Introduction to Demand Forecasting for Inventory Management (part 2)

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Evgeny Dobronravin
director of Genobium.com, return on …

Hence we can use various time series methods in forecasting. Their comparative evaluation is presented in Table 1.

Table 1. Procedures rates for 1 horizon of forecasting (fragment)

Forecasting procedure	*Evaluation criteria,in rates*		
	MAPE (mean absolute percentage error)	*MSE (mean squared deviation)*	*Median deviation in %*
Naïve forecast (forecast = actual for the previous period)	7	17	8
Moving Average	15	20	11
Simple Exponential Smoothing	3	13	7
Exponential Smoothing with Trend	4	7	4
Exponential Smoothing with Trend and Seasonal Factors	4	7	2
Combination (Mean value of 6 Procedures)	1	10	1

Best rate is 1, worst - 21.

To evaluate procedures we need to simulate their use on past data to get consecutive forecasts and to compare them to actual observations that are already available. And you could also use this instrument in your practice. Before you start to uses forecasts for inventory management you must choose initial historic data, and check on constants of procedures. Then you might want to test the precision of each procedure using actual data. For example, use 75% of initial data are to choose procedures and parameters to be tested and the rest 25% of the historic are to be compared with forecasts simulations made. Then you just choose the best procedure with the most accurate “forecast”.

Spyros Markidakis (reference?) made 1001 time-series simulation by 21 forecasting procedure. He has used various types of data: with different periods, of macro and micro level of economics, some contained trends and seasonal components, horizon was also being changed. Quality of the procedures was evaluated using 5 indicators.

Some procedures have shown to be better for macro-level, the others– for enterprise level, some– for short-term forecasting, some- for long-term forecasting. On a whole, for short-term forecasting - simple procedures have shown to be better then complex ones such as dynamic programming of Box-Jenkins or econometrical and they could be recommended to be used in enterprises in many cases. But particular interest should be given to exponential smoothing procedure. It could be applied with trends and seasonal analytics and life-cycle knowledge could be also used. Let us consider smoothing

procedure in more detail. With moving average there is the drawback that it gives equal significance for all past periods. In addition, we use only most recent observations and if we choose to use elder periods than forecast loses the accuracy. As simple but much more accurate procedure is exponential smoothing. It endorses more significance to most recent observation and takes all the data present in forecasts.

Let us apply exponential smoothing to our data.

Table 2. Exponential smoothing in comparison

week	demand	3-week	9-week	Exponential Smoothing (with alpha = 0.5)
1	1900			
2	2500			1900
3	2100			2200=(2500-1900)*0.5+1900
4	2600	2167		2150=(2100-2200)*0.5+2200
5	2600	2400		2375=(2600-2150)*0.5+2150
6	2400	2433		2488
7	2900	2533		2444
8	2800	2633		2672
9	2400	2700		2736
10	2800	2700	2467	2568
11	2800	2667	2567	2684
12	2600	2667	2600	2742
13	2400	2733	2756	2671
14	3400	2933	2744	2535
15	3100	3133	2833	2968

Essentially it is just weighted moving average where weights are exponentially smoothed but calculations are straight-forward and are shown in the table for 3, 5, 6 periods. And the formula is:

F(t) = (D (t-1)-F (t-1))*Alpha+F(t-1), where

F(t) and F(t-1) are forecasts for periods t and t-1 respectfully

D (t-1) is actual demand for a period t-1

The exponential smoothing uses only several data and so it can start if you only have 1 observation. To apply the procedure we must only choose the best constant alpha. This raises the first main choice. If we want to use more inertia in forecasting we use more little alpha (say 0.1) and if we want to chase all recent uphill and downfall moves of demand we choose it up to 1.0 (say 0.7). In any case simulation is excellent tool to check (even if you are even a stock trader not just inventory manager) the accuracy.

But the story about forecasting choices is not finished. If you "feel" (we already start to say about "qualitative" expert knowledge) that historic data contains trend or seasons you may use exponential smoothing with trend constant Beta and seasonal constant Gamma.

To be continued…

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