



# Introduction to Demand Forecasting for Inventory Management (part 1)

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Forecast is the evaluation of variable (or a number of variables) for a some moment of future period. Usually forecasting calculations serve as information source for planning process of an enterprise. In forecasting we start from awareness that if we could even approximately forecast the future we might to choose optimal behavior to become in probably better future position.

The main features of forecasts:

1. Forecast always contains mistake
2. Forecast is more complete with its possible mistake evaluation
3. Forecast is more precise when we take it for a group of commodities

4. Forecast is more precise taken with shorter forecasting horizons
5. Forecast cannot substitute calculated demand. Demand for dependent items is need to be calculated from end items demand that could be also forecasted

Quality of forecasts directly influences the quality of management decisions. So for effective inventory management we need to choose the best forecasting method and procedure. The choice depends on types of business-decisions. For example, a procedure to forecast sales for next month could not be suitable to forecast them for next 5 years. In addition, scientists often divide forecasting procedures into 3 types: short-term, medium-term and long-term forecasts. Forecasting customer demand for 6 month horizon is considered short-term, and 2-year horizon and above is for long-term forecasts.

*Table 1. The horizon of forecasting in connection with business decisions types*

Horizon	Decision type	Example
Short-term up to 6 months	Operative	Inventory management, production and distribution planning
Medium-term 6 months - 2 years	Tactical	Plant and equipment leasing, employment changes
Long-term	Strategic	Research and Design, plant development, capital investments. Product changes.

Forecasting methods could be divided between the types or categories:

1. Quantitative – when no formal mathematical model is used sometimes just because historic data do not represent the future states (for example in long-term foresights or any types of educated guessing)
2. Regression methods – line regression projections, where we suppose that variable is linearly dependent from other variables
3. Multiple-equations methods – when we have a number of variables that are interdependent by a number of equations (econometric models)

4. Time-series analysis methods – where we have one variable that changes in time and its future values depend on previous values

A demand could be divided in to following components: average demand for a period, trend, seasonal, cyclical, auto correction and mere accidental component.

Regression analysis is used to express functional relation in equation form say between cars sold and spare parts asked for them later. Main equation form is:  $y=kx+b$ . When we know K and B we just enter number of cars sold (as X) we get future spare parts sold (Y) say 6 month later.

But most often we use time-series analysis methods in inventory management. And regression analysis instruments could be also used when we use T (time) instead of X. It comes from statement that variable changes in time and depends on time and its past values only.

If  $F(t)$  – forecast for period t, equation would be:  $F(t) = f(D(t-1), D(t-2), \dots, D(0), t)$ . The aim of time-series analysis – to discover the character of f-function and to give the opportunity to forecast  $F_t$  as  $D(t)$  from the equation. Those methods are very well for short-term forecasting where past behavior of demand is good representative of its future state at least in short perspective.

For example historic data of 6 weeks could be used to forecast demand for week 7. Let us show how simple time-series methods work in their comparison.

The choice of forecasting method and necessity to analyze each component of demand depend on answer to the question – how deep should we analyze, and what is the cost of it.

If the demand for item does not rapidly grow and no seasonal factors than we might use just simple moving average as many of us probably do using Excel spreadsheets. But there is some difference exists (see Table 2).

*Table 2. Example of 3-week and 9-week moving average forecasts*

week	demand	3-week	9-week
1	1900		
2	2500		
3	2100		
4	2600	2167	
5	2600	2400	
6	2400	2433	
7	2900	2533	
8	2800	2633	
9	2400	2700	
10	2800	2700	2467
11	2800	2667	2567
12	2600	2667	2600
13	2400	2733	2756
14	3400	2933	2744
15	3100	3133	2833

The drawback of moving average is that all individual surveys of past demand are used, so we need more information and more calculations. But 9-week moving average is better when we have to make forecasts with more inertia in order to ignore individual recent spontaneous demand changes.

Weighted moving average. Meantime, when simple moving average gives equal significance to all demand surveys, weighted moving average is able to give more significance (weight) to most recent figures as they are better representatives of future demand. For example, a shop may figure out that the best demand forecast is provided when using 40% of actual demand from previous week, plus 30% of the week before it, plus 20% of the week before it, plus 10% of the week before it. The most precise procedure the more resources it needs – mentality, education, organization, information. But the later is not guaranty that it forecasts would be more precise and less risky.

...to be continued

Tags:

Operations management, Quantitative Methods for Business Decisions, Manufacturing Planning and Control Systems