profitable investment decision ARIMA could be helpful.

LIMITATION

There are some limitations in using ARIMA model to forecast time series data. This technique gives desired result only for short time. When sudden change in the data comes like when government changes policy or instability economic (structural break) etc. in that case it is hard to capture the change, so this model is not good to forecast in this period of time also forecasting with this model assumes that time series data is linear.

FUTURE SCOPE

Forecasting of stock price was done

using ARIMA model. Assumption for ARIMA is that time series data is linear, so implementing non-linear forecasting techniques using soft computing techniques can be considered with less white noise term.

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