|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Method | Alpha & Beta Values | RMSE | MAPE | Prediction Intervals |
| Naïve Forecast | - | 4.138 | 3.563 | - |
| MA-5 | - | 7.363 | 6.356 | 74.328-103.192 |
| ES | Alpha=1 | 4.138 | 3.563 | 81.681-97.904 |
| Trend | - | 10.033 | 9.218 | 73.289-112.622 |
| Smoothed Trend | Alpha=0.7  beta = 0.2 | 8.306 | 7.805 | 68.110-100.670 |
| 6-month ahead | Alpha, beta=1 | 30.583 | 26.666 | - |

Part 1

In the data, I observed no significant seasonality. Although there is an upward trend but it is hard to say it is an obvious upward trend. There are a lot of fluctuations and there is no pattern that can be strongly seen. I want to emphasize trend that is consistent of long term upward trends and also long term downward trend but overall there seems non-obvious upward trend.

Overall, it seems like Naïve Forecast or exponential smoothing with alpha equals to one is doing pretty good job with this dataset. Other methods are affected by trends that they estimated. Since the trend of the dataset has not an obvious shape, trend terms of other methods lead to misleading conclusions about the forecast.

6-month ahead forecast should be avoided because of structure of the dataset which doesn’t have seasonality and obvious trend patterns. 6-month ahead forecast’s RMSE is too high compared to other forecasts. MA-5 forecasting method is also deceived by the previous 5 data’s behaviors.

Using a naive forecast that includes trend and smoothed version of a naive forecast that includes trend is also not a good idea because of the irregularity of the trend.

Part 2

I observed an exponential decrease of ACF plot of the the realizations from an AR-1 process that I created(Can be seen from Table 14). My expectations before I plot the ACF was also observing an exponential decrease at ACF plot. RMSE starting from period 100 of the realizations from an AR-1 process is 22.095 which is quite high (Can be seen from Table 13). So it would be inefficient to use naïve forecast. Because of the randomness of the data

Chart

Description automatically generatedChart

Description automatically generatedPart 3

Table A) ACF and PACF plots of monthly average price index of coffee

Chart

Description automatically generatedChart

Description automatically generated

Table B) ACF and PACF plots of monthly average price index of coffee after differentiation

There is a overall linear decrease not an exponential decrease after the positive spike of the first lag that can be observed from ACF plot of Table A ,and also there is a positive spike at first lag and a cut off to zero after lag 2 at PACF plot of Table A. So I would propose AR(1) model with positive coefficient.

Graphical user interface, chart, line chart

Description automatically generated

Table1. Plot of the monthly average price index of coffee which corresponds to sale in the plot and month

Chart, line chart

Description automatically generated

Table2. Plot of the 12 month seasonal figure in order to investigate seasonality

Chart, line chart, histogram

Description automatically generated

Table3. Plot of the naive one month forecast & residual values for 1991-2020 period

Chart, histogram

Description automatically generated

Table4. Plot of the 5-period moving average & residual values for 1991-2020 period

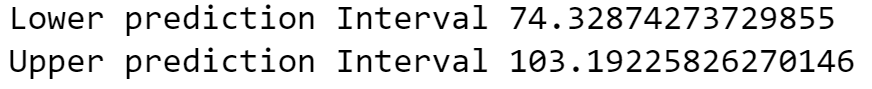


Table5. Calculation of %95 prediction interval with RMSE of 5-period moving average for one month ahead

Chart, line chart, histogram

Description automatically generated

Tablet6. Plot of exponential smoothing to forecast the one-month ahead price with using optimal alpha & residual values for 1991-2020 period

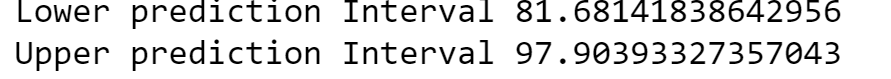


Table7. Calculation of %95 prediction interval with RMSE of exponential smoothing with using optimal alpha for one month ahead

Chart, line chart, histogram

Description automatically generated

Tablet8. Plot of naive forecast that includes trend& residual values for 1991-2020 period

Text

Description automatically generated

Table9. Calculation of %95 prediction interval with RMSE of naive forecast that includes trend for one month ahead

Chart, line chart, histogram

Description automatically generated

Tablet10. Plot of exponentially smoothed version of naive forecast that includes trend with alpha = 0.7 and beta = 0.2 & residual values for 1991-2020 period

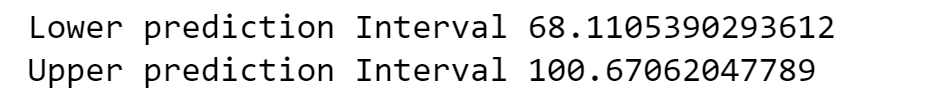


Table11. Calculation of %95 prediction interval with RMSE of exponentially smoothed version of naive forecast that includes trend with alpha = 0.7 and beta = 0.2 for one month ahead

Chart, line chart

Description automatically generated

Tablet12. Plot of six month ahead forecasts for exponentially smoothed version of naive forecast that includes trend with optimal alpha and beta & residual values for 1991-2020 period

A screenshot of a computer

Description automatically generated with low confidence

Tablet13. Plot AR-1 Process and naive forecast on that process

Chart

Description automatically generated

Tablet14. ACF plot of AR-1 Process that I created