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Pricing Analytics

Custom Decision Support, LLC. (CDS) provides pricing analytic services to both commercial customers and to the consulting and marketing research community. CDS has been involved in pricing research for over 25 years in industries ranging from consumer products to heavy industry products and services. We have had recent experience with industrial and protection chemicals, pharmaceuticals, and computer software and products, and industrial vehicles. We believe that the most reliable approach is using specific marketing research information as a basis of decision making. Typically, CDS provides consulting, research design, modeling and the development of appropriate planning tools for our clients. A commercial marketing research firm of the client's choice typically conducts the marketing research projects.

Optimum Competitive Pricing

The expected goal of pricing policy is to maximize long-term earnings. While this is a simple statement, it is a difficult problem beset by uncertainties, competitors, multiple products and segments. The core issue, however, is always the customer demand. How much of our products will he purchase against a set of competing products at various prices? The measured customer demand should be the critical driving tools for any realistic analytical approach to setting prices.

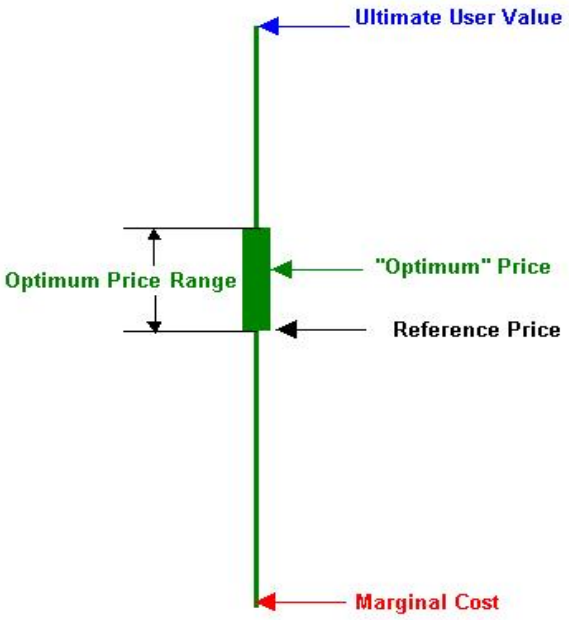
Custom Decision Support, Inc. has developed procedures and techniques to measure demand and integrated with other strategic planning procedures to provide support tools and models for identifying "optimum" competitive pricing policies. It should be noted, however, that there is no single best method for pricing analytics for all business situations. Each situation may require different or at least modified methods.

The diagrams below show the various types of pricing situations. The diagram on the left shows the idealized pricing situation for a single product. Here the term "optimum price" refers to the price that will maximize short-term product earnings. That is, the earnings assuming no changes in the competitive prices nor the impact of any coproducts. The optimum product range captures the prices over some acceptable range of earnings, for example 90% of the maximum.

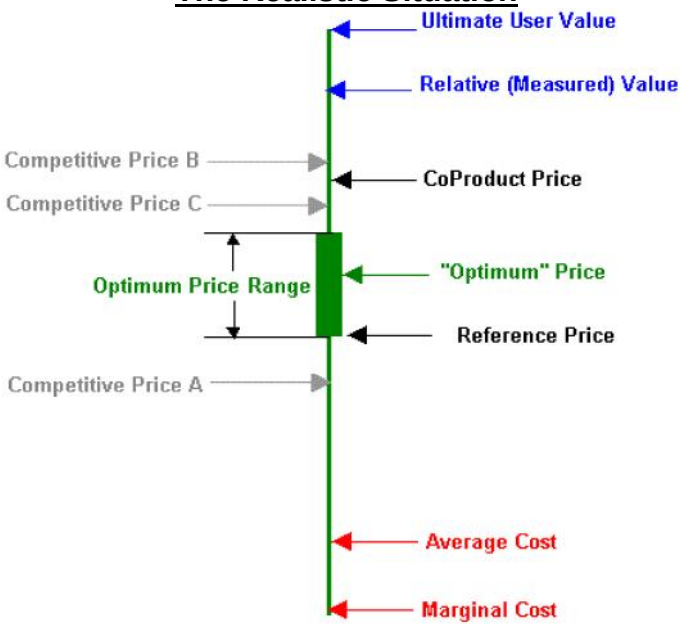
Referring to the left diagram again, the total range that a product might be priced at can vary between its marginal costs below which the sale of a product will result in an operational loss and the ultimate user value, above which the product has no differential value. Between these points there is usually a reference price which could be the existing or targeted price for the product. Traditionally, the business team selects a price around this reference. However, if an

"optimum price" can be estimated, it would clearly give useful information for an improved pricing decision.

Idealized Pricing Situation

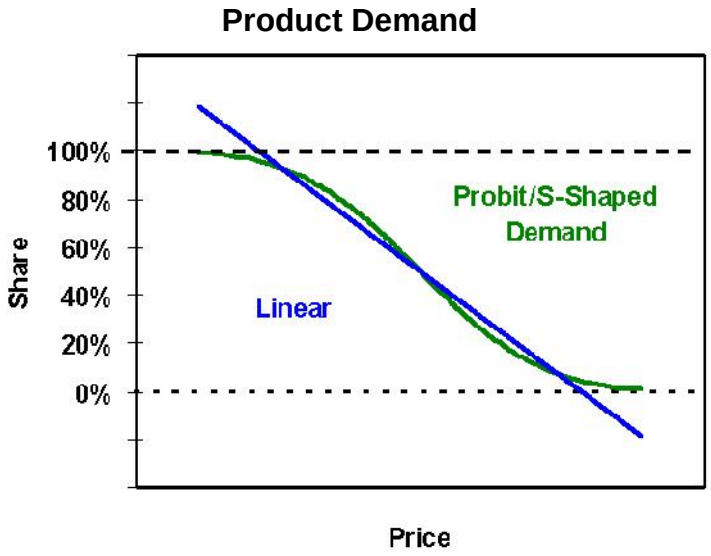


The Realistic Situation



The real situation is much more complicated, however, as shown on the right diagram above. Here we have a number of competing products and a coproduct as well as other measures of value and cost. Furthermore, the product optimum price and range will depend on the competitive prices as well as the prices of the coproducts. In order to handle these complexities we use a pricing market model which allows for the computation of optimum prices given changes in all of these factors.

Estimating optimum prices depends on knowledge of product price sensitivity or "demand" for a specific group of customers, a market segment. That is, how share or sales volume will depend on price. The diagram below shows typical estimations of demand curves, which typically goes down with increasing price. The straight line, "linear" form should be familiar from microeconomics. Unfortunately the linear form doesn't capture the limits of share. We have used the S-shaped demand for the basis of measurement and modeling.

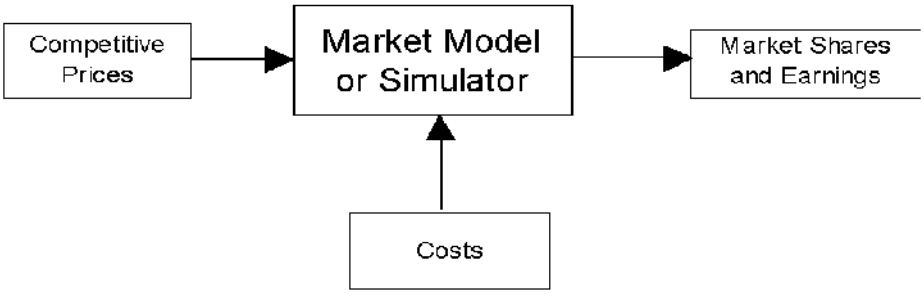


The trick is how to measure demand. It becomes more complex in the real environment of competitive prices and co-products. Ideally we would like to measure the price sensitivity across changing competitive prices and the existence of co-products. There are many methods[1] that can be used to measure price sensitivity, each with advantages and disadvantages. The selection of the approach depends on availability of data, cost constraints, and the competitive situation and to some extent the purchase process. However, for most competitive situations the method of "Choice Analysis" seems to offer the most robust method[2]. The method involves having potential customers simulate the buying decision with a number of pricing scenarios. For each scenario the customer is presented with a set of products and prices and asked to choose the one or more that they will purchase under this condition. The number of scenarios presented will depend on the number of products with varying prices. We have used this method in hundreds of cases successfully.

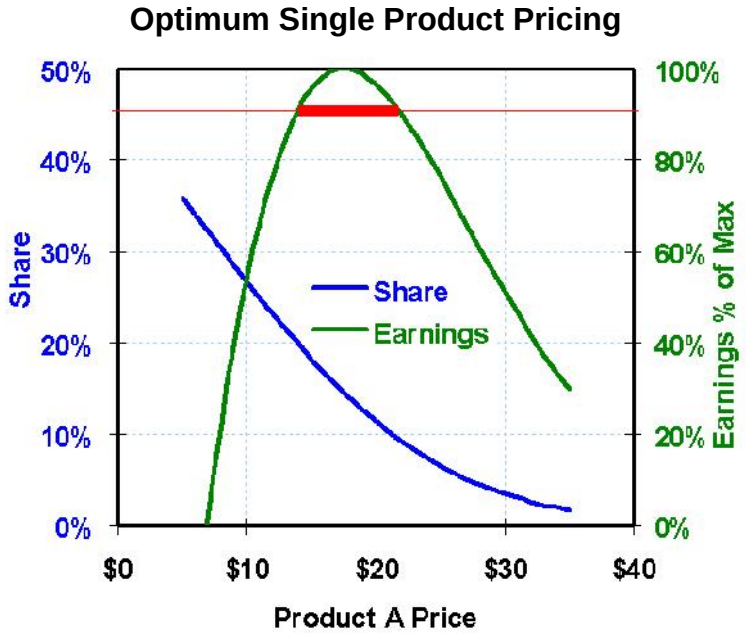
Typically Choice Analysis data is analyzed in aggregate using statistical regression. The result is a market model that allows the computation of share given competitive prices. When we include cost estimates, product earnings are computed. With this type of modeling the business team is usually provided a decision support simulators and planning tools that allows them of explore the impact of competitive price changes.

[1] A detail discussion of the various methods of pricing research can be found at: http://www.lieb.com/Documents/PRICING5.pdf

[2] Choice Analysis, however, is not without its limitations. This is often difficult and time consuming. But, particularly for industrial purchases, it has been found to be consistently feasible.



To provide further pricing insight, price that would optimize short-term earnings is computed. Based on single products, this optimization is done graphically and integrated into the simulator. Below is a typical analysis. The earnings as a percent of the maximum is computed and plotted along with the change of share. In this case an acceptable range is also indicated, at 90% of the maximum. Having both the share and earnings allows the business team to estimate the cost in earnings of increasing share.



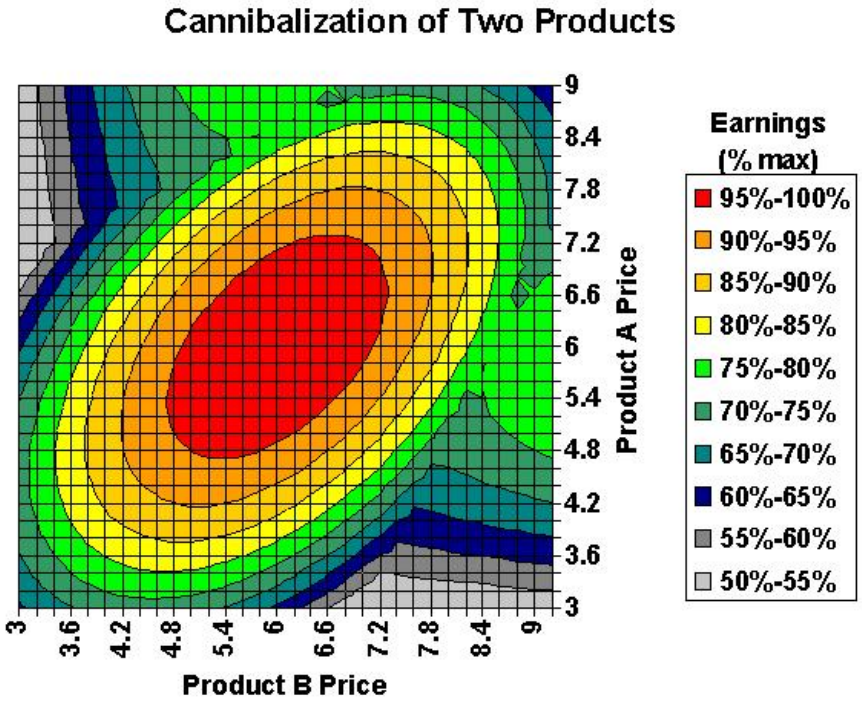
So far we have dealt with relatively simple, though competitive situations. There are, at least, four other complexities that often need to be considered: (1) multiple coproducts, (2) multiple interacting segments, (3) uncertainty, and (4) strategic price positioning.

Multiple Coproducts

Having more than one product in a specific market has become the norm. As firms try to provide targeted value, they have tended to introduce additional products. These may be merely larger quantities such as "family packs" or products with more features such as professional versions. Other cases, it involves different materials that can be used for similar purposes with different properties. In some cases these products may complement each other, but in most cases they act as competition and cannibalize the products. In either case, the optimum price based on

maximizing the individual product earnings for each product may not provide the maximum earnings for the firm.

In the chart below we see a contour map of the earnings for two coproducts. The earnings for the business is the sum of the earnings of each of the products. In this case we see a competitive situation where raising the price of one product increase the sales of the other. The red region of in this chart represents range of prices for the products that would give at least 95% of the maximum earnings. Where there are two coproducts, this type of chart is often included with the simulator[3]. This allows tracking changes in the optimum prices of coproducts with changes in competitive prices.



If there are more than two coproducts then we typically can not generate a single map indicating the competitive situation. In those cases, we rely on numerical optimization. Typically, our simulators are built in *Microsoft Excel*[4]. *Excel* provides a numeric searching tool, "*Solver*," which allows the identification of the joint optimum prices. With this tool, optimum prices for the coproducts are obtained over a range of conditions[5].

[3] As the number of graphs and options increase, simulators tend to become less efficient. As such, we tend to custom design the simulators based on the needs of our clients, balancing speed with flexibility.

[4] These simulators are built without the use of *Macros* or special third party Add-In packages. This allows for complete access by our clients to the computations and data.

[5] While provision to do this type of analysis is usually provided in the simulators, most of our clients have asked us to do the joint price optimization for them.

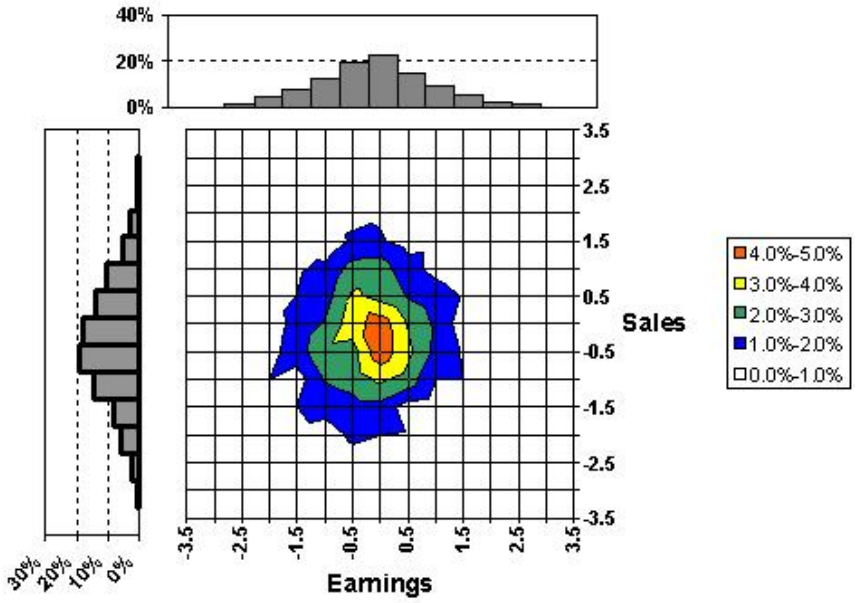
Merging Multiple Interacting Segments

In many cases there are different groups of influencers that effect the purchase of products. These may be in separate buying groups or along a distribution channel. But in all cases, they are effected differently by the market prices. For example, often the direct customer is a reseller who has different perceptions than the ultimate user. In some cases both the reseller and the customer must be involved as in the case of agricultural protection chemicals. In other cases there may be different segments sometimes with different competing products that need to be considered. Typically we are seeking a price that would be satisfactory to both groups. Alternatively put, we want a price that would provide satisfactory earnings irrespective of the group. We have been using a bar chart such as that shown below to handle these problems. The bars represent the optimum price ranges for the groups, in this case for growers and dealers in a protection chemical market. The overlap represents the matching satisfactory range. This has been also applied to multiple segments as well. Where this is a critical issue, these charts are included in the marketing simulators and tools.

Uncertainty and Risk

Estimating risk and uncertainty is a more complex problem. It is, of course, infeasible to analytically capture all sources of risk associated with pricing decisions. There are always factors and issues not captured by the models and simulators. However, estimates of the impact of changes in competitive prices or costs can be obtained. This is typically done using estimates of the distribution of possible values of competitive prices. Below is the result of a stochastic or Monte Carlo simulation.

Distribution of Outcomes



The result of the exercise is a plot of the distribution of earnings and sales given the input distributions of competitive prices for a specific price of the firm's products. Changing the prices on the firm's products gives different results. This can be done as part of the standard simulator but typically a separate planning tool is used, since the computation in *Excel* can be fairly long[6].

A similar, but more useful approach is to examine the impact of changes in product price on the likelihood of meeting an earnings goal. This is also a stochastic simulation based on given probability distributions of competitive prices. But, here we automatically vary the price of the targeted product and compute the number of "tries" that yield earnings greater than a given value. Below is a typical result of this type of simulation. This approach allows the estimation of a "stochastic optimum" giving an alternative perspective to optimum price. This type of simulator, because of long computation times, is typically prepared as a separate tool[7].

[6] The stochastic (Monte Carlo) simulators are built in *Microsoft Excel* without any additional packages.

[7] Neither of the risk analysis tools is usually requested because of the need for probability distribution estimates for the competitive prices. An alternative approach based on two extreme estimates has also been developed. This approach attempts to estimate the "Minimum Regret Price", which will provide a satisfactory result for the two extreme situation.

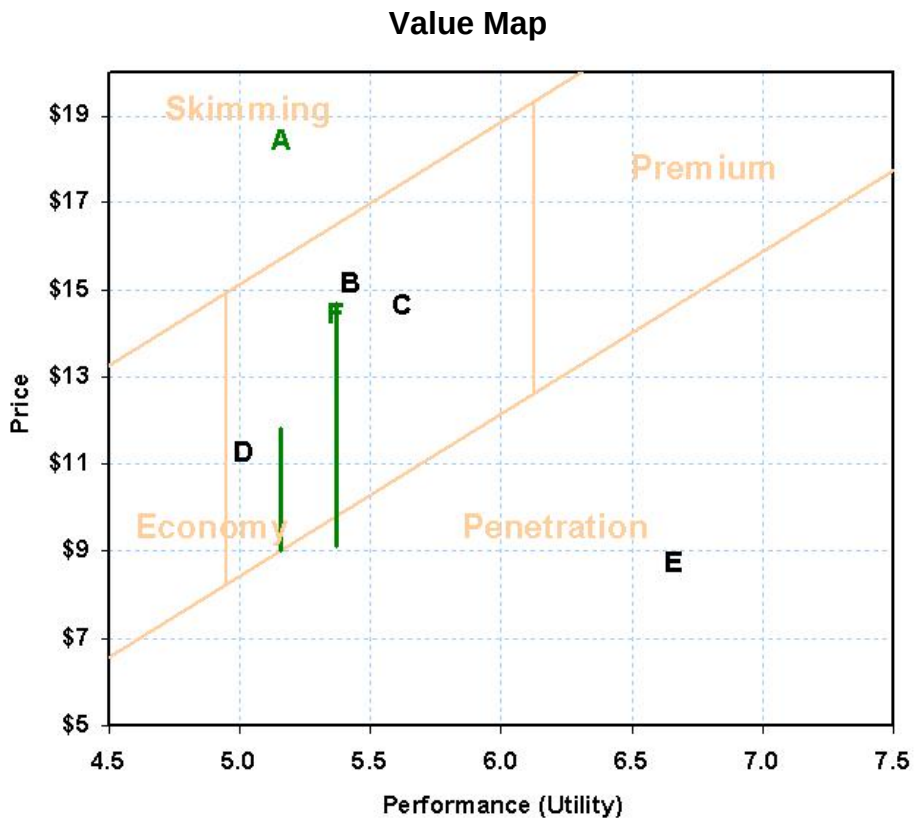
Strategic Pricing

Price is a key part of market strategy and as such should not be set independent of the "Value Position" of the competing products. Products are purchased because of the value that customers have for them exceeds their costs. The plots of existing or targeted price against estimated total value are referred to as "Value Maps" and show the relative position of products. A typical value map is shown below. We use these Value Maps exclusively for strategic positioning rather than as a substitute for demand analysis. As such, we have found it useful to group products on these plots by apparent strategies. These are products that are:

- Over-priced verses their apparent value resulting extracting value or **Skimming**
- Under-prices verses their apparent value resulting in **Penetration** into the market
- Properly priced but of lower value and price, or **Economic**
- Properly priced but of **Premium** value and price
- Properly priced by of **Average** value and price[8].

In the map below, the letters represent product positions. We typically impose the optimum price ranges for the firm's products onto the Value Map. These are the vertical green lines on the map. In this case products A and F represent the firm's products. It is clear that product A is both overpriced for its perceived value and far above its optimum price range. Product F is in the properly price zone but is at the upper limit of the optimum price range. Both products could sustain a price reduction unless that move would disturb the market and result in other effects.

[8] These strategic groups have been identified by John B. Frey who has provided estimates of their average relative shares and earnings based on the analysis of 5,000 businesses in the PIMS database. http://www.lieb.com/Documents/BusinessBehavior.pdf



Principles for the "Best" Pricing Policy

In summary it is useful to review the principles that we use to develop pricing policies. These are:

- Prices should "Nearly" maximize (short-term) earnings – All other things being equal (but they are normally not) prices should try to provide as much money to the firm as is feasible.
- Prices should strive to maintain or grow market position (share).
- Price should usually try to discourage adverse competitive actions or entries.
- Prices should supports the distribution channel.
- Where appropriate, the price structure should allow for sales discount initiatives for new potential mass markets.

Our beliefs

Our procedures and approaches have been developed from our experience and are based on underlying beliefs in making business decisions. We believe that:

- The best decisions are made with good business data
- The best marketing data comes from the customers.
- Understanding the business data comes through statistical analysis and modeling.

- It is important to acknowledge the uncertainty and noise in the data and our understanding.
- Best way to make the data useful is with decision support tools.
- And the best decision support tools are flexible, heuristic, simple and open.