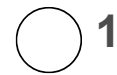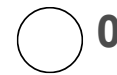# Introduction to Demand Forecasting for Inventory Management (part 3)

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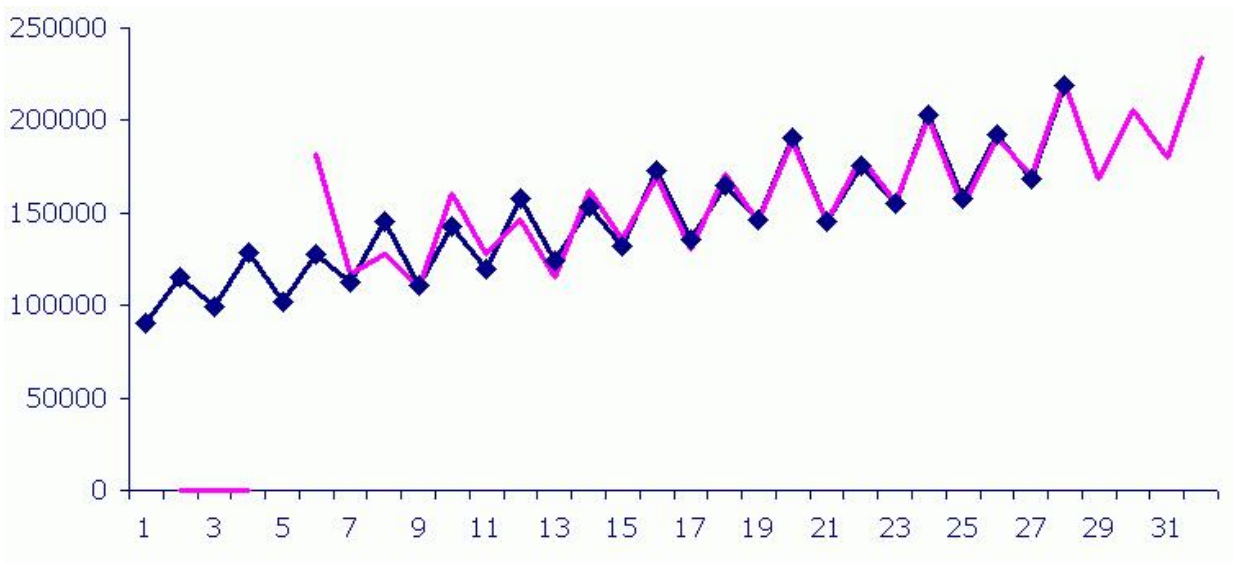
Evgeny Dobronravin
director of Genobium.com, return on …

Exponential smoothing with trend and seasonal decomposition would look as this:

Picture 1. Exponential Smoothing with Trend and Seasonality (Alpha=0.4, Beta=0.5, Gamma=0.7)
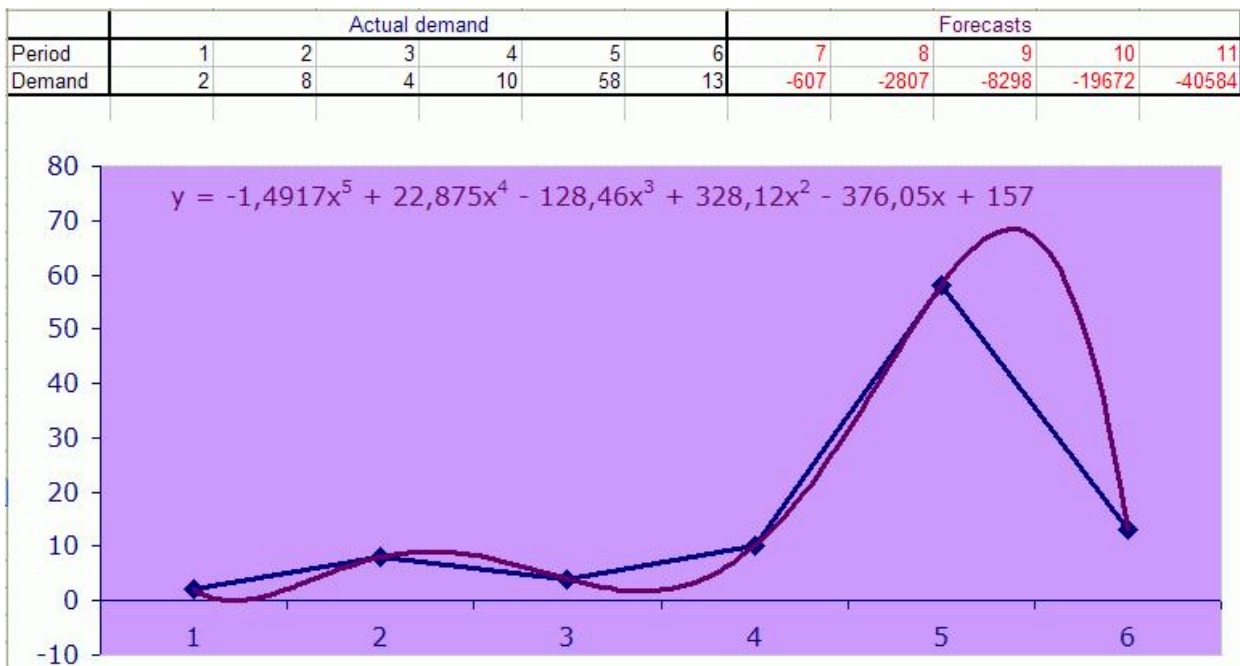
This is what in many books on inventory management use and in choosing the procedure you have the choice: what you plan to give up to be technically processed as a routine operation and what you plan to provide for manual setting needed because of changing conditions. For example if you believe that data contains trends and seasonality, what should be the constants alpha, beta and gamma be, and when they should change?

So you may see that there is something is inferred from the data, something to be supposed from the data and something that should be revised from time to time.

The big mistake when you miss to make simulation experiments properly (remember with these forecasts, 75% of historic data is used in the forecasting procedure and 25% is used for comparison to the actual demand). For example, if you find methods that describe actual points very well it does not mean they are good for forecasting. Let us look at the example with polynomial regression.

Picture 2. Forecasting demand using polynomial regression

	Actual demand						Forecasts				
Period	1	2	3	4	5	6	7	8	9	10	11
Demand	2	8	4	10	58	13	-607	-2807	-8298	-19672	-40584

$$y = -1{,}4917x^5 + 22{,}875x^4 - 128{,}46x^3 + 328{,}12x^2 - 376{,}05x + 157$$

The formula of this polynomial is shown above the graph. But if we apply what is supposed to be "inner law" of time and demand dependence we get wrong results – see the calculations results at the table above – where all the figures are negative! Could we decide we have found dependence at all??? So what have we actually found is mere description without any law. And we cannot apply such a procedure for forecasting.

The same is true for various neuron (with their problem of model overeducating) and genetic algorithms if we use them, without expert knowledge about what parameters and their values are supposed to be and without any simulation checking. The local deviation minimums problem and size of neuron net problem, lead onto numerous simulation experiments with different types of nets educating each many times. In essence, this process adapts models to real conditions with constant risk of "overeducating". Box-Jenkins is accurate but also very complicated procedure.

Instead, simple procedures as exponential smoothing and simple regression (sometimes with trend and seasonality analysis) do not have such a drawback, because all of the model and its constants are based on strong evidence. For example, we could be sure that most recent period has more significance; sometimes we could be sure that trend and seasonal component is present and therefore the procedure can remain for some time before constant changes.

There are many forecasting procedures: mere qualitative, causal regression, time series methods – simple and with regression, spectral methods, ARIMA (Box-Jenkins), trigonometric patterns, neuron methods and genetic algorithms, ranging from cheap to very expensive.

As far as inventory management deals primarily with historic independent demand and looks forward over only a short term horizon, the conclusion is that simple procedures as exponential smoothing works better in practice as it suits all criteria fine. The more complex and expensive procedures are not necessary better even in their technical precision, besides they are difficult to be implemented in their understanding and use by people.

Conclusions about forecasting for inventory management:

- Demand forecasts should be made together with forecasts of deviations

- Forecasts are not self-purpose; inventory limiting and systematic operative decisions are the other sides of the story

- Forecasting or calculating demand in an organization should be well organized

- Forecasts should be simple in usage and for understanding by those personnel involved

- For short-time horizon, sophisticated methods of a high technical level are very close in precision to exponential smoothing, (but this is a very different from usual practice in many companies)

- Forecasting for short term purposes is more correct with short –term procedures and the demand for a group of item is more stable

- Simulation is the best way to check the application of forecasting procedures

- Simulation procedure should be correctly organized (and without bias)

- Companies usually use some form of simple moving average without any deficits losses and exclusive demand analysis

- Procedures used should be stable (without any risk of system "neuroses" or "overeducating")

- Demand consists of components analysis and the chosen constants

- Forecasts precedes planning

To be continued