1. **JJ.xls**

This dataset consists of the quarterly sales of Johnson and Johnson over the past couple of years from 1960-1980. A new column is created to accommodate getting each value per year and for each quarter. The time series graph is given below.

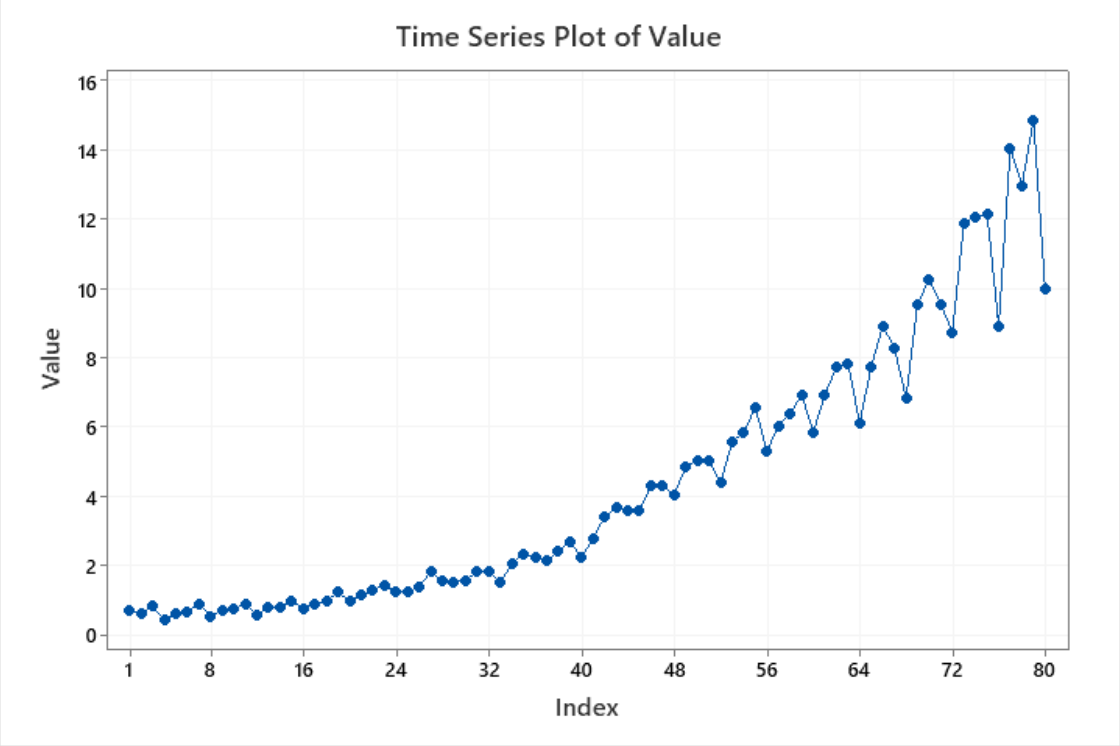


Figure 16 : Time series plot for JJ

From the above figure we can see that the plot has a trend and some seasonality.
Let us take the decomposition for this time series and find out the trend and how are the accuracy measures for the multiplicative and additive model.

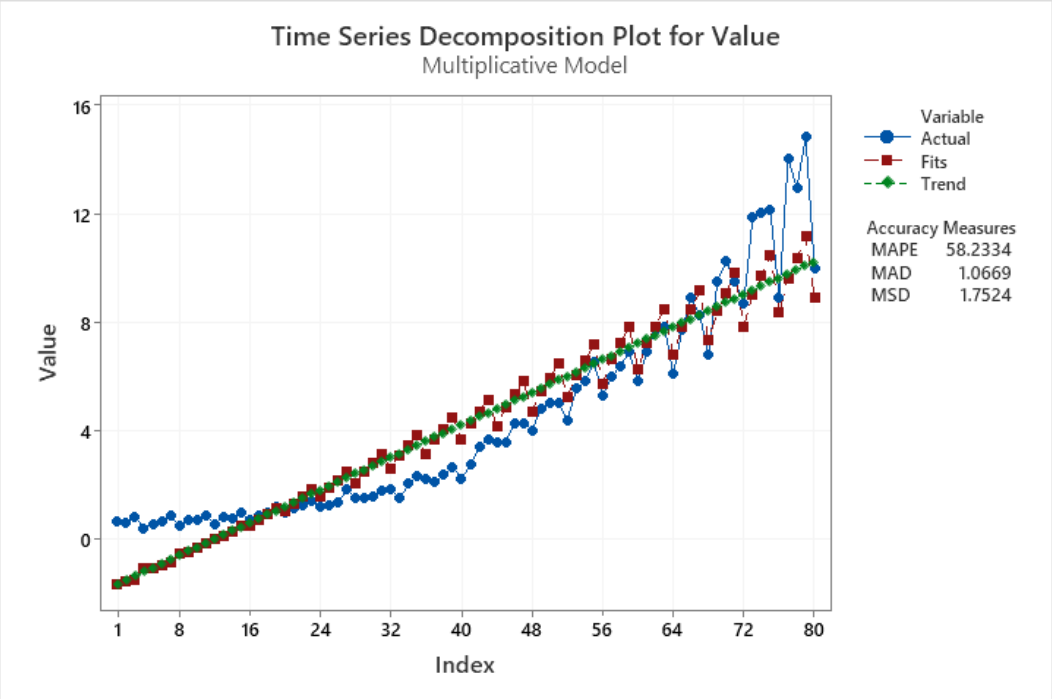
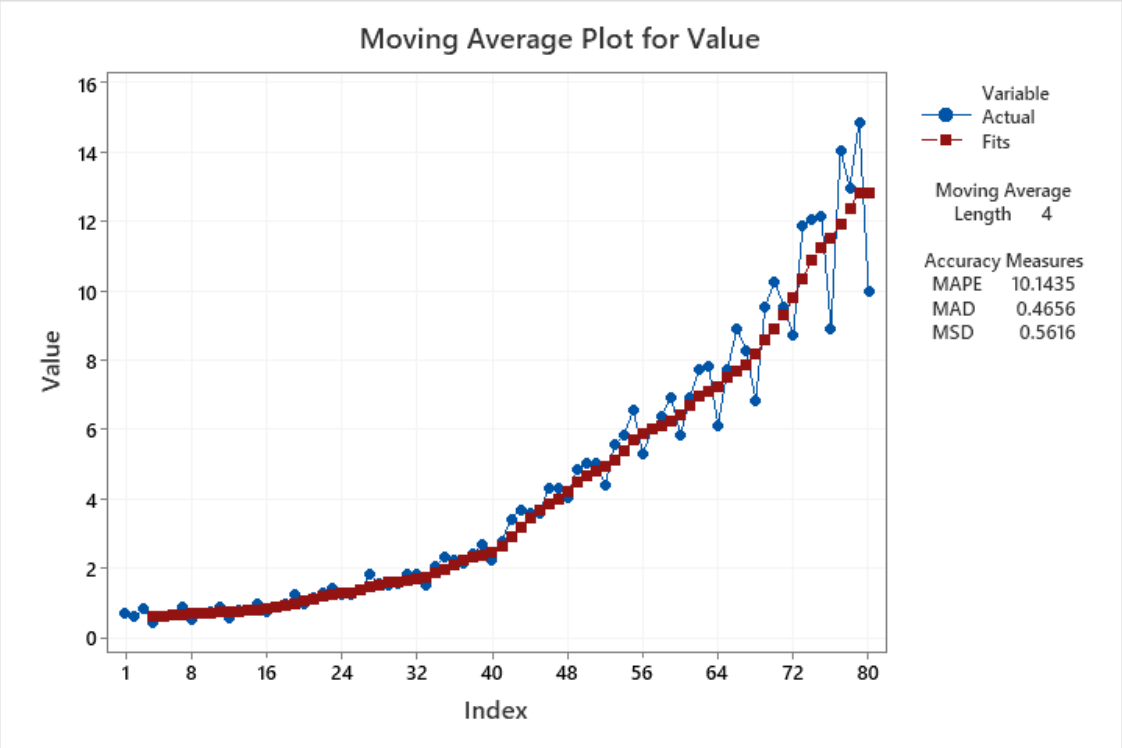


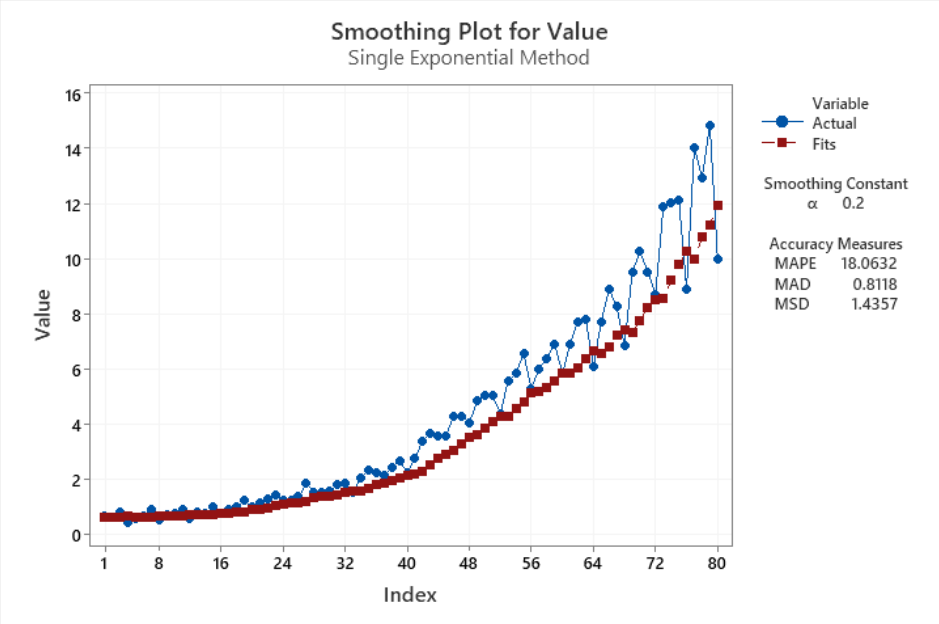
Figure 17 : Multiplicative model for JJ

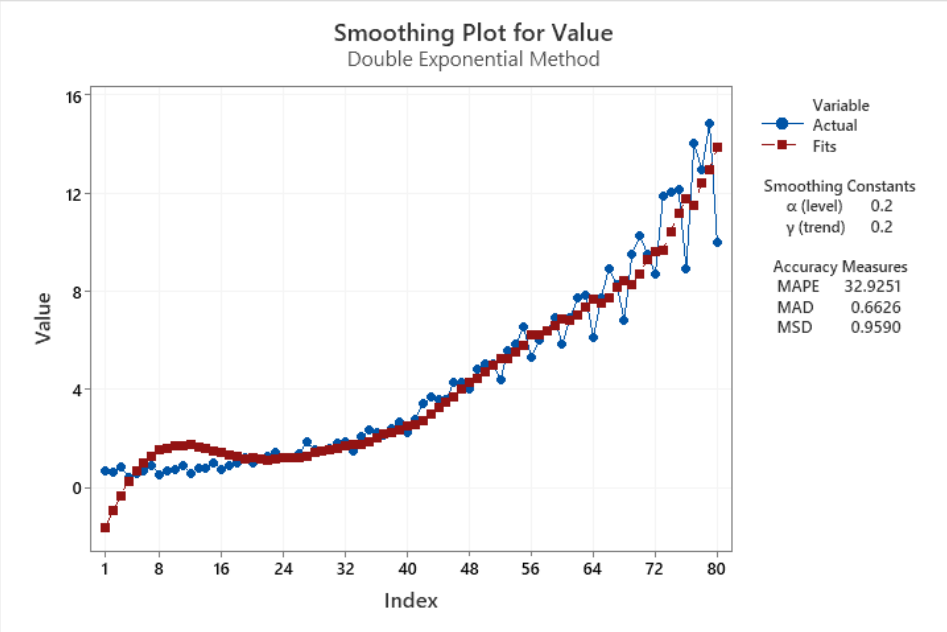
Multiplicative model does better.

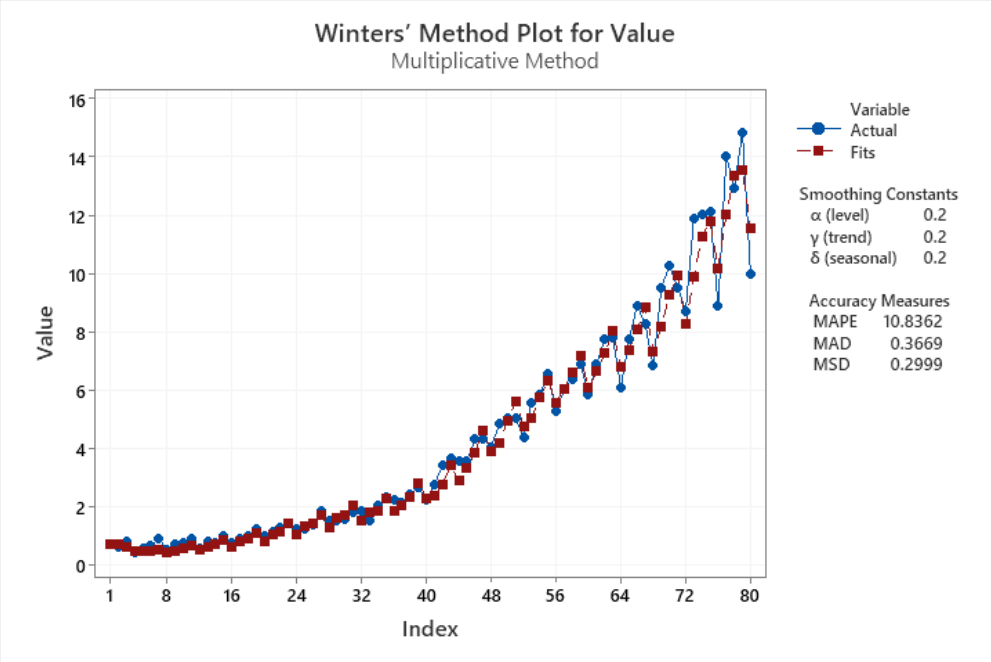
Moving averages plot is given below. We can see that as the index increases there is a dip in the accuracy.



Exponential smoothing is applied for this dataset. Let us check with single, double and winter exponential smoothing. After this we can decide which model works best.

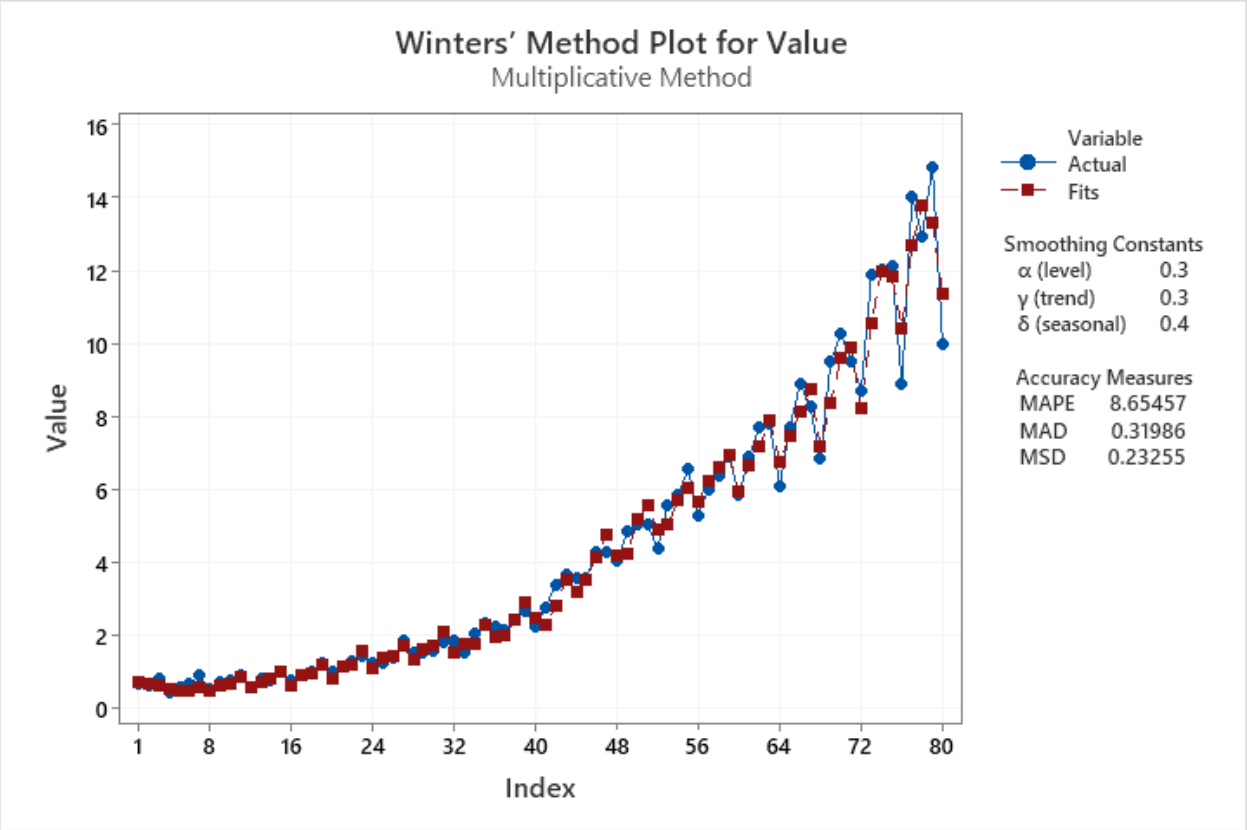






Holt-winters method seems to fit the model the best. The Alpha, beta and gamma values were taken as 0.2. The accuracy measures are lower than single and double exponential methods.

Let us tweak the parameters to get a better fitted model to forecast the values.



The above plot shows us a decent enough model using winters method. The accuracy measures are lower than when compared with lower values of alpha, beta and gamma. There may be other values that can be used to come up with a better model for forecasting.

Given below are the forecasts for JJ dataset.

Forecasts

Period	Forecast	Lower	Upper
81	14.9863	14.2027	15.7700
82	14.9305	14.0963	15.7648
83	15.3155	14.4212	16.2097
84	11.6898	10.7279	12.6517