Less work, better forecasts:

More efficient and accurate demand forecasting with quantitative forecasting tools!

Author: **Johanna Småros**
Director, Scandinavian Operations, D.Sc. (Tech.)
johanna.smaros@relexsolutions.com

Manufacturing companies rely on demand forecasts to control purchasing, production, inventories, and capacity. This means that forecast accuracy has a huge impact on both the efficiency of operations as well as the service level towards customers. Consequently, many manufacturers have taken steps to increase their forecast accuracy. In many cases this has meant multiplying the time and resources dedicated to forecasting – more time is spent on each individual forecast, forecasts are updated more frequently, forecasting is done on a more detailed level, and the forecasting horizon has become longer than before. Yet, increasing the forecast accuracy does not necessarily require increasing the amount of time spent on forecasting. An old Finnish proverb states that a fool works a lot, while a wise man gets off easier. This also applies to demand forecasting!

What is the return on the time spent on forecasting?

Demand forecasting burdens company experts. The time that the experts spend on forecasting should produce as good a return as possible. The return should be at least as good as, or preferably better, than if the sales manager spent the corresponding time on sales or if the demand and supply planning manager spent it on scheduling the production of seasonal products.

Expert judgment is needed in certain situations, but a big part of forecasting is routine work that can be done more efficiently than by having the sales or demand and supply manager feed numbers into table cells. Quantitative forecasting models can harness a computer to do the groundwork for a person, which increases the productivity of forecasting by decreasing the time consumed by it and by increasing forecast accuracy. By automating routine work, the forecasting task also becomes more meaningful.

When is quantitative forecasting beneficial?

The usefulness of quantitative forecasting increases with the number of products for which forecasts are needed as well as with the level of detail required in forecasting (e.g. forecasts on a regional, customer group, or customer level, or weekly or daily forecasts). When the number of items requiring forecasts is high, the expert responsible for forecasting cannot examine all the items that carefully, which lowers forecast accuracy. Alternatively, the expert has to spend a lot of time on forecasting, which reflects negatively on his/her other tasks. However, a computer can go through all of the items on all forecasting levels weekly, or even daily, efficiently, accurately, and tirelessly.

Quantitative forecasting models are based on the presumption that the future can be predicted by looking at the past, which means that quantitative forecasting is particularly well-suited to recurring situations, such as seasons or promotions, or on-going trends. It is, however, not necessary for the circumstances to be repeated in exactly the same way each time for the models to work. Quantitative forecasting models can, for example, automatically take into account an increase or decrease in the baseline sales of a seasonal product or the dampening of a trend in the demand.

What kinds of quantitative models are available?

The most used quantitative models are **time series models** that only use data on historical sales as input. The strength of time series models lies in their cost efficiency – maintaining the models and their input data is simple and the results are, in many cases, good.

If there are no significant trends or seasonal changes in demand, simple time series models such as moving average or exponential smoothing often produce good results. When using the moving average model, all of the demand observations stemming from a specified time period (e.g. the latest five weeks) are given the same weight. When using exponential smoothing models, more recent observations are given more weight when calculating the forecast and the weight of each observation decreases exponentially with its age. When using a moving average or exponential smoothing model, the most important management decision concerns deciding how many observations are included when calculating the forecast or how much weight is placed on the most recent observations, respectively. If the period is short or the impact of the most recent observations is high, the forecasting model reacts faster to changes in demand, but may also overreact to random variation in demand, subjecting the forecast to unnecessary nervousness.

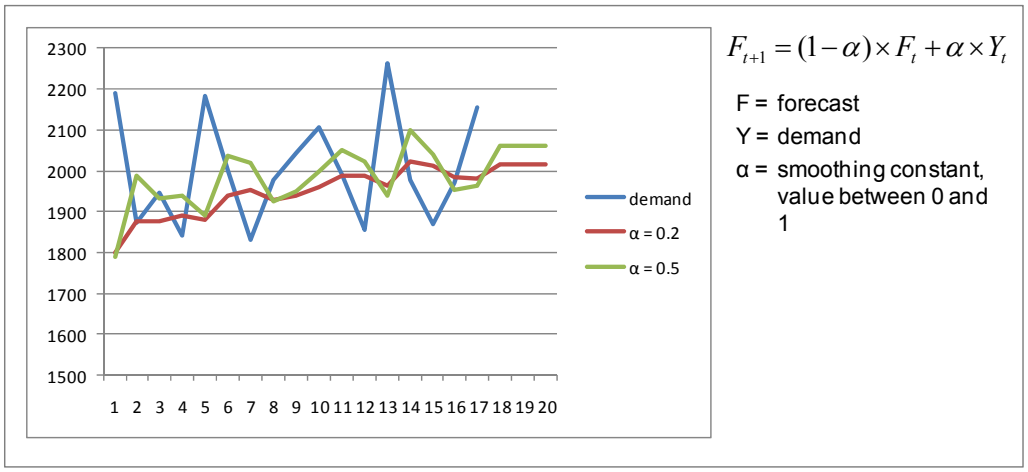

Figure 1. An example of a forecast calculated using an exponential smoothing model and two different smoothing constants.

More sophisticated time series models separate the baselines demand from seasonal or trend components and forecast their development as separate time series, often using exponential smoothing. In additive models, the change caused by the seasonal or trend component is added to or subtracted from the baseline demand. In multiplicative models, the change is taken into account using multipliers.

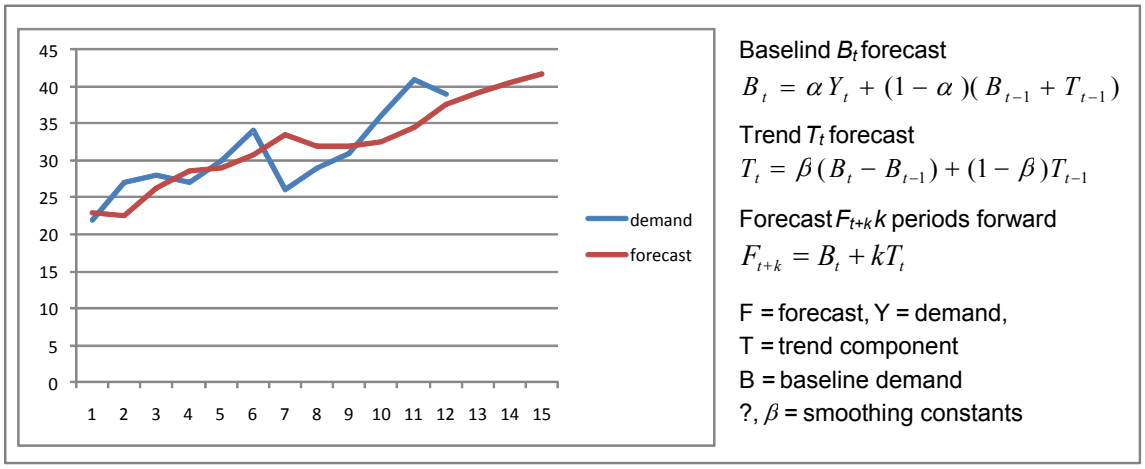

Figure 2. An example of a forecast calculated using an additive trend model (i.e. the Holt model).

Time series models have also been developed for forecasting the intermittent demand that is typical for spare parts, i.e. demand that consists of altering peaks in demand and periods of no demand. For example, Croston's method forecasts two components separately – the time between periods of demand and the magnitude of the demand peaks - and the final forecast is formed with the aid of these two components.

In addition to time series models, different kinds of **regression models** are used in demand forecasting. The aim of the regression models is to predict the effect of one or more variables or factors on others, such as the effect of a price change or promotion on the demand of a product. With the aid of regression analysis, a statistical model is created that aims at explaining the variation in demand with the aid of variation in other factors, such as price.

Regression analysis makes assumptions concerning the connections between the variables, which means that the accuracy of the model depends on the accuracy of these assumptions. Often more knowledge and skill are needed in assessing the suitability of the model than in actually using it. The greatest practical challenge in utilizing regression models is, however, maintaining the input data needed. In addition, to the simple historical sales data used by time series models, regression models require structured information on events affecting demand, such as promotions.

When is expert input needed in forecasting?

Quantitative forecast models are useful when the demand contains recurring features. However, in new circumstances, accurate forecasting often requires expert input. These situations include launching of new products, new kinds of promotions, or significant changes in the market or competitive situation.

An efficient way of combining the best of both approaches is to use quantitative forecasting to create a baseline forecast and to use expert judgment in adjusting the forecast when needed. However, quantitative forecast should only be adjusted for good reason. Research has shown that manual adjustments only increase forecast accuracy when significant changes are made to the forecast, i.e. when the expert has information that cannot be found in history or that cannot be utilized by the model. Small corrections, especially upwards, usually only weaken forecast accuracy! (Fildes et al., 2009.)

Some human input is also required in maintaining the forecast models and monitoring forecast accuracy. Nevertheless, with good system support, the amount of work required can be very small. Situations requiring attention, such as weak forecast accuracy or large changes in product demand can be automatically detected and brought up for inspection by the user. A good forecasting system can also recognize and suggest the most suitable forecast model and corresponding parameters for each item.

What can be gained from quantitative forecasting?

Quantitative forecasting offers the following advantages:

1. **Efficiency:** Quantitative forecasting decreases routine work for company experts. The freed up time can be spent on sales activities or managing special situations, such as major product launches.
2. **Accuracy:** Quantitative forecast models continuously utilize all available information on the realized demand of items and update forecasts regularly and objectively. Often this translates into faster reactions to demand changes and fewer overreactions in correcting the forecasts, which in turn leads to better forecast accuracy.
3. **Continuity:** The quality of the forecasts made by experts varies from person to person and they also carry the risk of the expert changing jobs, which typically weakens forecast accuracy until the replacement has learned the task. Quantitative forecasting ensures that forecasts are produced and that their quality is at least good, if not excellent, in all circumstances.

What next?

We at RELEX are experienced in increasing forecast accuracy and efficiency. We have successfully helped our customers to improve their sales planning and demand forecasting processes as well as to take quantitative forecasting into use. An hour's meeting is enough to go through your company's current situation and to define the first steps. Feel free to contact us: tommi.ylinen@relexsolutions.co.uk / +44 7546 124031.

Sources

Fildes, R., Goodwin, P., Lawrence, M., Nikolopoulos, K., (2009), "Effective forecasting and judgmental adjustments: an empirical evaluation and strategies for improvement in supply-chain planning", International Journal of Forecasting.