FAQ: Forecasting

What is extrapolation, and what are the dangers it creates?

Extrapolation is technically the extension of a trend line beyond the time frame from which it was developed. For example, if you plot the winning time for the Olympic Marathon on the vertical axis and the years on the horizontal axis, you would find a definite downward trend. If you developed a linear regression (trend) line through the data, you could make some pretty good forecasts (predictions) about the winning time in an upcoming marathon. If you extend that same trend line too far out, though, it will cross the horizontal axis. At that crossing point, the predicted time for the marathon would be zero. Surely this is nonsense. This danger only materializes if you venture too far out from the original time frame.

Why is smoothing necessary or desirable?

Consider a manufacturer of complex electronics items. Some of the needed raw materials are readily available from local suppliers, but some of the most expensive raw materials are actually manufactured in Taiwan. Those materials have a three to 6-month lead time. If the manufacturer orders too much, he will have money needlessly tied up in inventory. If he orders too little, he will not be able to satisfy demand; he will lose sales in the short run and perhaps customers in the long run.

The manufacturer can count on the inventories of products in his distribution supply chain (in distributor warehouses and in retail stores) to attenuate some of the variability in day-to-day demands, but orders will still tend to be variable, or *lumpy*. The manufacturer needs to try to maintain a comparatively stable production process. *Smoothing* is one way to level out the ups and downs of demands.

In what situations is exponential smoothing appropriate?

Exponential smoothing is appropriate when you desire to attenuate the period-to-period variability to stabilize your manufacturing or service planning processes. Even if it would seem that a warehouse could hold enough parts to supply any reasonable order, it is seldom economically wise to do so. There is a real cost to holding inventory. In some cases, inventory will degrade, expire, go out of style, or become obsolete.

Similarly, in the service industries, it rarely makes economic sense for the staff to handle every conceivable peak demand. There is a very real cost to have

service technicians and/or sales personnel idly sitting by.

What are the components of a linear forecast model?

Four components comprise the traditional linear forecast model. The first component is *trend*. Trend is the long-term change in the level over time. The second component is the term *cyclical*, which comes from the business cycle. The third component is *seasonal*. Seasonal components are patterns that repeat on an annual basis. The fourth component is *error*. Error is used to explain the difference between the forecast and what is actually observed.

For example, the Dow Jones Industrial Average (DJIA) has an upward trend. In the 1960s, the DJIA was in the hundreds—now it is much higher. The DJIA also displays a cyclical pattern mirroring the state of the economy. It also has a seasonal component usually explained by the buying and selling of stocks at the end of the year motivated by the desire to reduce personal income tax. Finally, the DJIA has a definite error component. It is virtually impossible to predict whether the DJIA will rise or fall on the next business day. In fact, it is much easier to predict where it will be in a year (up) than where it will be tomorrow.

What role does the smoothing factor, alpha, play in exponential smoothing?

The Greek letter α is the symbol for *alpha* and is a number between 0 and 1 (inclusive). It measures how much weight is given to the most recent actual and how much weight is given to the most recent estimate.

If alpha is close to 0, then the most recent actual is given little weight, and the forecasts that the formula generates will be very stable and will be slow to react to changes in demand. If alpha is close to 1, the forecasts the formula generates will be much quicker to react to changes in demand.

The choice of the right alpha-level depends on how much smoothing is desired. It really is situation dependent.