

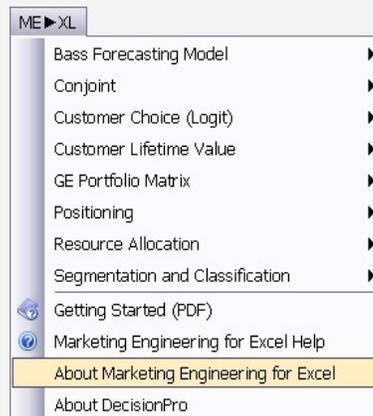
Tutorial

Bass Forecasting



Marketing Engineering for Excel is a *Microsoft Excel* add-in. The software runs from within *Microsoft Excel* and only with data contained in an *Excel* spreadsheet.

After installing the software, simply open *Microsoft Excel*. A new menu appears, called "ME ▶XL." This tutorial refers to the "ME ▶XL/*Bass Forecasting Model*" submenu.



Overview

The Bass forecasting model is a tool for forecasting the adoption of new products and new product categories. It implements the original Bass model (Bass 1969), as well as its extended version, the generalized Bass model (Bass, Krishnan, and Jain 1994). The generalized model expands on the original Bass model by including the effects of advertising and price changes.

The software provides two modes for calibrating the model: (1) by analogy and subsequent refinement (i.e., visual tracking) and (2) by fitting the Bass model to past data using nonlinear least squares (Srinivasan and Mason 1986).

Firms thus can use the Bass forecasting model to develop marketing programs that estimate product sales rates for future periods on the basis of historical sales data of the product or comparisons of the product to adoption rates of similar products.

Getting started

The Bass forecasting model allows you to use your own data directly or a preformatted template.

Because Bass forecasting models require a specific data format, users with their own data should review the preformatted template to become familiar with the appropriate structure.



This section explains how to create an easy-to-use template to enter your own data.

If you want to run Bass forecasting immediately, open the example file "*OfficeStar Data (Bass Forecasting, calibrated).xls*" and jump to "Step 5: Running analyses." By default, the example files install in "*My Documents/My Marketing Engineering/*."

Step 1 Creating a template

In Excel, if you click on ME ► XL → BASS FORECASTING MODEL → CREATE TEMPLATE, the following dialog box appears. This box represents the first step in creating a template for running the Bass forecasting model.

Bass

Please select the options to generate a template for your Bass analysis.

Generalized Bass Model

Generalized Bass Model

Advertising Coefficient (medium) 0.65

Price Coefficient (medium) 1.50

Number of Periods to Forecast 15

Forecasting Scenarios

Placeholders of Forecasting Scenarios 5

Past Data

Past Periods Available for Model Estimation 5

Cancel OK

The options are as follow:

- **Generalized Bass Model.** Click the checkbox if you want to set up the generalized Bass model, which includes two advanced decision variables, pricing and advertising, that determine the speed of diffusion. If the generalized Bass option is not checked, the template will exclude the pricing and advertising decision variables.
 - **Advertising Coefficient.** The generalized Bass model assumes that relative changes in advertising affect the speed of adoption. If the advertising level increases (compared with a base advertising level at the start), potential adopters adopt faster than they would have without the increase in advertising. Research shows that the advertising coefficient usually falls between 0.3 and 1.0.

- **Price Coefficient.** The generalized Bass model assumes relative changes in price also affect the speed of adoption. If the relative price decreases, potential adopters adopt faster. Documented values for the price coefficient typically range between 1.0 and 2.0.
- **Number of Periods to Forecast.** Enter the number of periods you want to forecast. Notice that this option simply creates placeholders for anticipated price and advertising levels; it does not generate forecasts.
- **Forecasting Scenarios.** Running the Bass forecasting model using different estimates for adoption parameters and market potential provides comparative forecasts. This control enables you decide how many forecasting scenarios you want to compare and creates placeholders in the spreadsheet.
- **Past Data.** This function indicates the number of periods for which you have past data about adoption rates. If you have no past data, enter 0; you still can parameterize the model using an analogy.

After completing the dialog box, click OK to generate the data template, as shown below for a generalized Bass model with 10 available past data periods.

Bass Parameters

Total Market	1	Total number of potential adopters before period 1.
Market Penetration Before Period 1	0	Total number of actual adopters before period 1.
Market Growth Rate	0.0%	Growth rate of the market potential.
Market Price	0.0%	Percentage increase of market potential with a 1% decrease in price.
Advertising Coefficient	0.85%	Percentage increase in speed of market penetration with a 1% increase in advertising.
Price Coefficient	150%	Percentage increase in speed of market penetration with a 1% decrease in price.

Forecasting Scenario

Scenario labels, total market potentials, and parameters p and q, used for different forecasting scenario.

Scenario					
Total Market	1	1	1	1	1
Parameter p					
Parameter q					

Past Data, Price and Advertising Data

Adoptions per period, and cumulative adoptions, observations vs. model.
By default, relative price and relative advertising are set to 1.0 in the first period

Period / Data	Adoptions/Period	Cumulated Adoptions	Relative Price	Relative Advertising
1	0	0	/	/
2	0	0	/	/
3	0	0	/	/
4	0	0	/	/
5	0	0	/	/
6	0	0	/	/
7	0	0	/	/
8	0	0	/	/
9	0	0	/	/
10	0	0	/	/
11			/	/
12			/	/
13			/	/
14			/	/
15			/	/
16			/	/
17			/	/
18			/	/
19			/	/
20			/	/

Step 2 Entering your data



In this tutorial, we use the example file "OfficeStar (Bass Forecasting).xls," which by default appears in "My Documents/My Marketing Engineering/."

To view a proper data format, open that spreadsheet in Excel. A snapshot is reproduced below.

Period / Data	Adoptions/Period	Cumulated Adoptions	Relative Price	Relative Advertising
1	70	120	1.00	1.00
2	125	245	0.99	1.01
3	100	345	0.98	1.02
4	164	509	0.97	1.03
5	210	719	0.96	1.04
6	265	984	0.95	1.05
7	330	1314	0.94	1.06
8	395	1709	0.93	1.07
9	450	2159	0.92	1.08
10	400	2559	0.91	1.09
11			0.90	1.10
12			0.89	1.11
13			0.88	1.12
14			0.88	1.12
15			0.87	1.13
16			0.86	1.13
17			0.85	1.14
18			0.84	1.15
19			0.83	1.15
20			0.83	0.88

A Bass forecasting spreadsheet contains different areas in which data must be entered or populated after estimations.

Bass parameters

- **Total Market Potential** is the total estimated number of adopters, that is, the total number of customers who eventually will adopt the product. This key figure needs to be supplied by the user but can be affected by other factors (see Market Growth Rate and Market Price Elasticity).
- **Market Penetration Before Period 1** represents the total number of potential adopters who *already* have adopted.
- **Market Growth Rate** is the estimated growth rate per period. If the market growth rate is 2% and market potential (supplied by the user) initially is 100, then market potential will be 102 in period 1, 104 in period 2, 106.1 in period 3, and so forth.

- **Market Price Elasticity** (generalized Bass model only) is the percentage increase of market potential with a 1% decrease in price. If price decreases, the model assumes that the product becomes more affordable, and more people become potential adopters, which then increases the total market potential.
- **Advertising Coefficient** (generalized Bass model only) is the percentage increase in speed of market penetration with a 1% increase in advertising. The advertising coefficient does not change the number of potential adopters but rather the speed at which they effectively adopt; it reflects the percentage increase in the speed of market acceptance with a 1% increase in advertising. (Recall that documented values for the advertising coefficient typically range between 0.3 and 1.)
- **Price Coefficient** (generalized Bass model only) is the percentage increase in speed of market penetration with a 1% decrease in price. The price coefficient reflects the percentage increase in speed of market acceptance with a 1% decrease in price. (Recall that documented values for the price coefficient typically range between 1 and 2.)

Forecasting scenario

A **forecasting scenario** is a placeholder that enables users to store different parameter values for the three key elements of the Bass model and then compare adoption forecasts.

- **Total Market Potential** is the total market size in units for the market. By default, any change in cell C3 automatically gets reported here; you thus can change the value manually in this cell.
- **Parameter p** represents the propensity to adopt, independent of how many customers have previously adopted, also referred to as the “innovation” component of the model.
- **Parameter q** represents the propensity to adopt as a function of the number of existing adopters, also referred to as the “imitation” component of the model.



The Bass forecasting model provides two forms of assistance for completing the estimated values for p and q . The first method analyzes past data and infers actual values through statistical estimation. The second approach uses analogy, that is, p and q values estimated from other products that resemble the one under investigation. Please refer to sections “Step 3: Estimating parameters using analogy” and “Step 4: Estimating parameters from past data.”

Past data

Past data placeholders appear only if you previously selected the Past Data option. For each period, enter the number of adoptions for that period; the total (accumulated adoptions) through that period get updated automatically.

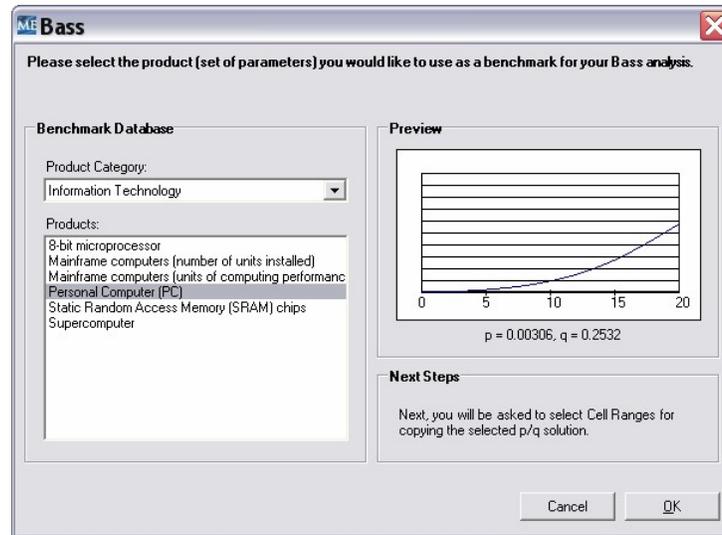
Price and advertising data

These placeholders appear only if you previously selected the generalized Bass model. For each prior period (if past data exist) and future period (if forecasting periods are greater than 0), enter the relative price and advertising levels compared with the first period. A relative price level of 1.2 indicates that price increased by 20% compared with the price level of 1.0 during the first period. The first row reveals the “level” of price and advertising. All other entries are relative to the first row. For example, if price is set to 50 in the first row, it might be 49 (decrease) or 51 (increase) in the next period.

Step 3 Estimating parameters using analogy

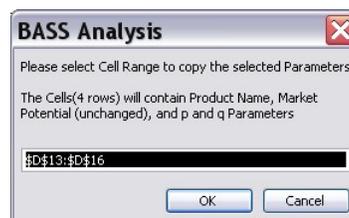
The Bass forecasting model in ME ▶ XL provides two methods of estimating the necessary values for p and q . The first method estimates parameters using analogies to other products for which the parameters already have been estimated.

In Excel, if you click on ME ▶ XL → BASS FORECASTING MODEL → ESTIMATE PARAMETERS USING ANALOGY, the following dialog box will open:



Use the scroll bar to move through the product categories and select a product that is close in characteristics to the product you are forecasting. Click OK to accept the p and q values for that product. You can also search subcategories of products, such as “Consumer Electronics,” to find more analogous products to the one for which you want to estimate the penetration rate.

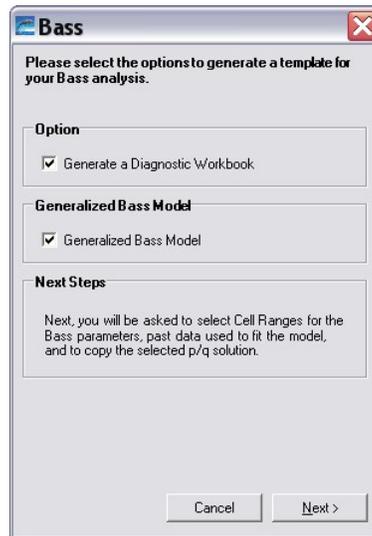
When you click OK, you must select a forecasting scenario placeholder, or cell range, to copy the p and q parameters in your spreadsheet. If using a *Marketing Engineering for Excel* template, the destination cells for your selection will be preselected within the Forecasting Scenario portion of the template. If you are not using a template, you must select the appropriate destination cells.



If you want to run the analysis with different parameters estimated from various products, repeat these steps for each scenario in your model to populate the p and q values for forecasting.

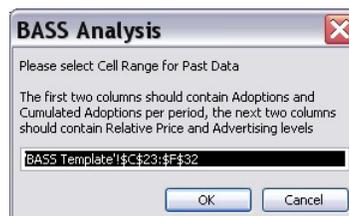
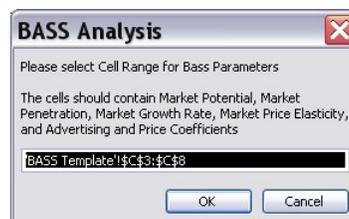
Step 4 Estimating parameters from past data

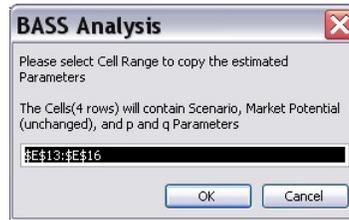
The second way to estimate p and q parameters analyzes past data (if available) and statistically infers parameter estimates. In Excel, if you click on ME ► XL → BASS FORECASTING MODEL → ESTIMATE PARAMETERS FROM PAST DATA, the following dialog box opens:



This dialog box begins the analysis process of determining the appropriate p and q values for your model on the basis of the past data you have available. Determine whether you want to generate a diagnostic workbook at the end of the analysis and whether you are using the generalized Bass model, and then click Next to begin the analysis.

Several dialog boxes ask you to select the Bass parameters (three rows in the simple Bass model; six rows in the generalized Bass model), past data (including relative price and advertising levels in the generalized Bass model), and the destination cell range for the output (estimated) parameters.





If you have selected the Generate Template option of *Marketing Engineering for Excel*, the appropriate ranges are preselected.

If you select the option and click OK, the newly generated workbook includes tabs showing the values generated by the Bass forecasting model on the basis of your past data. The p and q values are stored automatically in the cells you selected in your original (template) workbook. (Note: You may use a combination of data by analogy and past data to complete your forecasting scenario and then compare the different parameterizations.)

Step 5 Running analyses

To run the forecasting analyses, your spreadsheet should now contain:

- **Bass parameters:** A list of three key parameters (or six for the generalized Bass model, as shown below).
- **Forecasting scenario:** Different parameter estimates of total market potential, p and q , for which the parameters have been estimated either using analogy (see Step 3) or statistical analysis of past data (see Step 4).
- **Past data**, if available.
- **Relative price and relative advertising:** Levels (in the generalized Bass model) reflecting not only past data (if available) but also future periods (estimations) to indicate the effects of the most likely future changes in price and advertising levels on rate of adoption and market potential.

Microsoft Excel - OfficeStar Data (Bass Forecasting, calibrated).xls

File Edit View Insert Format Tools Data Window Help WebEx ME►XL Type a question for help

A1

Bass Parameters

Total Market	5000	Total number of potential adopters before period 1.
Market Penetration Before Period 1	100	Total number of actual adopters before period 1.
Market Growth Rate	2.0%	Growth rate of the market potential.
Market Price	0.0%	Percentage increase of market potential with a 1% decrease in price.
Advertising Coefficient	0.7%	Percentage increase in speed of market penetration with a 1% increase in advertising.
Price Coefficient	15%	Percentage increase in speed of market penetration with a 1% decrease in price.

Forecasting Scenario

Scenario labels, total market potentials, and parameters p and q, used for different forecasting scenario.

Scenario	Personal Computer (PC)	Cassette deck	Estimated From Past Data
Total Market	5000	5000	5000
Parameter p	0.0031	0.0125	0.0136
Parameter q	0.2532	0.2272	0.2943

Past Data, Price and Advertising Data

Adoptions per period, and relative price and advertising levels

By default, relative price and relative advertising are set to 1.0 in the first period

Period / Data	Adoptions/Period	Cumulated Adoptions	Relative Price	Relative Advertising
1	70	120	1.00	1.00
2	125	245	0.99	1.01
3	100	345	0.98	1.02
4	164	509	0.97	1.03
5	210	719	0.96	1.04
6	265	984	0.95	1.05
7	330	1314	0.94	1.06
8	395	1709	0.93	1.07
9	450	2159	0.92	1.08
10	400	2559	0.91	1.09
11			0.90	1.10
12			0.90	1.12
13			0.89	1.13
14			0.88	1.12
15			0.87	1.10
16			0.86	1.08
17			0.85	1.06
18			0.84	1.03

Ready

After entering the data in an Excel spreadsheet with the appropriate format, click on ME►XL → BASS FORECASTING MODEL → RUN ANALYSIS. The dialog box that appears enables you to set the options to perform a Bass forecasting analysis of your data.

ME Bass

Please select the options to run your Bass analysis.

Generalized Bass Model

Generalized Bass Model

Past Data

Plot Adoptions from Past Periods

Forecasting

Number of Periods to Forecast: 5

Sensitivity Analysis

Vary Parameters by Plus/Minus

Parameter p: 0.05

Parameter q: 0.05

Market Potential: 0.20

Next Steps

Next, you will be asked to select Cell Ranges for the Bass Parameters, Forecasting Scenarios, Past Data, and Future Relative Price/Advertising Levels

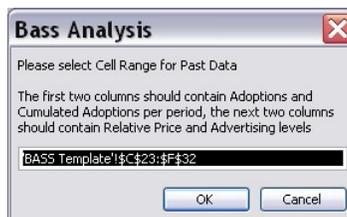
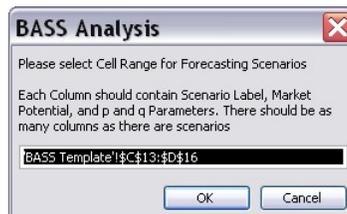
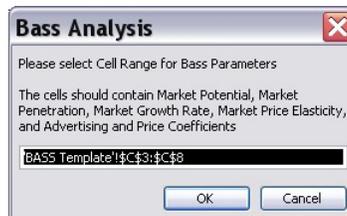
Save choices in current spreadsheet

Cancel Next >

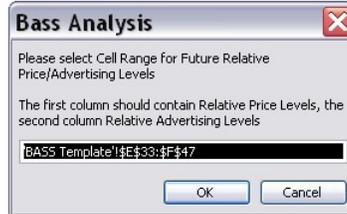
Options

- **Generalized Bass Model** is preselected if you previously specified the generalized Bass model.
- **Plot adoptions from past periods** are available if your spreadsheet contains past data. If this option is checked, generated charts contain not only forecasts but also past data. You must select the cell ranges that contain this data. If you specified Past Data in your template, these cells will be preselected.
- **Forecasting** specifies the number of periods being forecast. For the simple Bass model, you may enter as many periods as you would like, but in the generalized Bass model, the forecasts require additional data about future price and relative advertising levels, so the highest levels of this field should equal the number of periods for which you have supplied such data.
- **Sensitivity analysis** allows you to run forecasting analyses by slightly perturbing p , q , and/or the market potential variables for each forecasting scenario. This feature is particularly useful in cases in which you want to determine if the forecasts are highly sensitive to small changes in some parameters. The chosen sensitivities get charted in the output.

After selecting the desired options, click "Next >". The software presents three dialog boxes that enable you to select the data on which to perform the analysis. If you have used the Generate Template option, the cell ranges are preselected.



If you are running the generalized Bass model, a fourth and final dialog box will prompt you to select future relative price and advertising levels. The simple Bass model does not require such data to run.



After clicking OK, a diagnosis spreadsheet is created, with the forecasts made by the Bass model.

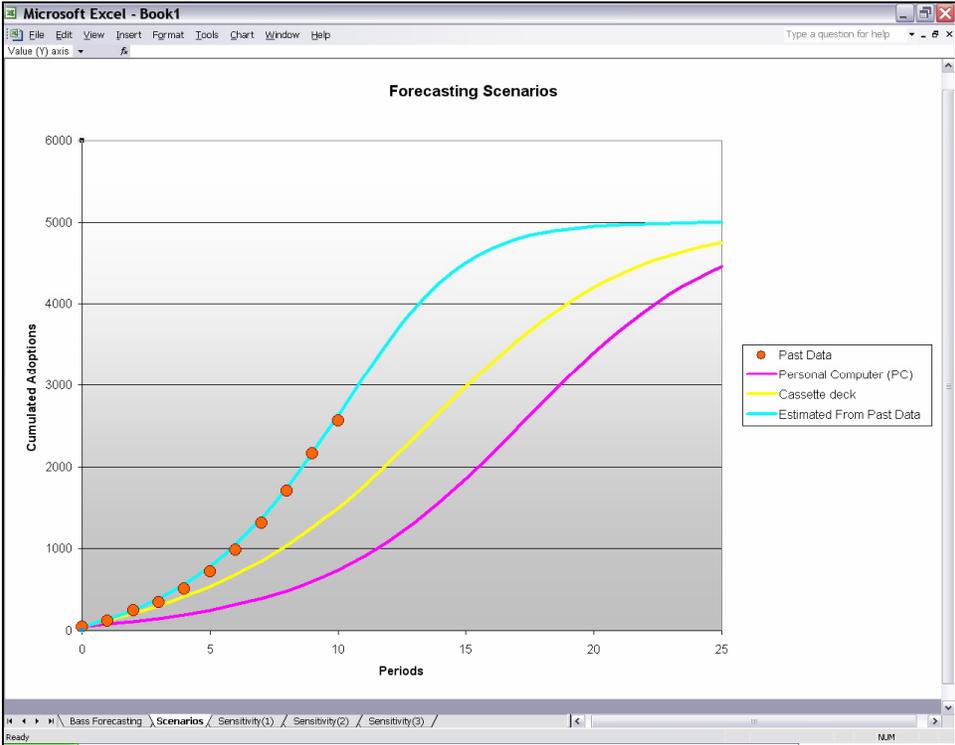
Step 6 Interpreting the results

Forecasting scenarios

The first sheet contains forecasts for the different scenarios, along with past data when available.

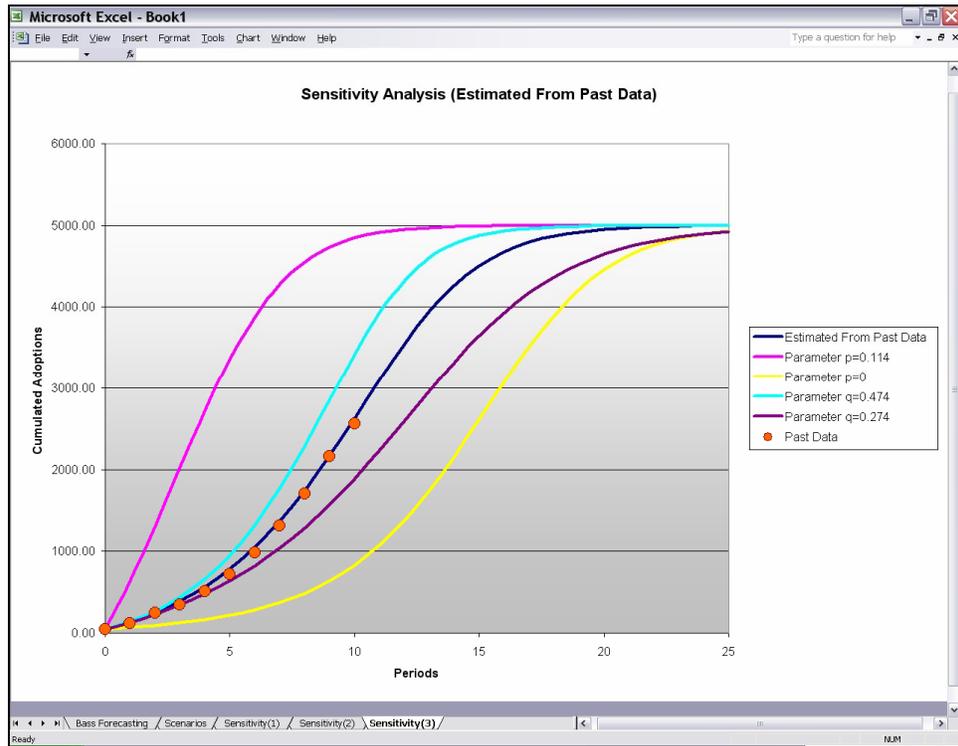
Period / Forecasting Scenarios	Past Data	Personal Computer (PC)	Cassette deck	Estimated From Past Data
Total Market Potential	N/A	5000	5000	5000
Parameter p	N/A	0.003	0.013	0.014
Parameter q	N/A	0.253	0.227	0.374
0	50	50	50	50
1	120	78	123	136
2	245	111	208	248
3	345	150	305	389
4	509	196	415	565
5	719	250	541	782
6	984	315	685	1046
7	1314	393	849	1364
8	1709	487	1039	1740
9	2159	601	1254	2166
10	2559	738	1496	2629
11		901	1763	3100
12		1094	2052	3550
13		1318	2359	3948
14		1573	2672	4269
15		1854	2981	4509
16		2155	3275	4678
17		2469	3549	4793
18		2788	3797	4868
19		3101	4015	4916
20		3398	4203	4947
21		3672	4361	4967
22		3916	4492	4979
23		4128	4599	4987
24		4307	4685	4993
25		4455	4754	4996

The results are also plotted on the next chart.



Sensitivity analysis

If the option is checked, several charts also output the forecasts by varying some parameters. This analysis helps identify those parameters that most affect the forecasts.



In the above chart, slightly varying the p parameter (fuchsia and yellow lines) drastically change the rate of adoptions, while modifying the q parameter has little impact.