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Pharmaceutical Pricing Research

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 marketing and business research for over 25 years in pharmaceuticals, medical products and the health care industries.

Pharmaceutical Pricing

That the American healthcare is, at least, in flux if not in crisis should come as no surprise. Healthcare costs have increased much faster than the economy in general, let alone the inflation rate, particularly among the elderly. Healthcare insurers are becoming increasingly aggressive in curtailing costs. And while regulators and the Government have remained aloft from direct intervention, they are likely to get involved sooner or later. Of the various factors of the healthcare industry, pharmaceuticals are among the most vulnerable to this pressure.

The expected goal of pricing policy is to maximize long-term earnings for the firm. While this is a simple statement, it is a difficult problem beset by the complexity of the buying process of pharmaceuticals as well as those issue common to pricing such as existence of competitors, multiple products and segments. With such a complex situation some type of predictive tools would be useful to understand the likely impact of market changes and to try to provide some type of "optimum" pricing policy. The core issue for obtaining an analytical view of pricing is customer demand. How much of our products will the "customer" purchase against a set of competing products at various prices? The problem with pharmaceuticals, of course, is that there are often several individuals involved in the specification, selection, use, and payment of the product. It is useful for pricing research purposes to divide the various purchase processes into three groups:

Direct Purchases where there is only one major party to the purchase. These include purchases by physicians for in-office applications (vaccines, etc.) as well as OTC's and ethical drugs not covered by insurance. In these cases, price sensitivity is concentrated in the individual buyer. Understanding the purchasers' demand will capture the potential market behavior.

Hospital Purchases include acute treatment drugs purchased by hospitals and major clinics. These drugs are used as part of therapeutic programs. Purchases of these drugs involve, at least, the P&T (formulary) committee, lead by the hospital pharmacist; physicians, and insurers. It

should be noted however, that the delivery of chronic treatment drugs are provided by the institution such as with veteran and military hospitals, these drugs are purchased in this manner.[1]

Outpatient Purchases are the traditional process of obtaining ethical drugs by patients. This involves physicians specifying the pharmaceutical of choice, patients filling the script by a retail pharmacist directly or remotely, and paid by an insurer with a copay by the patient. These are typically chronic drugs though some acute pharmaceuticals are included such as antibiotics.

For each of these situations, we need to have a different model with different measures of customer demand. CDSI 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.

For the simplest cases, direct purchases, we need only focus on one customer. For the more complex cases such as out-patient purchases, we need to capture the competitive price sensitivity of the decision makers in setting the formulary and on copay structure, sensitivity of the physicians to the formulary ranking and copay structure, and finally the copay price sensitivity of the patients. This is a much more complex process but the components basically follow the general logic of optimum pricing.

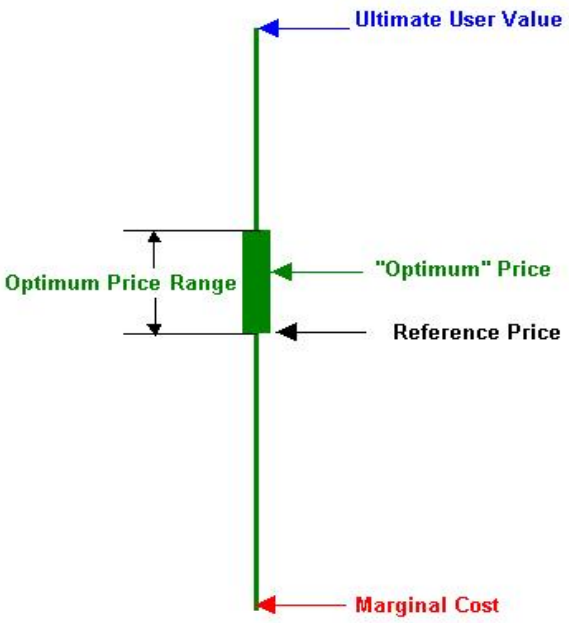
"Optimum" Pricing

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.

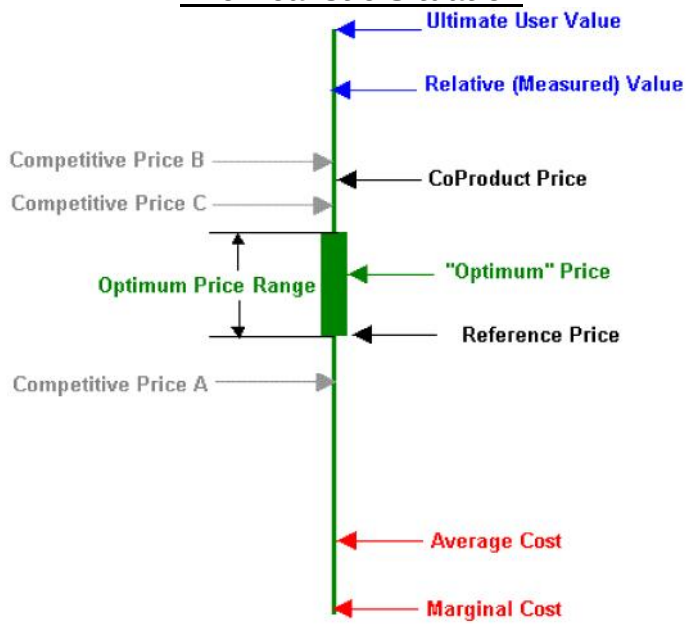
Referring to the left diagram again, the total range that a product might be priced at can vary between its marginal costs below which the sale of a product will result in an operational loss and the ultimate user value, above which the product has no differential value. Between these points there is 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.

[1] We have excluded here competitive bidding. While competitive bidding is used widely throughout the world, it is rarely used for pharmaceuticals in the United Stated.

Idealized Pricing Situation

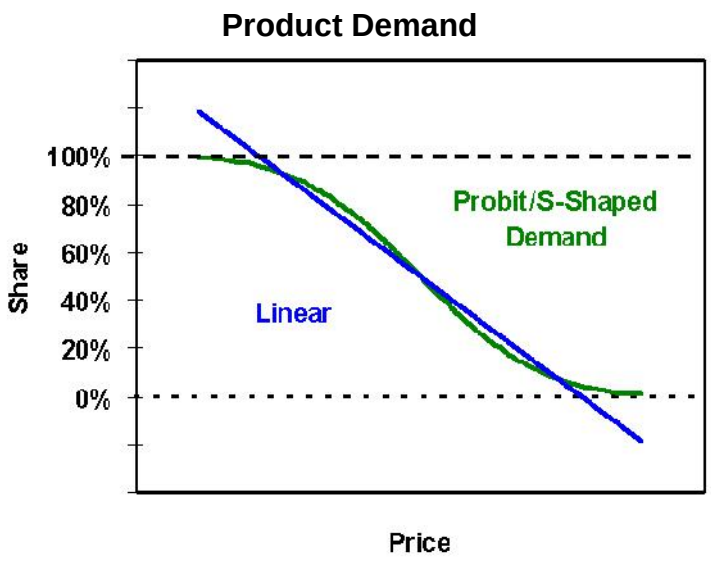


The Realistic Situation



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 coproducts. Ideally we would like to measure the price sensitivity across changing competitive prices and the existence of coproducts. There are many methods[2] 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[3]. 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.

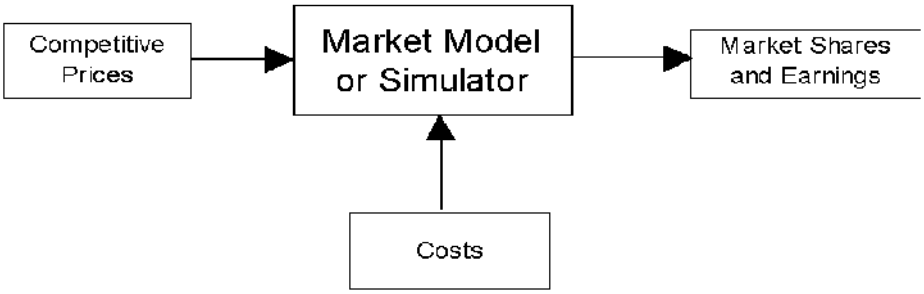
Typically Choice Analysis data is analyzed in aggregate using statistical regression. The result is a market model that allows the computation of the share given competitive prices. When we include cost estimates, product earnings are computed. With this type of modeling the business team is usually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

As we had noted earlier, there are often different groups of influencers that effect the purchase of pharmaceutical products. These are highly interactive buying groups. They also have different values and evaluate the products from different perspectives. Physicians typically value efficacy and safety with little direct concern over costs. Insurers focus on costs and substitutability. Patients are concerned with the perception of quality and copayments. These multiple

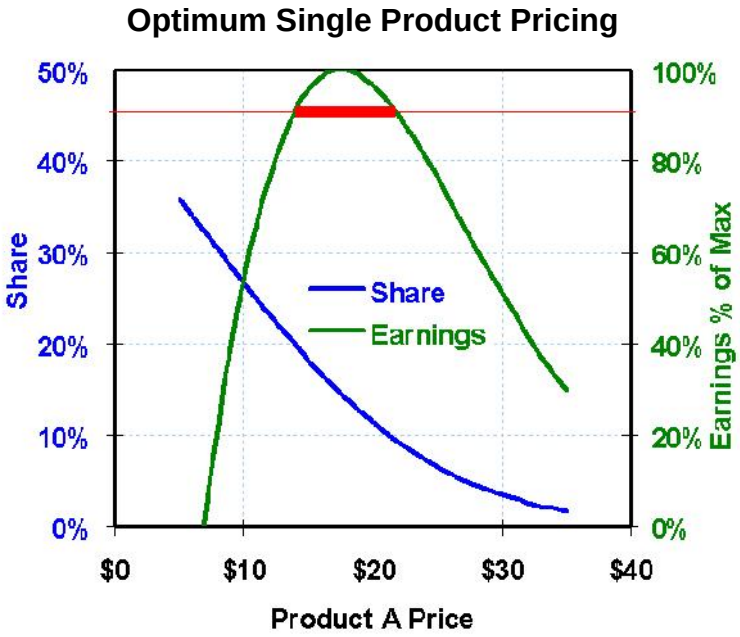
[2] A detail discussion of the various methods of pricing research can be found at: http://www.lieb.com/Documents/PRICING5.pdf

[3] 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.

influencers work together to form the overall demand. A mathematical model is constructed to merge the group demand functions to provide the overall estimates.



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.



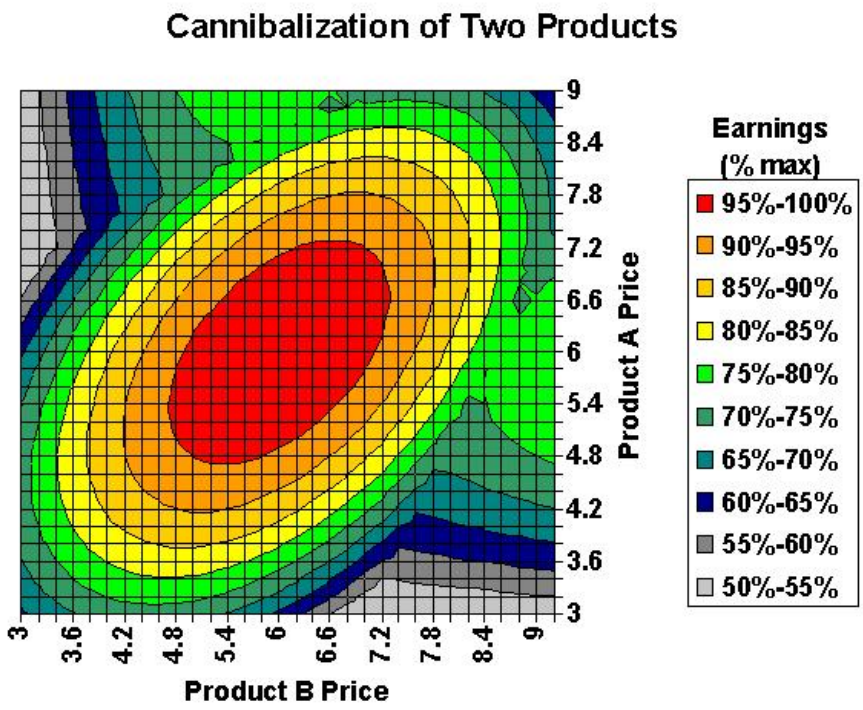
So far we have dealt with relatively simple, though competitive situations. There are, at least, three other complexities that may need to be considered including multiple coproducts, uncertainty, and strategic price positioning.

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 "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 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[4]. 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*[5]. *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[6].

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[4] 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.

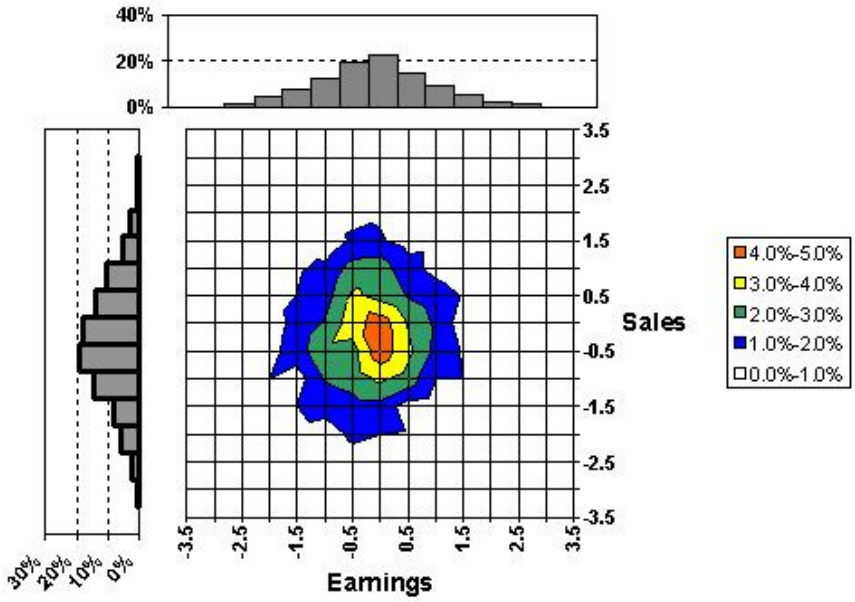
[5] These simulators are built without the use of *Macros* or special third party Add-In packages. This allows for complete access by our clients to the computations and data.

[6] 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.

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[7].

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[8].

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

[8] 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.

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.
- 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.