15.810 Analytics Simulated Store
Problem Set (Beta 1.0 Version)
September 19, 2015

This is the second of two experimental problem sets. If they are successful, I'll write more. If you complete this problem set you will better prepared for the analytics in the Brita case. By being comfortable with the analytics, you can focus on their implications and on the more-qualitative aspects of the case.

This problem set explores the managerial use of data obtained from the simulated test markets that pervade the consumer packaged goods markets. These analysis methods are based on experiments in a simulated store where consumers are exposed to new products in a situation that approximates the retail outlets. Advertising, sampling, couponing and other marketing elements are also simulated, often in an experimental design. Post-purchase behavior is then tracked so that the simulated test market can provide predictions of sales at different levels of marketing and (assumed) competitive behavior. Such markets are extremely accurate if executed correctly.[1] Our focus is on the use of simulated test markets, not the detailed methods used to make forecasts using experimental data.

I've created a companion spreadsheet, "15810 Analytics Simulated Store Spreadsheet Sept 2015.xlsx." You will need to think through the formulae to enter in the boxed yellow cells. Once you have completed these formulae, you may copy them to the green cells. I hope a simple "paste" will work, but check. There are also blue-highlighted cells. These are assumptions you need to make about the market. Feel free to change these assumptions to see how decisions are affected.

I have given your TA the "instructors" version of the spreadsheet. After you have cogitated on your spreadsheet, if it still does not make sense, talk to your TA.

Basic Managerial Challenge

You are the brand manager for an innovative company that has developed Personalized Pie Ovens (PPOs). In an analogy to Keurig K-Cups for coffee, tea, and hot-chocolate, the PPOs allow you to produce a single-serve piece of pie. The PPOs use Personalized Pie Kits, that you company also sells.

PPOs are the second product line introduced by your company. You are already the primary producer of Personalized Cake Ovens (PCOs) and Personalized Cake Kits. You have introduced PPOs because pies are becoming popular and are likely to be the "go-to" dessert over the next year or two.

[1] Simulated test markets were developed at MIT Sloan by Profs. Glen Urban and Al Silk, both now retired. Glen is a former Dean of the MIT Sloan School. Our current Dean, Dave Schmittlein, developed analysis tools for forecasting purchase intentions within simulated test markets. I've been involved with the extension of the concepts to consumer durables, B2B goods, services, and "really new" products. For example, the early forecasts of elective vehicle adoption were done at MIT with simulated test markets.

PPOs are a major investment. You have to invest in factories (or suppliers) for both the ovens and the kits. Although the channel of distribution for PCOs can be used for PPOs, it, too, will require investment. Finally, you must make consumers aware of PPOs and get them to try PPOs, so you will invest in advertising, free samples, and coupons. If the brand does not succeed, these are ephemeral investments for which there is no salvage value.

The Best Marketing Tactics for Personalized Pie Ovens

To mitigate your risk, to set your price, and to identify the best allocation of marketing investment to advertising, sampling, and coupons, you have commissioned a simulated test market. The following table summarizes the results. (These data are already entered in the companion spreadsheet.) For example, if you price PPOs at $22, spend $10 million on advertising, $10 million on sampling, and $4 million on coupons, you will sell 2.64 million over your planning horizon if competition is low. You will sell 2.15 million PPOs over your planning horizon if competition is high. The cost to you of a PPO is $12.

Scenario	Price	Advertising ($millions)	Sampling ($millions)	Coupons ($millions)	Assumed Competition	Forecast (millions of PPOs)
1	$22	$10	$5	$4	low	2.64
2	$22	$10	$5	$8	low	2.83
3	$22	$10	$10	$4	low	3.03
4	$22	$10	$10	$8	low	3.25
5	$22	$20	$5	$4	low	3.36
6	$22	$20	$5	$8	low	3.61
7	$22	$20	$10	$4	low	3.86
8	$22	$20	$10	$8	low	4.14
9	$24	$10	$5	$4	low	2.57
10	$24	$10	$5	$8	low	2.75
11	$24	$10	$10	$4	low	2.95
12	$24	$10	$10	$8	low	3.16
13	$24	$20	$5	$4	low	3.27
14	$24	$20	$5	$8	low	3.51
15	$24	$20	$10	$4	low	3.76
16	$24	$20	$10	$8	low	4.03

Scenario	Price	Advertising ($millions)	Sampling ($millions)	Coupons ($millions)	Assumed Competition	Forecast (millions of PPOs)
17	$22	$10	$5	$4	high	2.15
18	$22	$10	$5	$8	high	2.55
19	$22	$10	$10	$4	high	2.47
20	$22	$10	$10	$8	high	2.93
21	$22	$20	$5	$4	high	2.64
22	$22	$20	$5	$8	high	3.15
23	$22	$20	$10	$4	high	3.04
24	$22	$20	$10	$8	high	3.61
25	$24	$10	$5	$4	high	2.07
26	$24	$10	$5	$8	high	2.47
27	$24	$10	$10	$4	high	2.38
28	$24	$10	$10	$8	high	2.83
29	$24	$20	$5	$4	high	2.55
30	$24	$20	$5	$8	high	3.04
31	$24	$20	$10	$4	high	2.93
32	$24	$20	$10	$8	high	3.49

For the moment, ignore pie kits, cannibalization of PPCs, and growth effects. (1) We want to determine whether the launch of PPOs will be profitable and (2) we want to determine the best marketing allocation.

The first step is to compute the contribution before any marketing expense. This is simply (price minus costs) times forecast sales. We then want to total marketing expense. This simply sums the allocation to advertising, sampling, and coupons. If we subtract the marketing expense from contribution before marketing, we get the net profit before fixed costs. Enter the formulae in the boxed yellow cells in the companion spreadsheet. Copy them to the green cells.

1. If fixed costs are $2 million, are any of the scenarios profitable?
2. Can you survive an aggressive competitive response to your introduction of PPOs (scenarios 17 through 32)?
3. What is your best price and your best allocation of marketing expenditures among advertising, sampling, and couponing?

The Best Marketing Tactics for Personalized Pie Ovens and Pie Kits

But you also sell pie kits. Assume that over the lifetime of a PPO you sell eight (8) pie kits and that you earn $0.20 on every pie kit. To account for pie kits, you now include a forecast of the number of pie kits (eight times the forecast for PPOs). The contribution now includes contribution on both PPOs and pie kits. To account for the sales of pie kits, you use the second worksheet in the companion spreadsheet.

Enter the formulae in the yellow boxed cells and copy these formulae to the green cells. The assumption on the number of pie kits sold per PPO and the contribution per pie kit are in the blue cells. Be sure to use F$5 and L$5 in your formulae before you paste them.[2] For simplicity, we've assumed no marketing expense for pie kits.

1. Taking kits into account and if fixed costs are $2 million, are any of the scenarios profitable?
2. Taking kits into account, can you survive an aggressive competitive response to your introduction of PPOs (scenarios 17 through 32)?
3. Taking kits into account, what is your best price and your best allocation of marketing expenditures among advertising, sampling, and couponing?

The Best Marketing Tactics for Personalized Pie Ovens and Pie Kits, but with the Potential for Cannibalization of the Sales of our Cash Cow – Personalized Cake Ovens

Although you are the brand manager of PPOs, your company also cares about the sales of PCOs. They are the brand upon which your company was built. Pies substitute for cakes and PPOs substitute for PCOs. You know from the simulated test market that for every four PPOs that you sell, your company will sell three fewer PCOs. The third worksheet in the companion spreadsheet takes the loss of PCOs into account. The key new data are shown in blue: six cake kits for every PCO sold, $0.15 contribution for every cake kit sold, and a loss of 0.75 PCO for every PPO sold. The cost to your company of a PCO is $5.

Enter the formulae in the yellow boxed cells and copy these formulae to the green cells. Be sure to use F$5, F$6, F$7, L$5, and L$6 in your formulae before you paste the formulae.

1. Taking kits and cannibalization into account and if fixed costs are $2 million, are any of the scenarios profitable?
2. Taking kits and cannibalization into account, can you survive an aggressive competitive response to your introduction of PPOs (scenarios 17 through 32)?
3. Taking kits and cannibalization into account, what is your best price and your best allocation of marketing expenditures among advertising, sampling, and couponing?

[2] Formulae in Excel are relative. For example, if you enter A1+B1 in cell C1, cell C1 will contain an entry equal to the sum of the entries in cells A1 and B1. If you paste that formula into cell C2, then cell C2 will contain an entry equal to the sum of the entries in cells A2 and B2. If you want the formula to always reference cells A1 and B1, it should be A$1 + B$1. Note that the columns, A and B are still relative. If you don't want these to be relative, enter A1 + B1. Some versions of Excel use other cell-reference formats, but the basic concept is the same.

The Best Marketing Tactics for Personalized Pie Ovens and Pie Kits, but with the Potential for Cannibalization of the Sales of our Cash Cow, Taking into Account Marketing Savings for Personalized Cake Ovens, and a Growth Factor due to Installed Base Issues

We now introduce two more concepts to illustrate the many issues that you would take into account in a real situation. I am assuming you can generalize from these examples.

Because you are now selling fewer PCOs, your company might find that it is optimal to invest less in the marketing of PCOs. There are many ways to take this into account; the simulated test market data are not sufficient to quantify the effect. However, you can make assumptions and run sensitivity analyses. In this case we'll simply assume that for every dollar spend marketing PPOs, your company saves 20% of that from the PCO marketing budget.

The second concept is more complicated and will be explored more below. It is an adjustment to the number of pie kits that you will sell in your planning horizon. For example, assume that you sell 1 million PPOs on day 1. Over the planning horizon you will get an opportunity to sell all eight pie kits for every PPO sold. However, if you sold all of those PPOs on the last day of your planning horizon, you might not get to sell any pie kits in your planning horizon. If you sold all of the PPOs in the middle of your planning horizon, you might only sell four pie kits (in the planning horizon) for every PPO sold. For this section of the problem set, we'll simply assume an adjustment factor of 80%.

Enter the formulae in the yellow boxed cells and copy these formulae to the green cells. Be sure to use F$5, F$6, F$7, F$8, F$9, L$5, and L$6 in your formulae before you paste the formulae. Assume there is no growth adjustment necessary for cake kits.

1. Taking kits, cannibalization, growth adjustments, and marketing savings into account and if fixed costs are $2 million, are any of the scenarios profitable?
2. Taking kits, cannibalization, growth adjustments, and marketing savings into account, can you survive an aggressive competitive response to your introduction of PPOs (scenarios 17 through 32)?
3. Taking kits, cannibalization, growth adjustments, and marketing savings into account, what is your best price and your best allocation of marketing expenditures among advertising, sampling, and couponing?

Additional Questions

1. Should you launch PPOs if fixed costs are $4 million?
2. What other concepts would you want to take into account, and include in the spreadsheet, before making a GO/NO GO decision on PPOs?

Exploring Growth Factors

Although consumers will purchase eight pie kits over the lifetime of owning a PPO, you may not realize those sales within your planning horizon. Suppose a very simple model. Assume that the consumer remains a PPO user for exactly five years and over those five years purchases eight pie kits. That is, over those five years the consumer will purchase 1.6 pie kits per year (8/5).

If we define the effective installed base as those consumers who purchased a PPO in the last five years or less, then the sales of pie kits in any given year is 1.6 times the five-year installed base. The last worksheet in the companion spreadsheet puts this assumption into spreadsheet formulae.

There are two assumptions you can change in the worksheet: (1) the number of pie kits sold over the five-year window and (2) the rate at which the market for PPOs is growing. In the worksheet, these assumption are set to eight pie kits over the five-year window and 100% growth. The assumptions are in the blue cells of the worksheet.

1. What is the ratio of pie kits to PPOs in the first year? In year 5? In "steady state?"
2. Why is this ratio less than 8.0?
3. Change the rate at which the PPO market is growing from 100% to 0%. What is the ratio of pie kits to PPOs in the first year? In year 3? In year 5? In "steady state?"
4. Why is the ratio under no growth of PPOs higher than the ratio when the number of PPOs is growing?
5. Compare the evolution of the growth-adjustment ratio for different amounts of growth in PPO sales.
6. Is there ever a situation where the ratio of pie kits to PPOs exceeds 8.0?

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