

# ***Using the Anticipation of Competitive Actions to Make SMART Pricing Decisions***

***By: Scott Davis, Principal, Strategic Marketing Decisions  
John Cripps, Vice President Data-Driven Marketing,  
Fireman's Fund Insurance Company  
Steve Kutner, Partner, Corporate Value Associates***

***Scott Davis is the Principal and Founder of Strategic Marketing Decisions. Strategic Marketing Decisions provides consulting services in pricing, marketing strategy and planning; and on-site professional instruction in marketing and consulting services with an emphasis on strategic marketing planning and pricing policies. Dr. Davis will be one of our speakers at the upcoming fall conference in Chicago.***

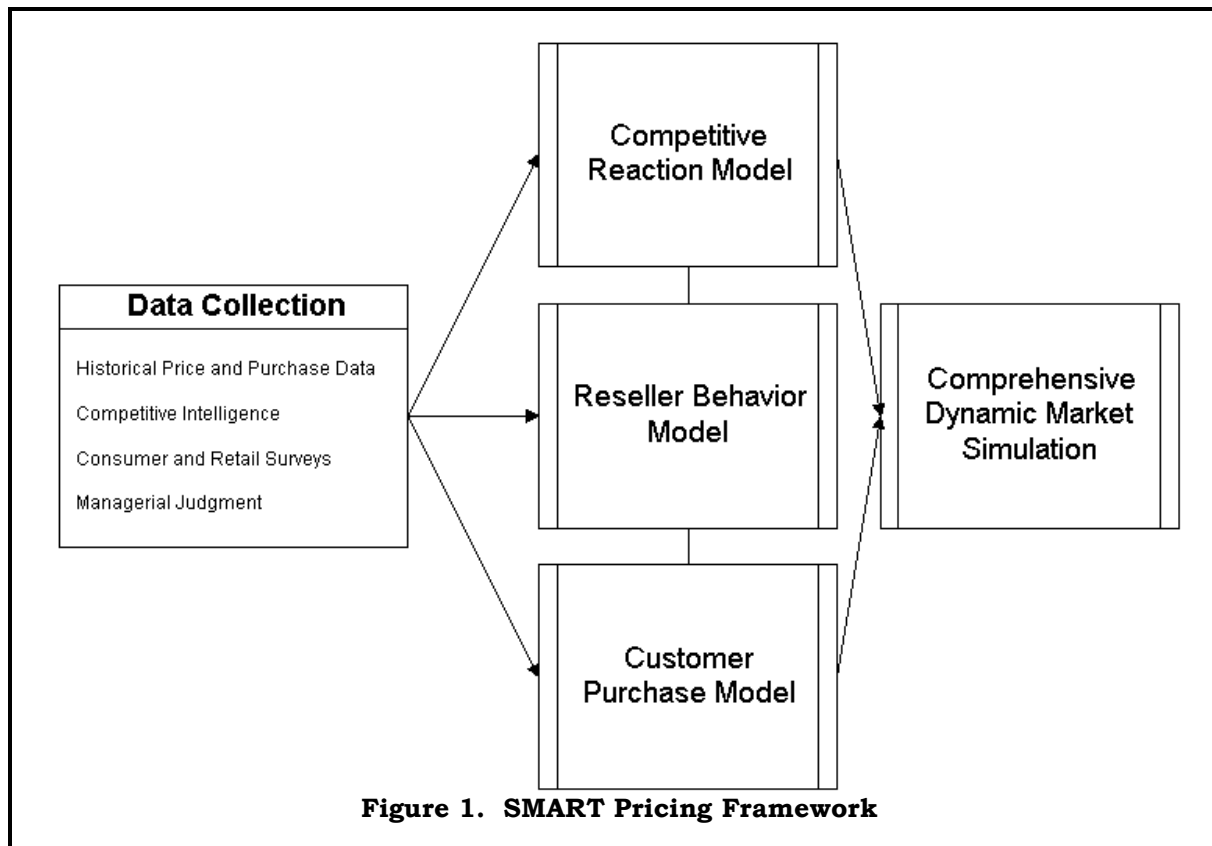
## **Failures of Current Pricing Practices**

In highly competitive industries, the most successful managers are constantly looking for actions they can take to improve the performance of their companies. When market share or profitability falters, there can be great pressure to do something. Unfortunately, price changes are often the tactic of choice. Despite the prime importance of pricing decisions, we have observed that prices are frequently set using very naïve pricing rules, based more on hunch, convention and fear rather than within a strategic framework that explicitly anticipates the reaction of competitors, resellers and end customers.

For example, it is a very common practice to set prices based on cost-plus pricing rules. Although this approach simplifies the pricing decision, it can result in setting prices that fail to reap gains that could be obtained by better assessments of customer value and price sensitivity. A preferred solution is to explicitly model customer demand using the variety of demand modeling techniques that exist today. Nonetheless, our experience is that even when explicit models of customer demand are estimated, the overall price levels are not optimally set.

Even sophisticated managers, who base pricing decisions on models of customer demand, often fail to explicitly anticipate and forecast the responses of competitors to price changes. As a consequence of this myopic behavior, pricing decisions are often less effective than they could be. For example, many industries have two or more key competitors that have a substantial impact on the market. In these cases, price cuts that significantly increase share and sales volume will often be matched quickly and share and profit gains may be short-lived. To be effective, pricing decisions will also need to account for the tradeoff between the short-run profits due to the sales volume increase and the reduced long-run profits that will result from competitive price reductions. In general, failures to explicitly anticipate the behavior of customers, resellers or competitors will lead to either unprofitable pricing initiatives, or to forgone opportunities to make profitable price changes.

This article will provide an overview of an approach to modeling the impact of pricing decisions in a dynamic competitive market.



The proposed Strategic Marketing Anticipating Responses and Timing (SMART) Pricing Framework explicitly accounts for dynamic aspects of competitors, channel members and customer markets to provide predictions of both the short and long run impacts of pricing policies (see Figure 1). The framework begins by collecting relevant background information from market data, competitive intelligence, surveys and managerial judgment. This information is integrated to form three models. One model is a competitive reaction model, which is designed to predict competitor reactions to different potential sets of market conditions. Another model captures critical aspects of reseller behavior including markup policies as well as stocking and promotional decisions. A third model is designed to capture the dynamics of consumer purchase behavior, which might include the impact of price expectations, or changing preferences. These three models are then integrated to form a comprehensive dynamic market simulation. Here we will focus on the first of the three models: the competitive reaction model.

### An Approach to Pricing based on a SMART Framework

Over the past fifteen years, there has been a tremendous increase in the amount of historic

customer purchase data that is available to analyze customer buying behavior. In addition, advances in customer modeling techniques using survey data (e.g. choice analysis) or historic purchase data (e.g. econometric and data mining tools) have advanced rapidly. As result, reliable models of customer demand can be estimated in most market situations that provide a solid basis for forecasting customer reactions to price changes. However, market simulations that are based on these demand analyses are typically conditional on static assumptions about competitor behavior.

### Modeling Competitive Behavior

A key element of the SMART framework is the anticipation of how a competitor's actions will influence the returns from different pricing alternatives. To do this effectively one should try to identify the factors that will motivate change, infer a competitor's approach to pricing, and use this information to predict the changes that are likely to be implemented and when they will take place.

Changes in a competitor's marketing activities may be due to two reasons. One reason may be changes in their market conditions. Some of these changes may be external to the firm, such as

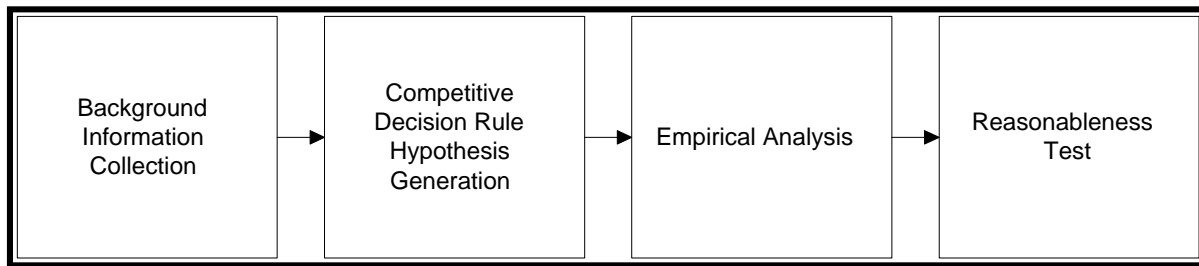
changes in the industry's cost structure or consumer behavior. Other changes may be internal to the firm. They might include changes in management, management's objectives, or their capabilities. For example, a technological breakthrough or a decision to launch a new product will often have impacts throughout a competitor's product line. The second reason is due to changes in another competitor's actions. For example, a price change by one firm may stimulate a price response by many of the firm's competitors. Price responses may also be stimulated by the entry of a new competitor or an existing competitor's decision to add or drop a product from its line. Effective long term planning requires anticipating the reactions attributable to both reasons.

Central to anticipating competitive behavior is an understanding of how competitors make their pricing decisions. There are two broad approaches a decision-maker may utilize in setting prices: rule-based and objective-based. A rule-based approach suggests how price should depend on factors in the market. Examples of this type of approach are commonly found in pricing decisions. They might include rules that involve pegging the price to the prices charged by one or more competitors and rules that utilize costs as the primary basis for the price. In contrast, an objective-based approach involves setting prices to achieve one or more objectives, such as profit, share, growth, or capacity utilization. Different motivating factors and capabilities will imply different marketing responses to a given competitive environment. For example, a firm with high costs will choose a higher price than would a similarly situated firm with low costs. If profit is a significant motivating factor, it may be possible to use this relationship to infer a competitor's costs from its past pricing decisions. In the same way, a firm with a market share target will adjust its price to achieve its share goals. Some firms may employ a hybrid approach that involves utilizing a combination of these approaches, while others may respond by changing marketing activities other than price. An understanding of the way a competitor approaches its pricing decisions will make it possible to better predict the likely response to a change in market conditions.

In addition to understanding how competitive marketing decisions are made, it is important to predict when changes are likely to occur. A number of factors can provide insights regarding the timing of a competitor's price changes. One critical factor influencing the timing of a price response is how carefully a firm monitors the market. A firm that monitors market conditions carefully can quickly identify changes and will be inclined to respond rapidly, if management deems it appropriate to do so. In other cases a firm may be focused on results and will tend to respond only when a product's market performance falls short of expectations. In such a case, one would expect a competitor to respond slowly to a change in market conditions. A firm's business strategy and managerial philosophy will also influence the nature and speed of response. For example, a firm that is conscientiously pursuing a low-cost leadership strategy is likely to respond rapidly to competitive price cuts. In contrast, a firm that emphasizes the differential benefits of its products is likely to adopt a wait and see approach to responding to a price cut on a competing product of lesser quality. Finally, the decision-making structure of a firm will also influence the timing of responses. Firms with highly decentralized decision-making structures will tend to respond more quickly than will firms with more centralized structures in which pricing decisions must receive bureaucratic approval. Understanding these factors may provide insights as to the time it will take competitors to respond to price changes which can be incorporated into a dynamic market analysis.

### **The Process Of Modeling Competitor Reactions**

The key element of a SMART analysis is inferring competitor objectives, capabilities and decision rules in order to predict their actions. Economists have used game theoretic concepts, such as competitor reaction functions, to analyze competition in some industries. However, these constructs have had limited value as a practical tool for formulating and evaluating specific pricing policies. Typically game theoretic applications have failed to consider the practical realities of limited competitor data, complex competitive dynamics, and the need to describe the often less than rational economic behavior of competitors.



**Figure 2. The SMART Four-Step Process for Predicting Competitive Price Reactions**

An effective SMART analysis employs a set of practical and flexible procedures for explicitly representing expected competitive responses using a mix of available data and expert judgments to answer the following questions:

1. What are a competitor's objectives and do they influence pricing and other marketing policies?
2. What factors are likely to trigger a response?
3. What are the likely forms of the response, if any (e.g. in kind with price changes, or some other way such as advertising or additional channel support)?
4. How large is the likely response (e.g. how closely will price changes be matched)?
5. How quickly will the responses be implemented?

Figure 2 summarizes a four-step process for predicting competitive price reactions. The first step consists of obtaining background information and available hard data that can be used to develop a set of competitor response predictions. Competitive intelligence information from sources including both direct and indirect sources. Direct sources of information include statements by company representatives through personal appearances, press releases, or quarterly or annual reports. An expert may also use indirect information sources such as observations of past behavior to infer a competitor's approach to making marketing decisions and predict implementation timing.

In the second step, hypotheses are generated about the pricing policies used by competitors. Generally the hypotheses include both rule-based (e.g. pegging prices to one or more competitors) and objective-based (e.g. profit maximization) policies. Pricing policies that incorporate multiple

criteria or constraints may also be developed. For example, a competitor's price may be set to achieve a compromise between different objectives such as profit and share. In other cases, one competitor may peg its price to that of another competitor as long as doing so satisfies certain margin or share constraints. Even though price reaction rules may not be formalized as policy by a competitor, they are often implicit in competitor behavior and can be revealed by examining the historical data.

The third step in the process involves calibrating or fitting the hypothesized pricing policies from step 2 to the available competitive pricing data. The goal of this step is to assess how well these rules predict past pricing behavior and estimate the time it takes competitors to respond to changes in prices or market conditions. When there is sufficient data, the empirical analysis is also used to statistically calibrate pricing procedures that incorporate multiple objectives and rules. In the absence of sufficient historical data, managerial judgment may be used to supplement the empirical findings to improve the calibration of the model of the competitive behavior. The result of this calibration is a competitor's *reaction function*, which describes a competitor's likely response to any given situation. When industry price data is abundant, statistical data mining tools can be used to help uncover competitor reaction rules and subtleties that may not be obvious through management insight alone. This type of analysis can generate additional hypotheses that may better explain past competitive behavior than those obtained through managerial judgment. In some cases multiple reaction functions are estimated to predict the reactions for different potential decision rules.

The fourth step in the process is a reasonableness test of the proposed competitive reaction functions. Once the set of prospective reaction functions have been calibrated to existing data, judgment is used to determine which one(s) are most likely to be valuable in predicting future competitive behavior. By observing the relative

historical fit of different functions to past price observations, it is possible to predict the reliability of the different hypothesized decision approaches. The rules that pass the tests of predictive reliability and managerial plausibility are then used as inputs into a dynamic market simulation and again judged for reasonability. If a rule yields implausible results when incorporated into simulations, it is further refined or discarded.

The reaction functions and competitor's estimated response times derived from this four-step process are used to form a dynamic market simulation that can be used to predict the dynamics of competitive behavior. When multiple sets of reaction functions are developed, it is also possible to perform a sensitivity analysis to project the impact of different competitor objectives and decision rules on long run market outcomes. Such an analysis is quite valuable in cases in which no single objective function provides a highly reliable explanation of past competitive behavior or when a competitor's management has indicated that they will change their goals or strategy.

We believe that this reaction function approach is superior to the more typical what if analyses that forecast market outcomes given one or more competitive responses. While these what if analyses allow a direct input of possible competitor responses, they typically are based on managerial intuition and do not incorporate the available information in a model to *predict* responses in a systematic manner.

## A Case Example

To help clarify the SMART process, we will consider the simplified composite example of a computer motherboard manufacturer, I-Tec Electronics and its pricing decision concerning its high-end product, the I-1000, which it sells directly to original equipment manufacturers. The I-1000 currently enjoys high quality ratings and brand awareness in the market, which is consistent with its reputation for producing high end products and charging premium prices.

Currently I-Tec uses a cost-plus pricing rule, setting prices at a 40 percent premium over unit costs. A recent production process innovation has lowered the I-1000's variable costs by twenty percent. Given their current cost-based pricing practice I-Tec would pass the cost advantage through to its customers by lowering price from \$450 per unit to \$365 per unit. I-Tec's management team has decided to consider an approach to pricing that incorporates a demand

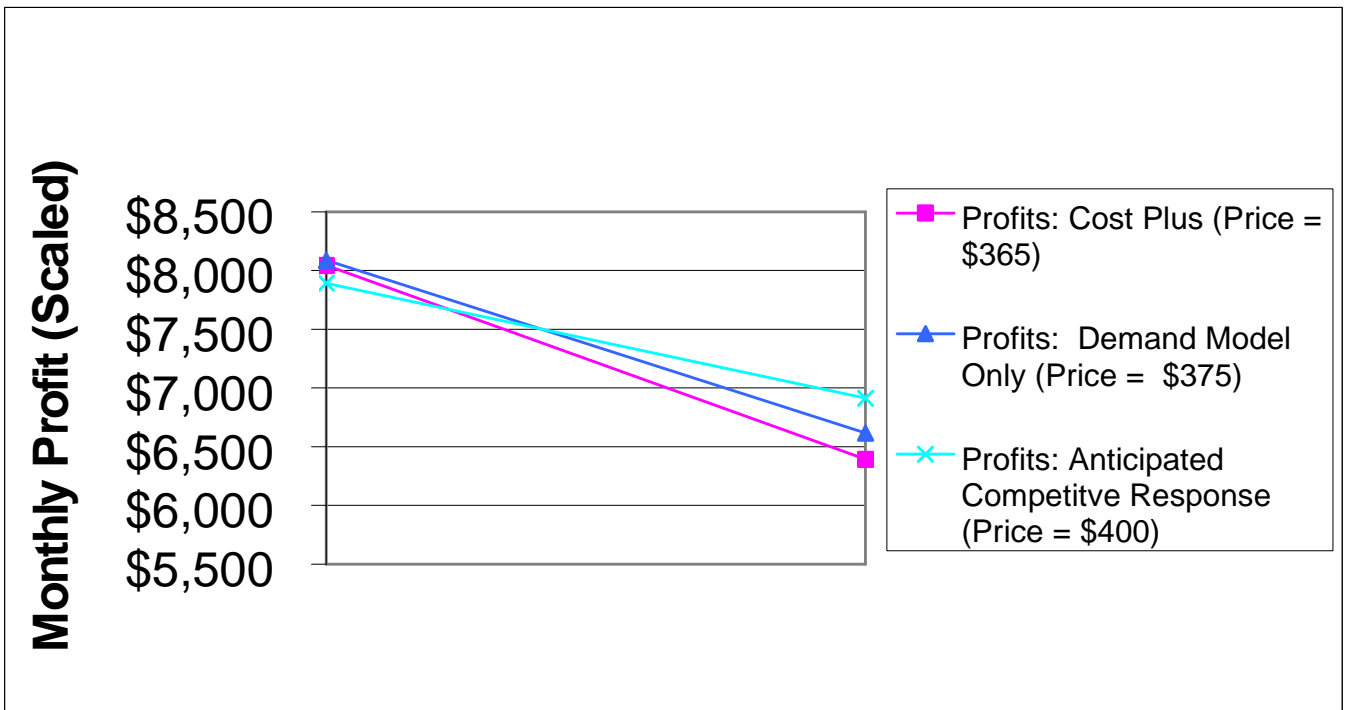
model that forecasts the target market's brand and model choice decisions. On the basis of the estimated demand model, the cost-based price cut appears to be very sensible since the demand model predicts that this price decrease will increase profit by 30 percent given the current prices of competing products. How effective is I-Tec's current pricing approach? Are there other pricing policies that would significantly improve profit relative to the cost-plus rule?

Using the traditional approach to pricing based on demand and cost information, the customer's price elasticity is used to derive customer optimal pricing given competitive prices. By explicitly considering customer price sensitivity in addition to cost, the demand model predicts that I-Tec improves profits by setting unit prices at \$375 rather than the \$365 suggested by the cost-plus pricing rule. This analysis suggests that not all cost savings should be passed through to the customer.

By charging a price of \$375, I-Tec's projected profit in the first month rises from 7.0 million to 7.3 million, as illustrated in Figure 3. However, given I-Tec's leadership position in the market, its competitors will respond to its price reduction by lowering their own prices. The demand model predicts that both prices will generate an increase in sales and market share given the current competitive prices. However, what fraction of those gains will be short-lived given likely competitive reactions?

To answer that question, we applied the SMART four-step process for predicting competitive price reactions:

- Step 1: Background data about I-Tec's competitors was collected. The process of predicting competitive reactions began by understanding the competitive landscape through interviews with management and industry analysts. These interviews indicated that there are three primary competitors for the I-1000 and that all three historically have responded to I-Tec's price changes and new model introductions.
- Step 2: Hypotheses were generated about competitor behavior. I-Tec's management believed that its competitors set their prices based on I-Tec's prices. They hypothesized that competitors set their prices at a fixed percentage discount to the comparable I-Tec product.



**Figure 3. Estimated Monthly Profit Comparison across 3 Pricing Policies**

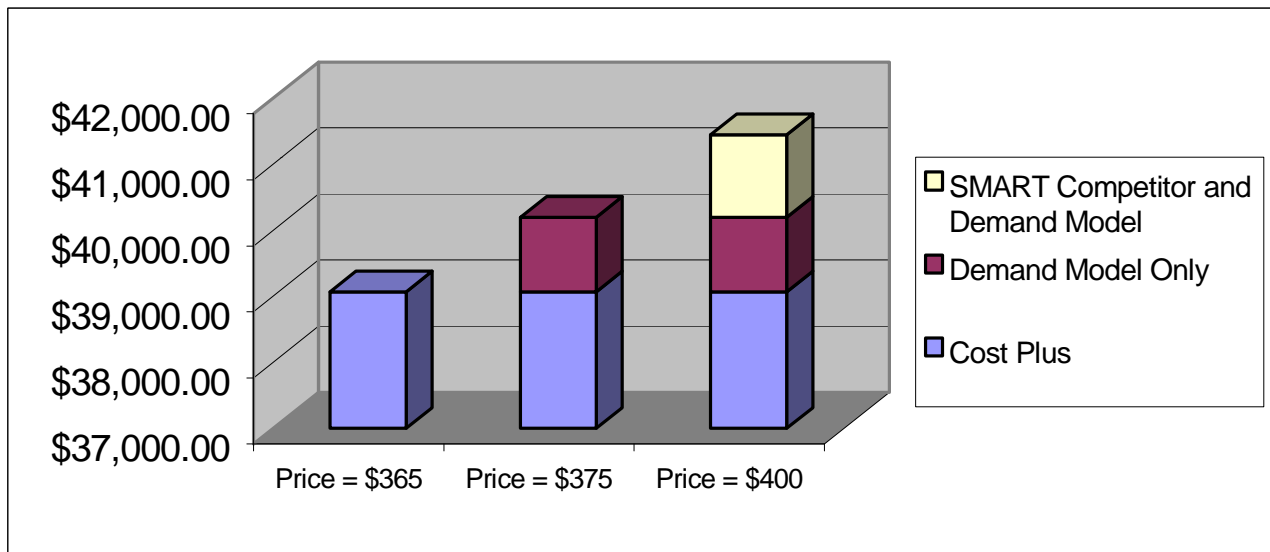
- Step 3: These hypotheses were then calibrated and used to construct competitive reaction functions. The reaction functions were then tested for their ability to predict past pricing decisions. Two years of monthly pricing data was broadly consistent with the managerial hypotheses. Two of the three firms seemed to set their prices at a constant discount to I-Tec. However, a statistical analysis of the data revealed that the third competitor behaved somewhat differently: apparently setting prices to maintain a level of steady sales growth rather than simply tracking I-Tec's pricing. The data also revealed that there was roughly a one-month lag before competitors were able to implement a price change in response to market price changes.
- Step 4: The new behavioral hypothesis for the third competitor and the results of several simulations were presented to I-Tec's management team and were judged to be reasonable.

The estimated competitive reaction functions made it possible to estimate I-Tec's profits after the competitive responses to a range of potential prices. For all price reductions, the competitors were projected to respond with price cuts of their own which would, in turn, reduce I-Tec's profits.

By considering a range of potential price changes, it was determined that a price of \$400 would be likely to earn the greatest discounted profit over the next six months. Interestingly, at this higher price, I-Tec earns lower profits initially than it would have by charging a price suggested by either the cost-plus rule or the traditional demand modeling approach. However, at the higher \$400 price competitive price reductions will be less steep. The higher competitor prices allow I-Tec to earn a greater expected profit after predicted competitive responses than it would have earned with the other two approaches (see Figure 3).

Why is setting price based on a demand model generally insufficient? If one can explicitly account for the way a competitor reacts to price changes (e.g. a price reduction in this case) and predict the size and timing of the reaction, profit performance can be improved.

By using the predicted expected competitive reactions in addition to the demand model, we see that a price of \$400 should yield higher six-month profits than the \$375 price suggested by demand analysis alone. At the \$400 price, profits are initially lower than those earned by basing price exclusively on the demand model. However, competitors will respond with smaller price cuts, thus allowing I-Tec to earn higher profits in the long run.



**Figure 4. Comparison of Estimated Six Month Profit across 3 Pricing Policies**

By accounting for competitor reactions prospectively, I-Tec achieved the best tradeoff between short and long run profit. As illustrated in Figure 4, optimizing prices to the consumer demand model yields an increase in discounted profit of 2.9% relative to the cost-plus pricing rule. However, explicitly anticipating and quantifying competitor reactions in addition to the consumer model can further improve results. The result is a discounted profit increase of 6.1% relative to the cost plus pricing rule over a 6 month planning horizon (see Figure 4).

### Taking A Long-Run Perspective

Although a simplified example, the I-Tec case demonstrates the value of developing pricing policies from a consumer demand model combined with an explicit competitive response model. By systematically anticipating and evaluating the future impact of current actions, pricing decisions can be made to enhance long-term profitability. As in the I-Tec example, the analysis can identify actions that may sacrifice short-term profits, yet will pay dividends in the form of enhanced long-run performance. In many cases the impact of including competitive responses can be even more dramatic than that demonstrated in this example.

The value of understanding competitive pricing decisions goes beyond predicting the price reactions of one firm to the prices of competing products. A number of factors may motivate a competitor to *initiate* changes in its product offerings and prices. These factors might include:

- Changes in consumer preferences,
- The emergence of new market segments,
- The development of new competitors, products, technologies, or business designs,
- Changes in costs or the structure of markets for supplies, and
- Changes in reseller behavior or composition.

In changing environments, it is critical to not only identify your own opportunities, but also the opportunities of your competitors and their likely actions. A failure to account for the ways a competitor adjusts its product offerings and prices could result in a significant reduction in profitability. By using a SMART analysis to predict their likely actions, a manager is better able to adjust prices quickly, and possibly preemptively, in a way that will yield the greatest profit over the long run.