What is a promotion

Promotions are a widely used marketing tool in packaged goods industries. They usually provide a short term incentive to the trade (supermarket chains) or to consumers to purchase more of a particular package size of a brand. A typical trade promotion might offer a discount on cases of the 12 oz size of a particular brand that are purchased over a 4 week period. Other types of trade promotions might combine a discount with an advertising allowance. The trade is supposed to use this allowance to purchase newspaper advertising to publicise the promotion to consumers. In both cases, it is expected that the trade will pass through some of its savings to the consumer, although this is a requirement that is hard to enforce.

Typical consumer promotions include on-pack and in-pack coupons, as well as coupons distributed via direct mail or newspaper supplements.

Usually, trade promotions are offered once a quarter or more frequently. Consequently, chains purchase heavily during these "deal periods" and very little in non-deal periods. Volume sold on deal often accounts for over 80% of total sales in categories such as soft drinks, orange juice, margarine and detergents.

Expenditures on trade and consumer promotions today far exceed total advertising expenditures, accounting for over 60% of the total marketing budget.

Baseline Analysis

The impact of a promotion on sales to the trade, or to consumers, is usually clear and unambiguous. Figure 1 shows a typical plot of sales over time. Periods 4 and 5 and 11 and 12 are the promotion periods; the sales in these periods exceed the average of nonpromoted periods by a factor of 5 to 8. Usually, the sales in the periods immediately preceding and following promotions are depressed, the first because the trade anticipates promotions and delays purchases, and the second because inventories built up during promotion are being drawn down. The phenomenon of the post-promotion dip is also evident in consumer sales, as home inventories built up during the promotion are depleted and purchases are delayed. In order to compute the incremental effect of a promotion, these dips need to be considered in addition to the sales during the promotion itself.

Figure 1

BRAND A SALES (OOOs)
The idea of the BASELINE is fundamental to the analysis of promotions. The baseline represents the level of sales that would be maintained in the absence of promotion, at least in the short run. Thus sales immediately preceding and following a promotion are likely to be below the baseline while sales during the promotion substantially exceed the baseline level. These ideas are illustrated in Figure 2 which shows the sales data of Figure 1 with a baseline superimposed. Therefore, computation of the baseline is the crucial part of promotion analysis.

The baseline in PROVAL is computed using a nonlinear smoothing technique first proposed by Tukey. Nonlinear smoothing uses running medians instead of averages or weighted averages of the data for smoothing. To illustrate, consider the simplest smoothing technique which is called 3R. Here the data point $X_t$ is replaced by the median of a window of three points $X_{t-1}$, $X_t$, and $X_{t+1}$. The process is repeated until the smoothed series does not change. Hence the nomenclature 3R. 3R maintains the original data whenever possible, and it does not introduce the artificial leads and lags that are characteristic of linear smoothing methods such as moving averages and exponential smoothing. Many other nonlinear smoothers are available which use a sequence of windows of different lengths. Adjusting the length of the window helps smooth over "disturbances" of different lengths. For example to ensure that a 2 or 3 period promotion is properly smoothed we need a window of 5 periods. Any information lost in the smoothing process is recaptured by smoothing the rough (rough = data - smoothed value) and adding this back to the smoothed value. This operation is called twicing. The smoother used in PROVAL is a complex one with a sequence of windows and twicing. In our tests it accurately smooths through promotions of different durations, and with different pre and post dips. Further details on nonlinear smoothing can be found in Velleman & Hoaglin, ABC's of EDA, Duxbury Press.
PROVAL then computes the incremental profit contribution for each promotion.

<table>
<thead>
<tr>
<th>PROMO</th>
<th>INCREMENTAL VOLUME (UNITS)</th>
<th>INCREMENTAL PROFITS ($)</th>
<th>INCREMENTAL PER $ COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROMO 1</td>
<td>9,110</td>
<td>8,319</td>
<td>0.21</td>
</tr>
<tr>
<td>PROMO 2</td>
<td>14,587</td>
<td>32,237</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Figure 3

Using the PROVAL Baseline

1. Estimating Incremental Sales
   In order to compute the incremental sales created by a promotion PROVAL first computes the sales gain during the promotion by subtracting the baseline sales from actual sales during the promotion periods. The start and end dates of the promotion are user inputs. PROVAL next estimates the duration of the post promotion dip. This is done by comparing a moving average of actual sales to the average baseline sales. When the moving average is within a user set critical tolerance from the baseline average, we hypothesise that the post promotion dip is over. The period the dip ends is the center of the window used for computing the moving average. The actual sales in the periods following the promotion until the end of the dip are subtracted from the baseline sales for these periods to compute the sales loss during the post promotion dip. Subtracting the sales loss from the sales gain we obtain incremental sales. If a pre promotion dip is anticipated (usually when analyzing shipments to the trade) PROVAL computes the volume loss prior to the promotion and adjusts the incremental sales appropriately. Figure 3 displays the PROVAL Incremental Sales Report.

2. Cannibalization and Draw
   When a particular package is promoted it often takes sales away from another nonpromoted size of the same brand. For example the 12 oz. can of a beverage, when promoted, may take sales away from the 16 oz. bottle. This phenomenon is called CANNIBALIZATION. Similarly, the promotion likely deprives the 12 oz. can of a competitor of some sales. This is called DRAW.

   PROVAL estimates cannibalization and draw using a baseline that is developed for the pack from which it is expected that the promotion will take sales. If cannibalization occurs, we would expect a temporary dip in sales of the cannibalized pack during the promotion. Thus sales of this pack will be below its baseline. (Figure 4) PROVAL estimates cannibalization by computing the difference between actual and baseline sales for the appropriate user selected package during the previously specified promotion periods. Draw is computed similarly.

Figure 4
3. Promotion Profitability

In order to compute the incremental profit generated by the promotion, PROVAL requires additional user inputs. Basically, these relate to unit price, margin contribution and total promotion cost. PROVAL then calculates the incremental contribution generated by the promotion (unit contribution x incremental sales) and subtracts promotion cost in order to calculate incremental profit. A sensitivity analysis is then performed to estimate the breakeven volume -- See Figure 5.

Modelling Incremental Sales

Related to each promotion are a number of characteristics - the details of the deal itself such as discount offered, advertising allowance etc., and policy variables, such as the frequency of dealing, the time since the last deal and the duration of the deal. The relationship between incremental sales and these characteristics has substantial value since it can help support promotion decisions in a what-if model. Since the promotion characteristics are either discrete variables or can be categorized without loss of information we have abandoned the conventional regression modeling approach here also. Instead, we have adopted another exploratory data analysis technique, namely median polish. Median polish is similar to analysis of variance with the marginal values showing the impact of the levels of each characteristic. The main difference between median polish and the analysis of variance is that the former operates on medians rather than means. Thus it provides protection against outliers and produces results that are extremely robust. Consequently this analysis technique can be automated.

The modeling of the promotion increment using median polish will be available with the next release of PROVAL.

PROVAL provides a variety of sensitivity analyses. An example of a volume sensitivity analysis is shown below:

<table>
<thead>
<tr>
<th>ACTUAL RESULTS (UNITS)</th>
<th></th>
<th>BREAKEVEN RESULTS (UNITS)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TOTAL</td>
<td>INCREMENTAL</td>
<td>TOTAL</td>
</tr>
<tr>
<td>PROMO 1</td>
<td>20,088</td>
<td>9,110</td>
<td>17,612</td>
</tr>
<tr>
<td>PROMO 2</td>
<td>26,944</td>
<td>14,587</td>
<td>18,470</td>
</tr>
</tbody>
</table>

Figure 5
Procedure

The automated PROVAL system is a menu driven procedure which first prompts the user to select the data series to be analysed. A typical sequence asks for the following responses:

a. Brand(s)
b. Size(s) - e.g. 12 oz can
c. Market(s)
d. Time frame
e. Unit of Measurement - e.g. factory unit shipments, supermarket warehouse withdrawals, scanner data, etc.

Data series may be analysed individually; repetitively, e.g. each size over all sizes; or as aggregates along the Brand/Size/Market dimensions.

The user is supplied with the list of valid responses at each prompt and selects by either cursor movement if the terminal has full screen editing capabilities or by typing in the response.

After data selection and retrieval, the user is prompted for promotion analysis information:

a. Tolerance limit - the percentage used in calculating the length of post (and pre) promotion dips. That is: "We're still in a dip, if sales are less than 10% of the baseline."

b. Start and end dates of the promotion
c. Unit selling price
d. Margin contribution
e. Total promotion cost

All prompts and responses are required for each data series to be analysed. However, if for example, you are "looping" through a list of brands/sizes/markets it is possible to set any response as a default for all series. This completes the prompting sequence. Reports and graphs are now generated automatically.