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**ALY 6050: Enterprise Analytics**

***Project:* *Forecasting Financial Time Series***

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**INTRODUCTION**

**Background:** In this report on time series analysis mainly focus on two stock Bank of America (BAC) and Caterpillar (CAT), while the last also work on the pricing of the wine price forecast to analyze the price forecasting of the wine. This project report is divided into 3 parts.

Part 1: Short-term forecasting where some plots to detect the seasonal, irregular, and behavioral trend of the stock price by which it will be easy to forecast the price of the stock with lower risk and high profit for the investors. On the other hand, calculated the mean percentage of the absolute deviation of each forecast for the specific stocks on certain values of 0.15,0.35,0.55,0.75 for the smoothing parameter known as alpha. While doing the analysis it was interesting to get the values and forecast the trend of the data. After this MAPD, determined the error of the mean absolute percentage (MAPE) with specific values of 0.15, 0.25,0.45,0.85.

Part 2: Long-term forecasting in which we have checked the weighted average from 1 to 100 by using the 0.3, 0.5, 0.2 where we are able to find out the specific value for the 101 the linear trend and forecasted the value for 5 more observations from the actual closing price of the data. After creating the forecasting value calculated the mean absolute percentage error (MAPE) of the absolute error.

Part3: Analyses in R for both the stocks to forecast the trend and price of the stock by implementing the ARIMA model to get the forecast value and analyze the future expected price of the stock. while doing this analysis on the same time series using ARIMA implemented on the dry wine dataset.

At last, we will discuss the analytical evaluation while using excel, and the implementation of ARIMA with numerical evaluation. In conclusion, will define which model has the better significance and which has major reliability for the forecast the data to get the better results and excellent prediction in the stock market to analyze the stock price.

**ANALYSIS AND INTERPRETATION**

***Part – I – Short-Term Forecasting***

Analysis for the BAC below the chart shows the stock is a trend and has a steady market pricing by analyzing the trend of the stock will be easy for the investor.

**Chart1: Bank of America (NYSE: BAC) 1Yr Data**

In this graph, we have seen less movement in the stock price where investors feel comfortable investing in a particular stock because the risk becomes low to get the desired price from the stock. We have seen the price movement was within the range of 150 and 250 from the 1 year.

**Chart 2: Caterpillar (NASDAQ: CAT)**

**(iii) MAPD**

**Bank of America**

The mean absolute percentage deviation is around 0.247 at alpha 0.15, near 0.831 at alpha 0.35, near 1.532 at alpha 0.55, and near 1.466 at alpha 0.75, indicating that the mean is close to the predicted distance of each data value that spreads out further from the mean.

Table 1: MAPD analysis for Bank of America

|  |  |
| --- | --- |
| **Alpha** | **MAPD** |
| 𝜶 | BAC |
| 0.15 | 0.247 |
| 0.35 | 0.831 |
| 0.55 | 1.532 |
| 0.75 | 1.466 |

**Caterpillar**

The mean absolute percentage deviation is around 2.504 at alpha 0.15, near 1.198 at alpha 0.35, near 0.457 at alpha 0.55, and near 1.331 at alpha 0.75, indicating that the mean is close to the predicted distance of each data value that spreads out further from the mean.

Table 2: MAPD analysis for Caterpillar

|  |  |
| --- | --- |
| **Alpha** | **MAPD** |
| 𝜶 | CAT |
| 0.15 | 2.504 |
| 0.35 | 1.198 |
| 0.55 | 0.457 |
| 0.75 | 1.331 |

**MAPE**

**Bank of America**

The mean absolute percentage error is around 0.761 at alpha 0.15, near 0.833 at alpha 0.25, near 0.764 at alpha 0.45, and near 0.783 at alpha 0.85, indicating that the difference between the measured value and true value is close to the predicted distance of each price of the stock by measuring the mean absolute error.

Table 3: MAPE analysis for Bank of America

|  |  |
| --- | --- |
| **Alpha** | **MAPE** |
| 𝜶 | BAC |
| 0.15 | 0.761 |
| 0.25 | 0.833 |
| 0.45 | 0.764 |
| 0.85 | 0.783 |

**Caterpillar**

The mean absolute percentage error is around 0.753 at alpha 0.15, near 0.828 at alpha 0.25, near 0.789 at alpha 0.45, and near 0.811 at alpha 0.85, indicating that the difference between the measured value and true value is close to the predicted distance of each price of the stock by measuring the mean absolute error.

**Table 4: MAPE analysis for Caterpillar**

|  |  |
| --- | --- |
| **Alpha** | **MAPE** |
| 𝜶 | CAT |
| 0.15 | 0.753 |
| 0.25 | 0.828 |
| 0.45 | 0.789 |
| 0.85 | 0.811 |

***PART 2***

***PART II***

***Timeseries analysis to forecast the price of Bank of America in Excel***

On the one hand, we have seen that the time series analysis reveals that the stock price may move in both uptrend and downtrend directions; on the other hand, we have seen that the orange line depicts the stock's close price, which we anticipated based on historical data.

**Chart 3: Forecast analysis for Bank of America**

Whereas if we have seen the chart of caterpillar the stock price will fall in the forecast which indicates that the price of the stock will change against the trend. Here we found the mean absolute error is high which is why we didn’t find that forecast will be successful.

Chart 4: Forecast analysis for Caterpillar

Moreover, if we look at the mean average percentage error bank of America has 2.803 which is the true mean error from the actual price of the stock, however, caterpillar shows the error of 2.854 which is a true error from the actual price of the stock.

Table 5: MAPE analysis for both stocks

|  |  |
| --- | --- |
| **Stock** | **MAPE** |
| **BAC** | **2.803** |
| **CAT** | **2.854** |

***PART III***

**Time Series analysis for BAC (Bank of America)**

Well, we have seen that the stock price movement in the past year was fluctuating at the initial level we have seen that the stock price is around 50 and it goes nearly to zero, and then we have seen the lower highs in the price of the stock. whereas the recent price of the stock is around 40.

Chart 5: Time series analysis for Bank of America

Chart, histogram

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Implemented auto ARIMA on the closing price of the stock to forecast the price of the stock for the next 90 days, which will effectively identify the trend of the stock and where the price movement of the stock would move soon, as per the report's requirements. To anticipate the stock's price, we utilized R's auto.arima package to forecast the stock's trend and future price. The price of the stock is showing a downturn in the anticipated value, which ranges from 32.53 to 19.55 in the few observations.

Table 6: Forecast table for Bank of America for the period of 90 days

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**Charts 6: Forecast price for the Bank of America**

Chart, line chart

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**Time Series Analysis for CAT (Caterpillar)**

Well, we have seen that the stock price movement in the past year was fluctuating at the initial level we have seen that the stock price is around 55 and it goes nearly to 250, and then we have seen the higher highs in the price of the stock. whereas the recent price of the stock is around 231.

Chart 7: Timeseries analysis for Caterpillar

Chart, histogram

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**Forecast analysis**

Implemented auto ARIMA on the closing price of the stock to forecast the price of the stock for the next 90 days, which will effectively identify the trend of the stock and where the price movement of the stock would move in the near future, as per the report's requirements. To anticipate the stock's price, we utilized R's auto.arima package to forecast the stock's trend and future price. The price of the stock is showing a downturn in the anticipated value, which ranges from 215.18 which is almost the same in the few observations. We have see that the forecast price is the same which totally depends on the historical trend we have able to analyze the stock price for future analysis.

**Table 7: Forecast data price for the caterpillar**

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**Chart 8: Forecast analysis for Caterpillar**

Chart, histogram

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**Time series analysis of wine**

In this analysis, we have seen the price of the stock, which will define the price of the wine on the basis of the month, such as August 269.26, September 271.36, October 282.34, and November 329.35, but we have also seen that the lowest price is in the month of 198.56 in January, while the highest price is in December 427.75, indicating that the sale of the price will increase.

Table 8: Forecast price of dry wine

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Chart 9: Forecast price of the dry wine

Chart, line chart, histogram

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***Recommendation and Conclusion***

The stock is in a trend and has a steady market price, as shown in the analysis below the chart. Analyzing the stock's trend will be simple for the investor. We have witnessed less change in stock prices when investors feel safe investing in stock since the danger of not getting the desired price from the stock is minimal. From the previous year, we have observed that the price movement was between 150 and 250. The mean absolute percentage deviation for alpha 0.15 is roughly 0.247, 0.831 for alpha 0.35, 1.532 for alpha 0.55, and 1.466 for alpha 0.75, suggesting that the mean is close to the projected distance of each data value that spreads out more from the mean. At alpha 0.15, the mean absolute percentage deviation is roughly 2.504, 1.198 at alpha 0.35, 0.457 at alpha 0.55, and 1.331 at alpha 0.75, suggesting that the mean is close to the expected distance of each data value that spreads out further from the mean. The mean absolute percentage error is around 0.761 at alpha 0.15, near 0.833 at alpha 0.25, near 0.764 at alpha 0.45, and near 0.783 at alpha 0.85, indicating that the difference between the measured value and true value is close to the predicted distance of each stock price when the mean absolute error is measured. The mean absolute percentage error is around 0.753 at alpha 0.15, near 0.828 at alpha 0.25, near 0.789 at alpha 0.45, and near 0.811 at alpha 0.85, indicating that the difference between the measured and true values is close to the predicted distance of each stock price measured by the mean absolute Furthermore, the mean average percentage error for Bank of America is 2.803, which is the real mean error from the actual stock price, but the error for Caterpillar is 2.854, which is a genuine error from the actual stock price. We have seen that the stock price movement in the previous year was oscillating at the starting level, where the stock price is about 50 and virtually zero, and then we have seen the lower highs in the stock price. however, the stock's current price is about 40. Implemented auto ARIMA on the stock's closing price to forecast the stock's price for the following 90 days, effectively identifying the stock's trend and where the stock's price movement would go soon, as per the report's criteria. We used R's auto.arima package to forecast the stock's trend and future price in order to forecast the stock's price. In the few observations, the stock price is displaying a downward trend in the expected value, which runs from 32.53 to 19.55. We have seen that the stock price movement in the previous year was oscillating at the starting level, where the stock price is about 55 and it nearly reaches 250, and then we have seen higher highs in the stock price. however, the stock's most recent price is about 231The stock price is indicating a decrease in the expected value, which ranges from 215.18 to 215.18, which is about the same in the few observations. We have seen that the predicted price is the same, which is entirely dependent on the previous pattern. We have used this information to examine the stock price in the future. We have seen the stock price, which will define the price of the wine on a month-by-month basis, such as August 269.26, September 271.36, October 282.34, and November 329.35, but we have also seen that the lowest price is in the month of 198.56 in January, and the highest price is in December 427.75, indicating that the price of the wine will increase. In conclusion, we can see that the time series analysis provides the results on the seasonal data where the movement of the price is almost moving in a similar pattern. Whereas AR is the abbreviation for autoregressive. p stands for the autoregressive parameter. When p = 0, the series does not have any autocorrelation. When p=1, the autocorrelation of the series is up to one lag. It was interesting to analyze the data and provide a better understanding of the price in the future of the stock which will help to analyze the market movements, on the other hand, investor will have the confidence to understand the stock price of the stock and increase the profitability in the portfolio.

Reference:

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