Case Study Unit 10

Chulwalar Export Forecast

**Introduction**

The purpose of this analysis is to test a variety of forecasting methods for predicting the exports of island of Chuwalhar, part of the island group Urbano. The data available are the past exports of flowers ranging from the years 2008 to 2013, planned exports from 2008 to 2013 for spices and teas, and a number of indicators likely related to exports (satisfaction indexes, export prices, temperature, etc). In addition, there are also a number of national holidays in March, April, and December which influence exports.

**Methodology**

The software used to perform the forecasts is RStudio utilizing the “fpp” and “forecast” packages. These packages allow the use of the below forecasting methods.

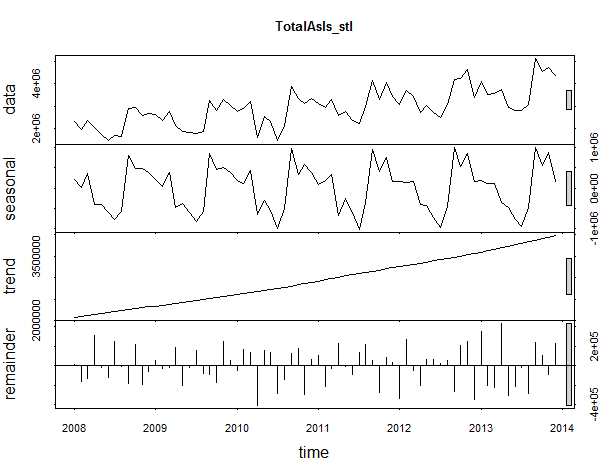
* Simple Exponential Smoothing
* Holtz Winter’s with Linear Trend
* Holtz Winter’s with Exponential Trend
* Holtz Winter’s with Exponential Trend and Dampening
* Holtz Winter’s with Additive Seasonality
* Holtz Winter’s with Multiplicative Seasonality

Initially the data were loaded into RStudio as Data Frames. In order to perform the forecasts the data had to be transformed into Time Series. Analysis of the time series was then performed to check for outliers and/or missing data. After that, correlations for actuals and planned were perfomed. As can be seen below, there are high correlations amongst various flowers and exports, indicating they will be good predictors of exports.

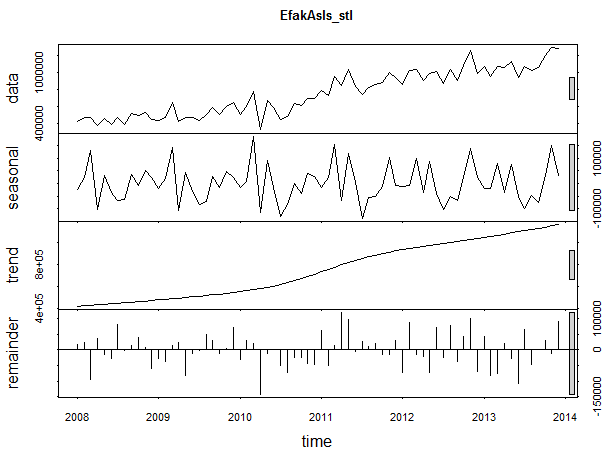


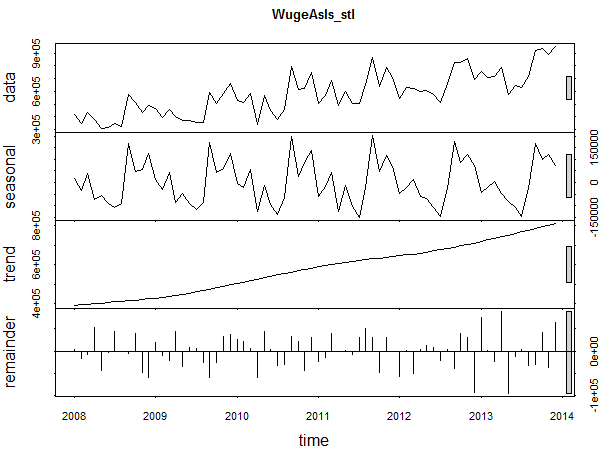
A linear model was then performed for total actual flower production vs total planned exports. The linear model was found to be a good fit since the R-squared = 0.8433 and the p-value was < 2.2e-16.

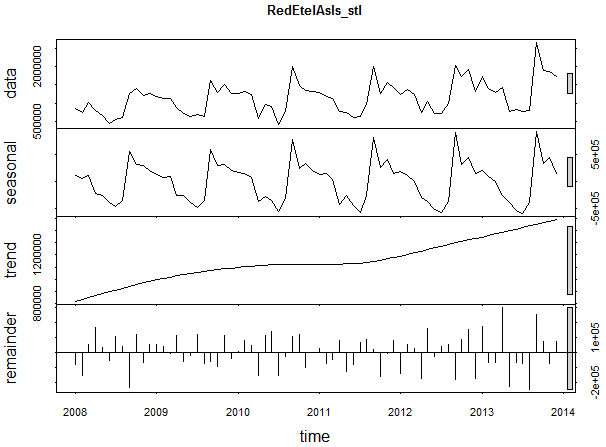
Next the STL function was used to assess linearity and seasonality of exports. The trend of total exports was found to be almost linear with uniform seasonality, as shown below.

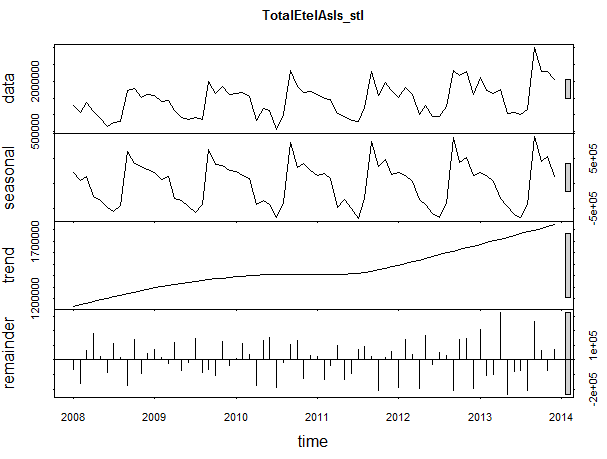


Individually however, less linearity and seasonality was seen. Efak, Wuge, Red Etel, and Total Etel were found to have S like linearity as shown below.

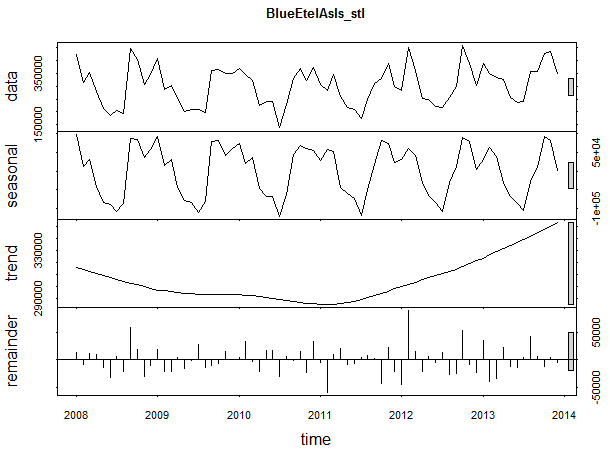








Blue Etel however, showed a U shaped linearity.



The next step was to assess the correlation of the provided indicators vs total exports. A table of the correlations is shown below.

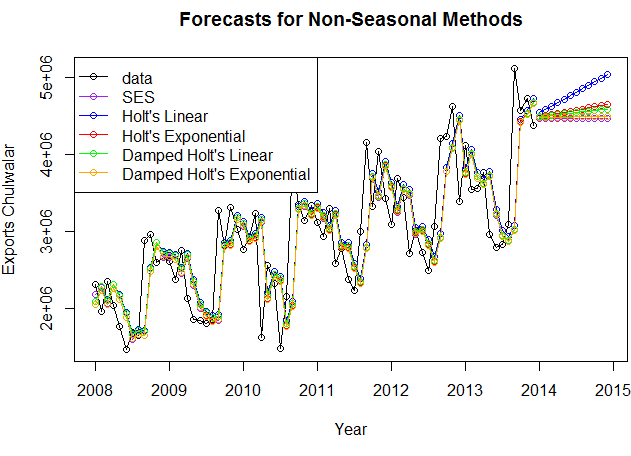


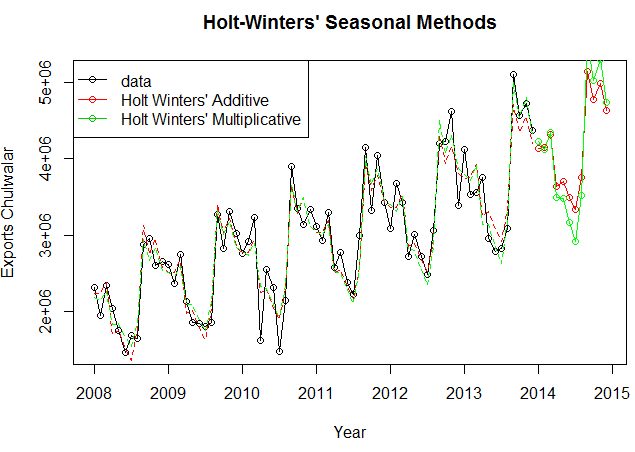
From this, we observe the top 3 predicators of exports to be:

* Change in Export Price Index
* Urbano Total Exports
* Globalisation Party Membership.

Next various forecasting models were assessed which include the bulleted below. Below are graphs of the different forecast methods.

* Simple Exponential Smoothing
* Holt’s Linear
* Holt’s Exponential
* Damped Holt’s Linear
* Damped Holt’s Exponential
* Holt-Winters’ Additive Seasonal
* Holt-Winters’ Multiplicative Seasonal





As shown above, the non-seasonal methods predict only straight lines and give no predictions for seasonality while the seasonality methods predict monthly variations. However, to choose the best method, a number of accuracy measurements were assessed for each method. These measures are outlined in the table below.



As shown above, the seasonal methods are more accurate by most measures. The additive seasonal method was better for AIC, AICc, BIC, and MPE while the multiplicative method was better for RMSE, MAE, MAPE, and MASE.

**Summary**

After performing the analysis, the Holt-Winter’s additive seasonal method was found to be best suited for predicting Chulwalar’s exports. While the multiplicative seasonal method was more accurate by some measurements, preference is given to AIC, AICc, and BIC, which the additive seasonal method was found to be more accurate for. Advice to the Prime Minister of Chulwalar would be to use that method as guidance when planning exports.