XII. FORECAST

FORECASTING

Forecasting is basically associated with time series and causal models. It is a means of predicting values of variables important in decision processes from historic values of selected variables, Typical applications involve, Sales, Budgeting, Inventory Management, Production Planning, Financial Planning, Staff Scheduling, Facilities Planning and Process Control.

Microsoft has 19 free Excel worksheet sets that deal with forecasting in business. They can be downloaded (free) by going into template help with the word "forecast". They are primarily set up to collect data and by normal excel cell operations, obtain summary data. They do not however have new functions or routines that would represent better models/representations of time series.

Excel does not have the function or routine depth to do more involved time series analysis of data. The two tools that it does provide are limited and defective. Excel does not provide better current forecasting tools.

Excel 2003 and 2007 lack Box-Jenkins type models, important cyclical (seasonal) models, higher order exponential smoothing models, adaptive control methods, and other autocorrelation functions.

THE EXCEL FUNCTION FORECAST

The Excel function FORECAST does a simple linear regression on the input data and outputs a Y value from the equation a + b*X, where the values of a and b are calculated from the input data range. To get the information, select a blank cell, select the fx symbol in the worksheet header, select FORECAST, then select (on the bottom) Help on this function. It is a simple linear regression on historic data.

EXPONENTIAL SMOOTHING

The Analysis Toolpac Exponential Smoothing tool does a simple forecast. It predicts a value based on the prior period data and prior forecasts. The new forecast is adjusted for the error in prior forecasts. The tool uses the smoothing constant a, the magnitude of which determines how strongly forecasts respond to errors in the prior forecast.

THE FUNCTION

Exponential smoothing is considered as a statistical analysis of data.

Description from help

"The Exponential Smoothing analysis tool predicts a value based on the forecast for the prior period, adjusted for the error in that prior forecast. The tool uses the smoothing constant a, the magnitude of which determines how strongly forecasts respond to errors in the prior forecast.

Note *Values of 0.2 to 0.3 are reasonable smoothing constants. These values indicate that the current forecast should be adjusted 20 to 30 percent for error in the prior forecast. Larger constants yield a faster response but can produce erratic projections. Smaller constants can result in long lags for forecast values."*

THE DATA ANALYSIS HELP GIVES:

"Input Range

Enter the cell reference for the range of data you want to analyze. The range must contain a single column or row with four or more cells of data.

Damping factor

Enter the damping factor you want to use as the exponential smoothing constant. The damping factor is a corrective factor that minimizes the instability of data collected across a population. The default damping factor is 0.3.

Note *Values of 0.2 to 0.3 are reasonable smoothing constants. These values indicate that the current forecast should be adjusted 20 to 30 percent for error in the prior forecast. Larger constants yield a faster response but can produce erratic projections. Smaller constants can result in long lags for forecast values.*

Labels

Select if the first row and column of your input range contain labels. Clear this check box if your input range has no labels; Microsoft Excel generates appropriate data labels for the output table.

Output Range

Enter the reference for the upper-left cell of the output table. If you select the ***Standard Errors*** *check box, Excel generates a two-column output table with standard error values in the right column. If there are insufficient historical values to project a forecast or calculate a standard error, Excel returns the #N/A error value.*

Note *The output range must be on the same worksheet as the data used in the input range. For this reason, the* ***New Worksheet Ply*** *and* ***New Workbook*** *options are unavailable.*

Chart Output

Select to generate an embedded chart for the actual and forecast values in the output table.

Standard Errors

Select if you want to include a column that contains standard error values in the output table. Clear if you want a single-column output table without standard error values."

THE ROUTINE ITSELF

No further details are provided in any KBA articles. The routine however when used, leaves the actual equations used in the output cells.

The routine follows "Simple Exponential Smoothing" as given in texts on forecasting and time series analysis (i.e. Montgomery and Johnson 1976) The simple exponential smoothing function is:

$S_T = \alpha * X_T + (1 - \alpha) * S_{T-1}$

Where:

X_T is the observed value at time period T

S_T is the smoothed value at time period T

S_{T-1} is the smoothed value at time period T – 1

α (alpha) is the smoothing constant

This form is found in many textbooks on forecasting. The use of "alpha" is normally used as the measure of the degree of smoothing. However Microsoft turned it all backwards, and the equation actually used is

$S_T = (DF-1) * X_T + DF * S_{T-1}$

Where DF is the message box input "Damping factor" value. Consequently alpha = 1-DF.

Montgomery and Johnson (1976) say, "The choice of the smoothing constant α is important in determining the operating characteristics of the exponential smoothing.The smaller the value of α, the slower the response. Larger values of α cause the smoothed value to react quickly – not only to real changes but also to random fluctuations. For an N-period moving average, alpha would be

$\alpha = 2/(N+1)$

If the user takes the HELP description (above) literally and interprets the input" Damping value as the "smoothing constant" then the whole thing runs backward. A "Damping value" of 0.2 gives an alpha value of 0.8, and the resulting series jumps severely from period to period, contrary to what the HELP note says.

AN EXAMPLE

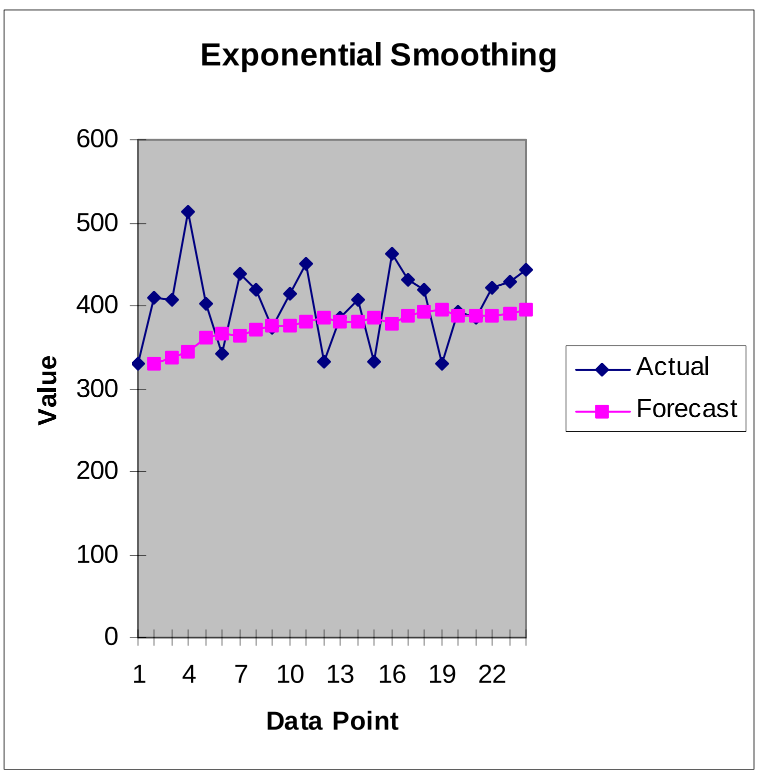
The use then (with the dampening factor set to 0.9) results in columns of data like the following:

Period	Sales		
1	330	#N/A	#N/A
2	410	330	#N/A
3	408	338	#N/A
4	514	345	#N/A
5	402	361.9	115.2693
6	343	365.91	108.1188
7	438	363.619	101.1499
8	419	371.0571	50.54836
9	374	375.8514	52.77601
10	415	375.6663	51.10278
11	451	379.5996	35.81942

Period	Sales		
12	333	386.7397	47.07648
13	386	381.3657	56.37112
14	408	381.8291	51.66379
15	333	384.4462	34.61379
16	463	379.3016	33.43204
17	432	387.6714	58.69995
18	419	392.1043	62.2285
19	329	394.7939	56.8443
20	392	388.2145	48.36401
21	385	388.593	41.09559
22	421	388.2337	38.10543
23	430	391.5104	19.1561
24	443	395.3593	29.25743

Column 3 is the smoothed value of column 2. Column 4 is the standard error of the smoothed value as a “sigma”, [=SQRT(SUMXMY2(select short range col 2, short range on col 3) / # in short range]. Here the short range is 3.

The selected chart (Excel 2003) is as follows



The Excel 2007 chart is entirely different. It is shown in section 20.