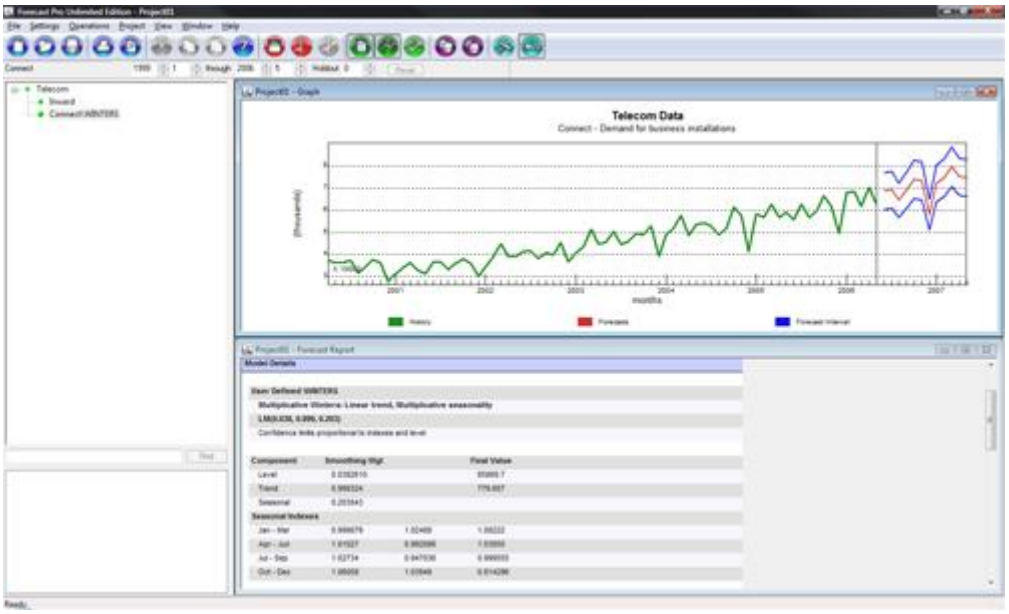
Forecasting 101: Exponential Smoothing Demystified
Part III - How to Interpret the Results

This instalment of Forecasting 101 presents the third of three articles on exponential smoothing. The first two articles presented a conceptual overview of the technique and examined how to select an appropriate exponential smoothing model for a given data set. In this instalment we explain how to interpret the output from an exponential smoothing model.



The Forecast Pro screenshot above shows the model output from a Winters exponential smoothing model. The display includes the smoothing weights and the final values for the level, trend and seasonal components. We'll explore each of these in turn.

Interpreting the Smoothing Weights
As we discussed in the first article in this series, exponential smoothing models use smoothing weights to determine the amount of emphasis to give to each data point when estimating the final values of the model components (e.g., level, trend and seasonal indices). The smoothing weights go into the model's updating equations and their size determines the amount of emphasis to give to the most recent data vs. the more distant past when estimating the given component.

The weights can take on any values between 0 and 1. The larger the smoothing weight, the more emphasis given to recent history. Although there is not a great deal of direct interpretation to the weights, their values do give you an indication of how quickly the components are changing.

Small values (e.g., between 0.0 and 0.1) indicate that the given component is changing slowly and a lot of smoothing is being applied when estimating its final value. Large values (e.g., between 0.85 and 1.0) indicate that the given component is changing rapidly and a lot of emphasis is being given to the recent data when estimating its final value to capture the rapid change in the data.

In our example, the smoothing weight for the level is 0.038, the smoothing weight for the trend is 0.99 and the smoothing weight for the seasonal component is 0.20. Thus we can ascertain that the level of the series is changing slowly, the trend component is changing rapidly and the seasonal component is changing at a moderate rate.

Interpreting the Final Values
The final values generated by the updating equations represent the value of each component at the end of the data set. These are the building blocks from which the forecasts are created.

In our example the final values are:

Level	65870
Trend	780

Seasonal Indexes

Jan - Mar	0.999	1.025	1.082
Apr - Jun	1.010	0.992	1.030
Jul - Sep	1.027	0.947	0.999
Oct - Dec	1.061	1.039	0.814

The final value of the level is the starting point for the forecasts. Combining this with the final value of the trend defines the nonseasonal forecast. Applying the seasonal indices to the nonseasonal forecast introduces the seasonal pattern.

In our example the first forecast is for June of 2007. Thus the first two forecasts are calculated as:

June's Forecast = (Final Level + (Forecast Step * Final Trend)) * June's seasonal index
= (65870 + (1 * 780)) * 1.030
= 68,650
July's Forecast = (Final Level + (Forecast Step * Final Trend)) * July's seasonal index
= (65870 + (2 * 780)) * 1.027
= 69,250

Notice that the final values have direct interpretation. The sales level at the end of the data set is 65,870. The trend is 780 units per month. Each seasonal index defines its month's seasonal pattern. For instance March is our best month—we sell 8% more in March than in an average month (i.e. the index is 1.08). December is our worst month—we sell 19% less in December than in an average month, etc.

Summary
Exponential smoothing is a method of choice for many corporate forecasters. The technique creates accurate forecasts, is easy to apply and can be automated, which allows it to be used for large scale forecasting. In this series of three articles we examined how this important technique works, how to apply it and how to interpret the results.

About the author:
Eric Stellwagen is Vice President and co-founder of Business Forecast Systems, Inc. (BFS) and co-author of the Forecast Pro software product line. He consults widely in the area of practical business forecasting—spending 20-30 days a year presenting workshops on the subject—and frequently addresses professional groups such as the University of Tennessee's Sales Forecasting Management Forum, APICS and the Institute for Business Forecasting. Recognized as a leading expert in the field, he has worked with numerous firms including Coca-Cola, Procter & Gamble, Merck, Blue Cross Blue Shield, Nabisco, Owens-Corning and Verizon, and has served on the board of directors of the International Institute of Forecasters (IIF).