

2. TUTORIAL FOR VISUAL RESPONSE MODELING (modeler.xls)

CASE: CONGLOMERATE, INC. RESPONSE MODEL, P. 60

Modeler is an Excel spreadsheet that analyzes graphs designed to help you understand the results of market-response models with a single independent variable. Modeler has two modes of analysis: forecasting (where the independent variable refers to time) and response (where the independent variable refers to the marketing-mix element of interest).

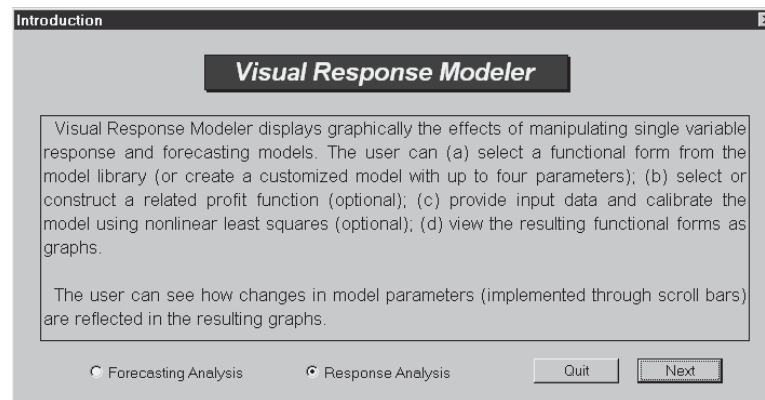
The program allows you to

- Select a model form from a library of common response models,
- Build a custom or user-defined model (with up to four parameters),
- Estimate model parameters (if data are available),
- Develop a profit function to explore the profit implications of the model (in response mode only), and
- Explore how changes in response model parameters (such as elasticities) and profit parameters (such as production cost) affect market response.

This tutorial is divided into three sections: In section 1, we describe how to develop a market response model and calibrate it with data. In section 2, we develop a user-defined function and apply it to the same data. Section 3 concerns the forecast model.

Section 1— Response curve for built-in model

From the **Model** menu select **Visual Response Modeling** (modeler.xls) to see the **Introduction** screen.



In the **Introduction** dialog box select **Response Analysis**, and click **Next** to go to the **Main Menu**.

From the **Main Menu**, choose the form of the response function and, optionally, the form of the profit function. For example, click the built-in ADBUDG response function from the drop-down menu and Marketing Effort from the drop-down **Profit Function** menu to examine the effect of advertising expenditure.

* Tutorial 2, June 2005

Main Menu

Response Function

ADBUDG

$$\text{Sales} = b + (a - b) * \frac{X^c}{d + X^c}$$

Add New Delete

Select Profit function

Profit Function

Marketing Effort

$$\text{Profit} = (r - s) * \text{Sales} - tX$$

Add New Delete

OK Help Quit

Click **OK** to get to the **Data Maintenance** sheet. The example screen below shows a short data series for marketing effort level (X) and the corresponding sales level (Y). These are data that you provide.

Marketing Engineering - modeler

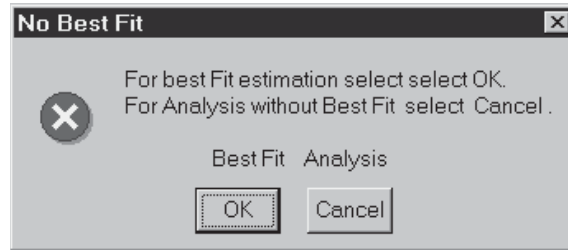
File Edit View Insert Format Tools Data Window Model Help

D19 50

	A	B	C	D	E	F	G	H
1	<div style="border: 1px solid gray; padding: 5px;"> <p style="text-align: center; font-weight: bold;">Data Maintenance</p> <div style="display: flex; justify-content: space-between;"> Best Fit Estimates Analysis </div> <div style="display: flex; justify-content: space-between;"> Main menu Help </div> <div style="display: flex; justify-content: space-between;"> <div> <p>Sales Function:</p> $\text{Sales} = b + (a - b) * \frac{X^c}{d + X^c}$ </div> <div> <p>Profit Function: (if any)</p> $\text{Profit} = (r - s) * \text{Sales} - tX$ </div> </div> </div>							
2								
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13			0	30				
14			1	32				
15			2	35				
16			3	40				
17			4	45				
18			5	47				
19			6	50				
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21								

Ready Sum=50 NUM

If you click **Analysis** without first selecting **Best-Fit Estimates**, you get the warning **No Best-Fit**. Even though calibrating the function takes time, it is generally a good idea to ask for the best-fit estimates—if only to get a benchmark.

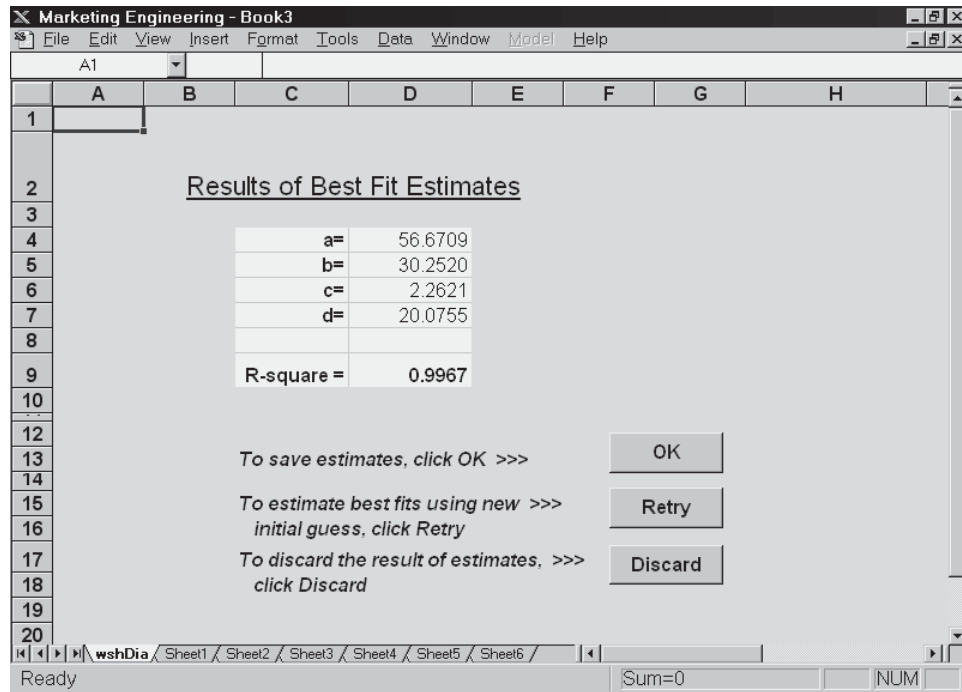


If you run **Best Fit Estimates**, you will get the **Curve Fitting** dialog box. You can specify constraints on the coefficients or provide initial guesses to be used in estimating coefficients. In the example below, we have entered initial estimates for the ADBUDG coefficients.

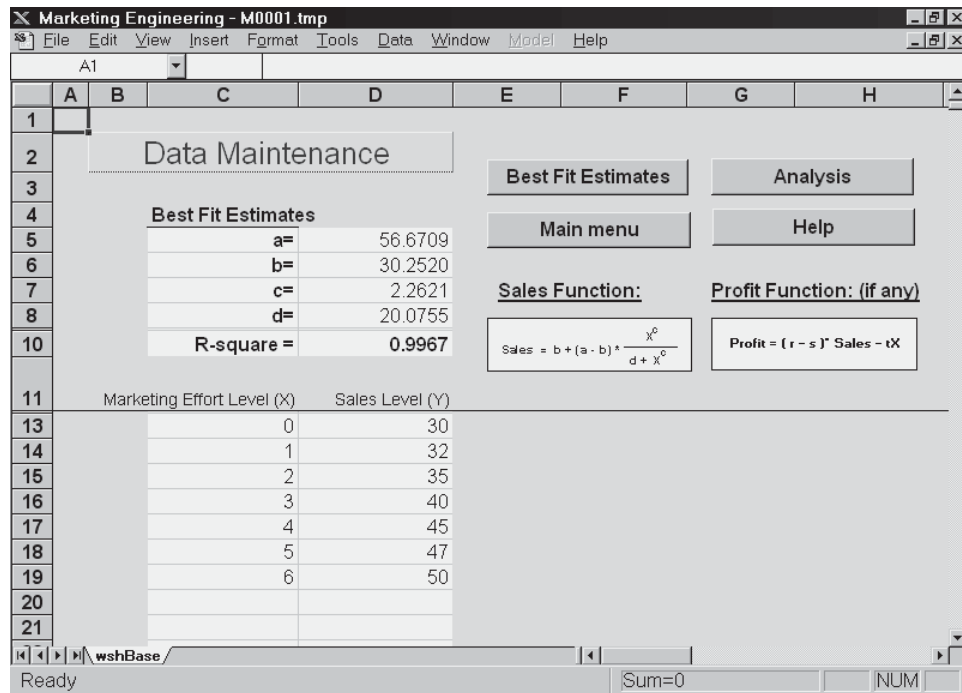
Note: To obtain the best-fit estimates, the model minimizes a squared error objective function using Excel's Solver. As this involves a nonlinear least-squares estimation procedure, the algorithm may converge to a local (nonoptimal) solution or not converge at all. However, if you have reasonable initial estimates (and, in some cases, if you impose constraints, e.g., $c > 1$) for the parameter coefficients, you can improve the chances that the algorithm will converge to a good solution. See Chapter 2 in the textbook for some insights into what parameter values may be reasonable.

	initial guess	Limits	
		lower	upper
a =	60		
b =	30		
c =	3		
d =	100		

The program displays the results of the estimation procedure on a new sheet. If the procedure fails to converge on a solution, click **Retry** to get back to the **Curve Fitting** dialog box. Click **Discard** to start over. If the parameter estimates make sense and seem to provide a good fit (e.g., as indicated by a high R-square value), keep them and click **OK**.



The **Data Maintenance** sheet shows the calculated estimates.



Once you have completed the data maintenance part of the analysis, click **Analysis**.

Response Function Parameter Setup

Function Name: **ADBUDG**

$$\text{Sales} = b + (a - b) * \frac{X^c}{d + X^c}$$

OK
Cancel
Help

Scroll Bars Range (From -5 To +5 Increments)

	Start	Increment (>=0)	Estimates
a =	56.6709	2	56.6709
b =	30.2520	2	30.2520
c =	2.2621	.1	2.2621
d =	20.0755	2	20.0755

You will see the **Response Function Parameter Setup** dialog box. Specify the “tracking” ranges for each of the parameters. This will enable you to explore visually how the response curve changes as you vary the parameter values around the starting values. Specifically, the parameters can be varied from -5 increment to +5 increment around the start values. The program lists previously determined best-fit estimates to provide you with some guidance about what ranges to plot.

Click **OK**. You will get the **Profit Function Parameter Setup** dialog box if you previously checked this option in the **Main Menu**. In the example shown below, the increments have been given values of zero, which fixes the parameter values for the profit function.

Note that the parameters for the profit function are denoted as

- r = unit price,
- s = unit cost,
- t = unit cost of marketing mix variable.

Profit function parameter setup

Function Name: **Marketing Effort**

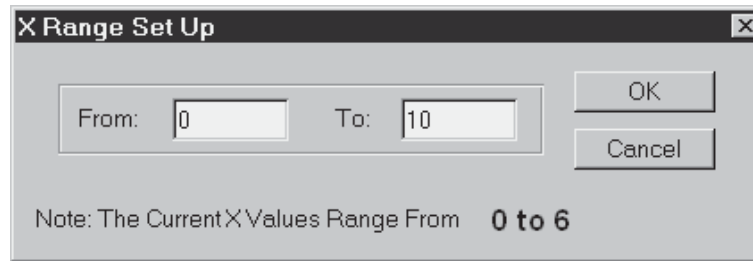
$$\text{Profit} = (r - s) * \text{Sales} - tX$$

OK
Cancel
Help

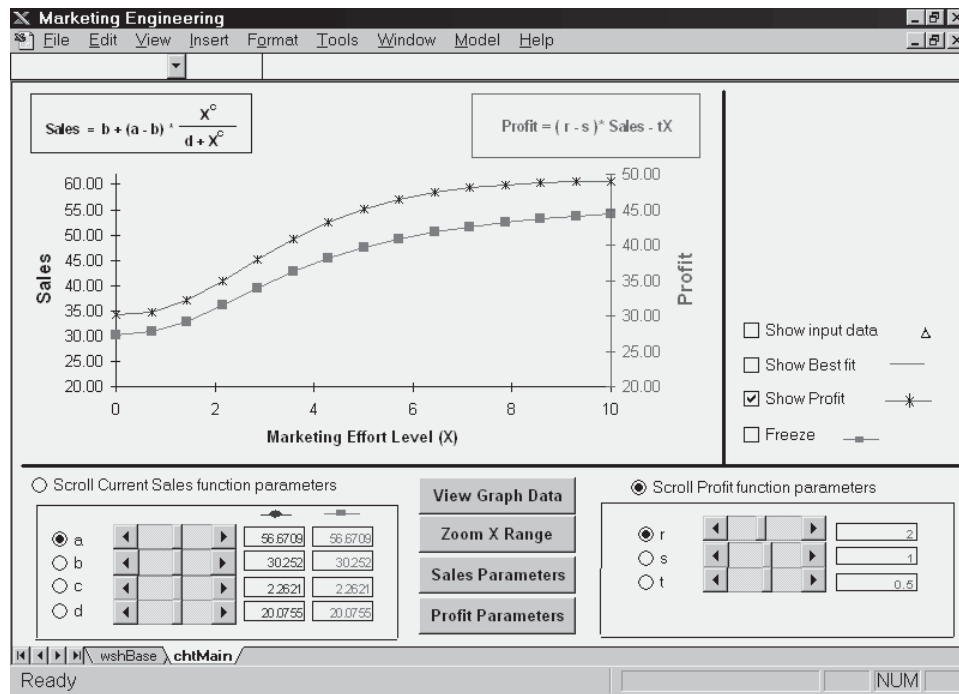
Scroll Bars Range (From -5 To +5 Increments)

	Start	Increment (>=0)
r =	2	0
s =	1	0
t =	.5	0

Next, specify the plotting range along the category axis (x-axis). To help you to specify a suitable range, the program informs you of the number of data points that are available for display. You can choose to plot over a narrow or broad range.



Finally, you can investigate your functions graphically. The first curve plotted reflects the current starting values for the parameters you provided earlier. Select **Show Profit** to include the profit function in the chart. You can look at your input data or the best fitting curve, by selecting the appropriate boxes.



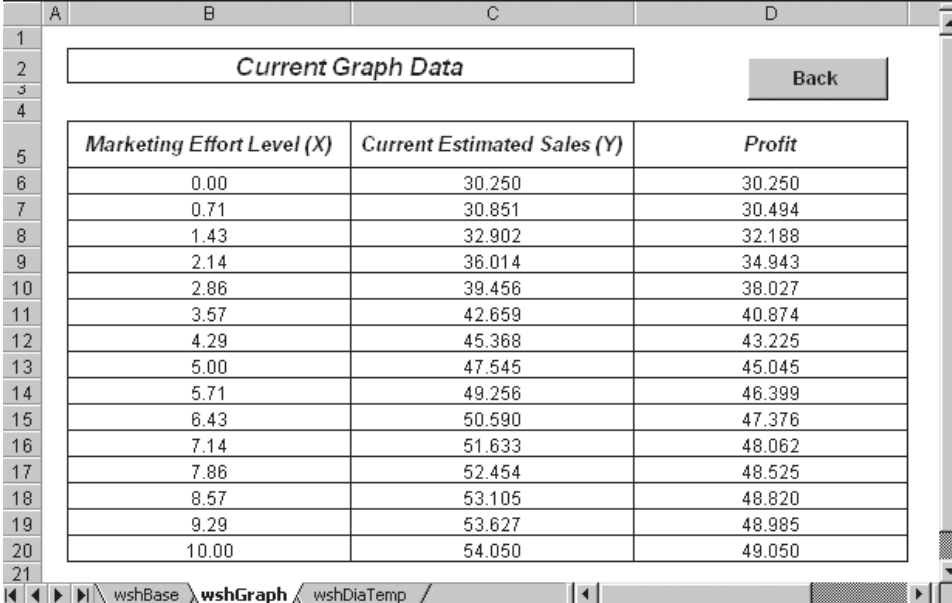
Select **Scroll Current Sales Function Parameters** to gain control of the scroll boxes linked to the response curve coefficient values. You can move the slider to change the values of the respective parameters and observe the effects on the curve. You can also try a graphical parameter calibration on the original data.

If you like a curve, check **Freeze** and the program will save the current parameter values as a reference. As you continue changing the parameter values, the changing curve will separate from the reference curve. You can have up to four curves, i.e., current, best fit, frozen, and profit, plotted on the screen at the same time.

Choose **Scroll Profit Function Parameters** to gain control of the scroll boxes linked to the profit-function coefficients. You can investigate the impact that parameter changes have on profitability, e.g., what happens if costs go down.

To modify the parameter setup for the visual tracking, e.g., the “tracking ranges,” click **Sales Parameter** or **Profit Parameter**. To focus on smaller areas by defining finer ranges, click **Zoom X Range**.

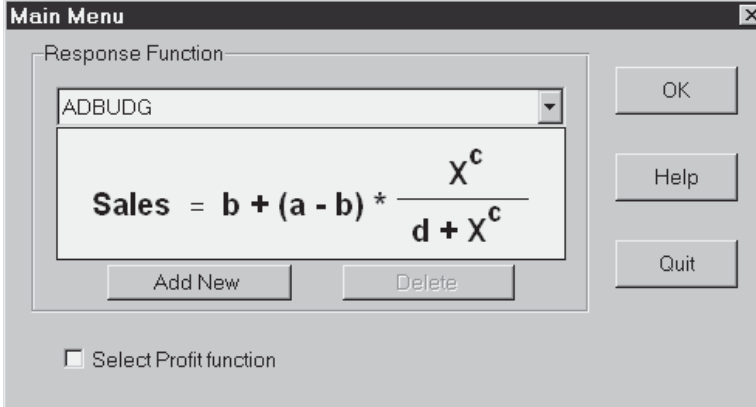
Click **View Graph Data** to see the data behind the graphs as shown below:



Marketing Effort Level (X)	Current Estimated Sales (Y)	Profit
0.00	30.250	30.250
0.71	30.851	30.494
1.43	32.902	32.188
2.14	36.014	34.943
2.86	39.456	38.027
3.57	42.659	40.874
4.29	45.368	43.225
5.00	47.545	45.045
5.71	49.256	46.399
6.43	50.590	47.376
7.14	51.633	48.062
7.86	52.454	48.525
8.57	53.105	48.820
9.29	53.627	48.985
10.00	54.050	49.050

Section 2 — Response curve for custom model

You can set up models with functional forms other than those provided by Modeler. To do this, access the **Main Menu** and click **Add New**.



Main Menu

Response Function

ADBUDG

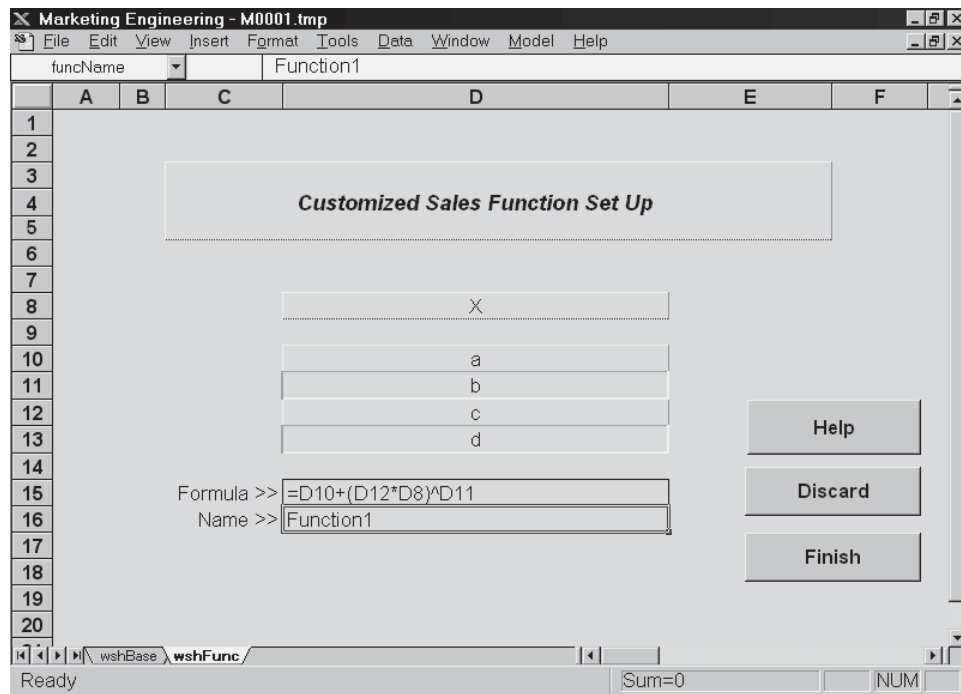
$$\text{Sales} = b + (a - b) * \frac{X^c}{d + X^c}$$

Add New Delete

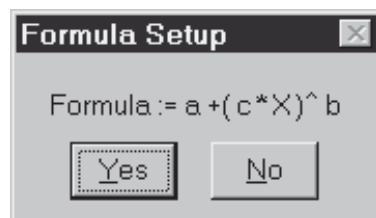
Select Profit function

OK Help Quit

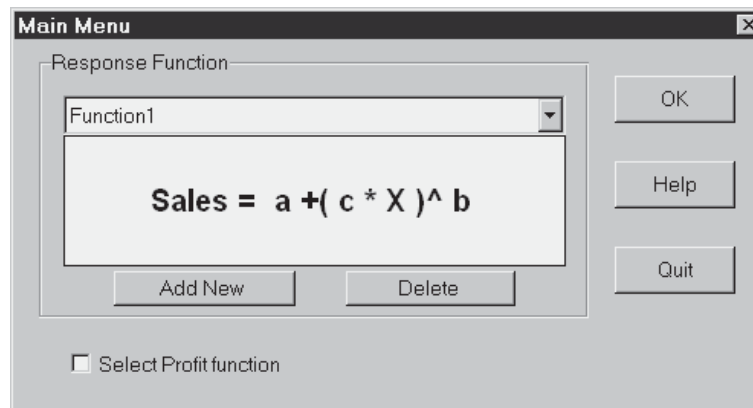
You can specify functions with up to four parameters. Input the formulas in Excel fashion (start your formula with the “=”). Use X as the independent variable and a, b, c, and d (in alphabetical order) as parameters.



Click **Finish**, and your formula is displayed.

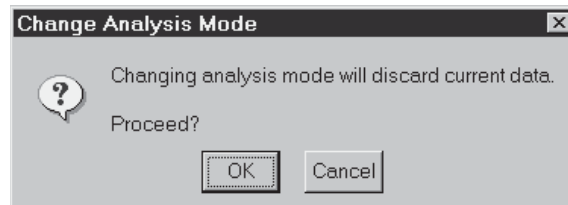
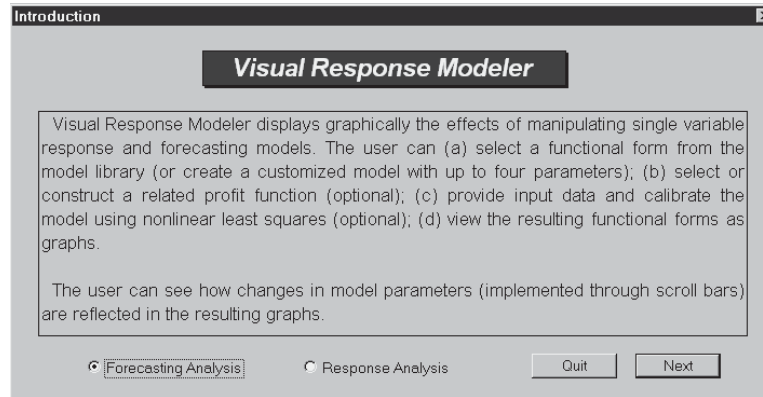


Click **Yes** if you want to retain the formula. Now, you can go back and reanalyze your old data with the new formula.



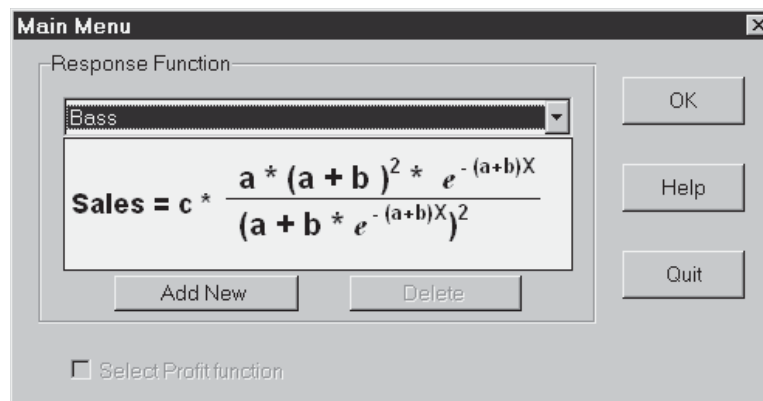
Section 3 — Forecasting analysis

Modeler can also be used as a forecasting tool. From the **Model** menu, click **Introduction**. In the **Introduction** dialog box, select **Forecasting Analysis** and click **Next**.



You will get a message warning you that all the data originating from previous analysis in the response mode will be discarded. Click **OK** to get to the **Main Menu**.

As before, you can select a functional form from the built-in model bank or design your own models. As an example, choose the **Bass** model.



Click **OK**. On the **Data Maintenance** sheet click **Analysis** (no new data input) to get to the **Response Function Parameter Setup**. Provide parameter coefficients, values for the increments as well as for the range along the category axis (x-axis) to be plotted.

Response Function Parameter Setup

Function Name: **Bass**

$$\text{Sales} = c * \frac{a * (a + b)^2 * e^{-(a+b)X}}{(a + b * e^{-(a+b)X})^2}$$

OK
Cancel
Help

Scroll Bars Range (From -5 To +5 Increments)

	Start	Increment (>=0)	Estimates
a =	0.0136	.002	0.0136
b =	0.8176	.1	0.8176
c =	165	10	165.507

X Range Set Up

From: 1 To: 10

OK
Cancel

Note: The Current X Values Range From **1 to 5**

Subsequently, the program charts the resulting graph. You can do an analysis similar to that in the response function example; however, since X now refers to time, you cannot perform a profit analysis.

