A MODEL FOR PRICING DECISIONS IN "FIRST PERIOD"
MARKETING SIMULATION GAMES

Amir Rashid, Wayne State University
Hugh M. Cannon, Wayne State University
Fred W. Morgan, Wayne State University

ABSTRACT

In this paper an expert system model is proposed for making "first-period" pricing decisions in the context of a simulation game, Compete. Such decisions are usually characterized by very low information availability. The model is based on a pricing decision framework developed by the authors.

INTRODUCTION

This study is part of an ongoing project which seeks to develop an expert system for playing marketing simulation games. The expert system, in turn, serves two objectives. First, it provides a teaching model for students who often respond to unstructured marketing decision by despairing of rational decision rules and resorting to mindless guessing Second, it constitutes a first step in developing a more sophisticated model that may be used in real-world marketing decision. Both of these objectives comprise a higher-level goal of expanding our understanding of normative marketing decision theory in general.

The focus of this paper is pricing decision-making in "first-period" simulation environments where games have no history upon which to base decision. In addition, students typically have very little information regarding pricing norms or other market factors that might, provide cues for an informed pricing decision.

THE PRICING MODEL

In a recent manuscript, the present authors suggest a decision model for selecting among various pricing approaches, depending upon the nature of the pricing problem (Cannon and Morgan 1987). The logic of the model is depicted in Figure 1.

This pricing model encompasses a simple rule-based system for selecting among six alternative pricing approaches, designated Al through A6 in Figure 1. These approaches are target-profit (Al), cost-plus (A2), perceived-value (A3) going-rate (A4), sealed-bid (AS), and negotiated (A6) pricing. Target-profit pricing results in prices derived from sales forecasts (Rich 1983) and estimates of elasticities (Shoemaker 1986). Cost-plus pricing adds a common mark-up to unit costs and leads to the same prices in mature industries. Perceived-value pricing requires some estimate of consumers' value-price trade-off (Levin and Johnson 1984). Going-rate pricing adheres closely to industry tradition in price-setting (Kotler 1984). Sealed-bid pricing is based on the expected prices of close competitors (Alpert 1971). Negotiated prices are set on a case-by-case basis with customers (Schill 1985). This pricing model is driven by the answers to six different questions regarding the nature of the pricing situation. Depending on these answers, the model gradually narrows down the feasible set of alternatives. For example, the first question determines whether the customer merits individual pricing consideration. If the answer is yes,

any pricing method that does not offer a custom price to each customer can be eliminated. Thus, all but sealed-bid and negotiated pricing are excluded. The remaining trails in the decision framework evolve in similar fashion.

The major task described in this paper is to identify the type(s) of pricing approach(es) that is(are) generally appropriate for first-period game decisions and to develop and expert system that would enable students to operationalize the approach(es).

DESCRIPTION OF THE SIMULATION GAME

The business simulation game chosen for use in this study is the marketing game. Compete (Faria, Nulsen, and Ross 1984). Compete is typical of marketing simulations in its basic structure. It offers a simulated environment where up to five student teams/companies vie for sales of three different products in three different regions. The three products are:
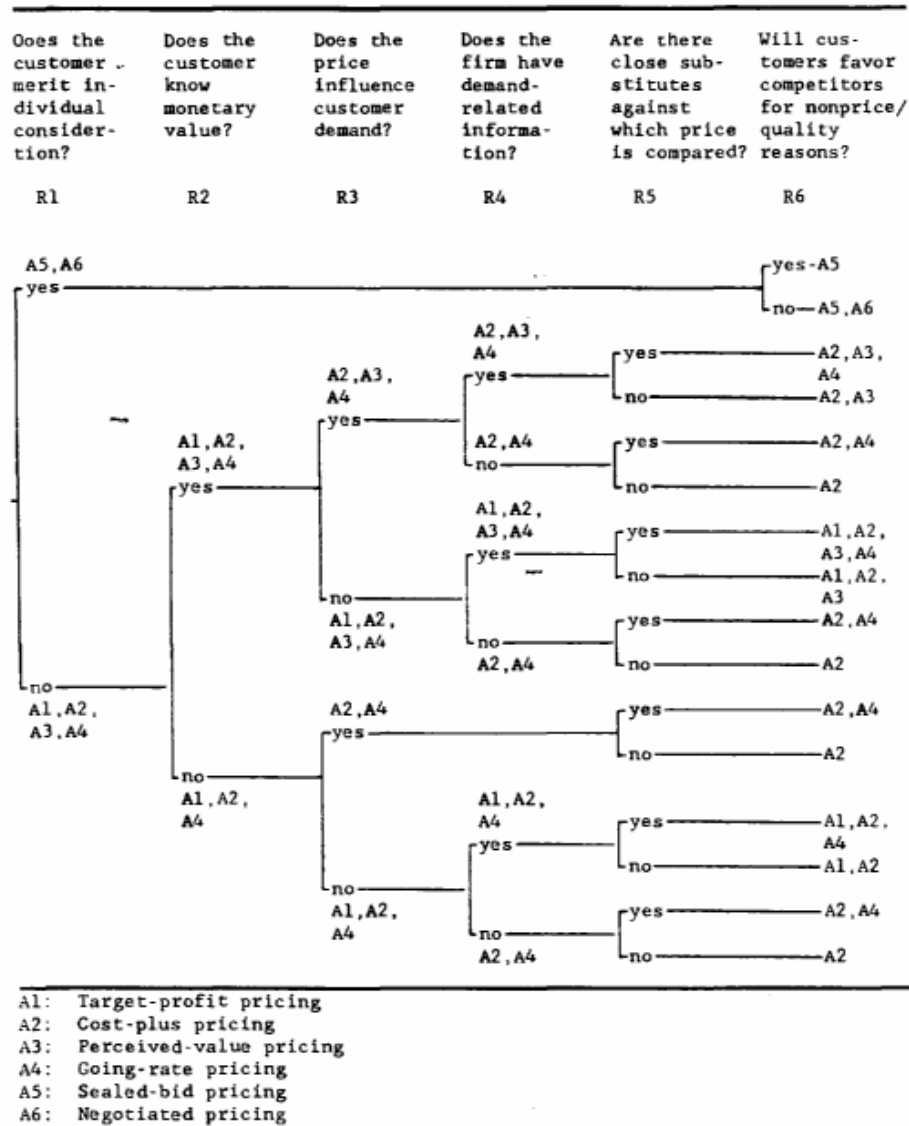
1. Large-scale television (four by five feet screen) in the late growth stage of its life cycle.

2. Home computer system that combines the characteristics of home computer and video game and is in the early growth stage of its life cycle.

3. A weight control system that has audio response and memory capability and has recently been introduced into the market.

The game is played in three regions:

I. Northeast/northcentral region- -this region contains 44% of the total population of the market. It is highly industrialized and his high but volatile sales per capita.

2. Southeast/southcentral region--this region has 28% of the total population of the market and has lower but stable income than the northeast/northcentral region.

3. West/far-west region--this region has 28% of the total population of the market. It is the fastest growing area and has incomes between those of regions I and 2.

Students are required to make decisions regarding pricing, production volume. salesforce size and commission, allocation of salesforce time to various products, advertising budget, advertising media, advertising message, and the research and development budget. Marketing research studies can be purchased by student groups at varying cost. These reports are not available for first-period decisions because they must be ordered one period in advance of their receipt and because first-period decision must be made in order to generate the data upon which the research reports are based. In the first period, the only price-related information is the typical retail price in the

Figure 1
A Normative Pricing Decision Model

Ooes the customer merit individual consideration?	Does the customer know monetary value?	Does the price influence customer demand?	Does the firm have demand-related information?	Are there close substitutes against which price is compared?	Will customers favor competitors for nonprice/quality reasons?
R1	R2	R3	R4	R5	R6

```
A1:   Target-profit pricing
A2:   Cost-plus pricing
A3:   Perceived-value pricing
A4:   Going-rate pricing
A5:   Sealed-bid pricing
A6:   Negotiated pricing
```

previous year. production cost information, retail margin, and projected industry volume.

THE FIRST-PERIOD PRICING DECISION

The relative paucity of first-period information in Compete is typical of most marketing games. In terms of the authors' pricing model (Cannon and Morgan 1987; See Figure 1), the pricing situation can be described in terms of six key characteristics:

1. The customers are not large enough to merit individual pricing consideration, since the game focuses on end-consumer sales of consumer goods marketed through retail distribution. The game makes no effort to simulate the manufacturer-retailer sales transaction, where individual pricing might be a possibility under some conditions.

2. Consumers can be assumed to have some knowledge of the monetary value of the products, based on past pricing practices and trends for products offering different option.

3. One can assume that price will have a significant impact on demand, since student teams compete directly with each other in each of the three market with products that are only moderately differentiated at best. This should create inevitable price competition.

4. In the first period of play, there is virtually no way for teams to develop information regarding the relationship between price and quantity.

5. While there are close substitutes available against which consumers might compare prices, there is no way for student teams to determine competitive prices in the first period.

6. While it is possible that some consumers might develop an unreasoned brand loyalty, the effect of this would be relatively small when compared to the kind of supplier loyalty that might be developed

when intense personal selling is the primary method of promotion. All three products are being distributed through impersonal mass distribution outlets.

The application of these six characteristics to the pricing model in Figure 1 suggests cost-plus pricing. The model does not, however, explain how to implement this strategy. Compete provides no information regarding the margin structure one might use to develop a cost-plus price.

The authors have addressed this issues elsewhere (Rashid, Cannon, and Morgan 1987), suggesting that cost-plus pricing problems can be divided into four basic types. These are illustrated in Table 1.
The framework in Table I assumes that margin information

Table 1
A Typology of Cost-Plus Pricing Situations

		Have access to competitive norms?	
		Yes	No
Have access to established company norms?	Yes	Type I	Type II
	No	Type III	Type IV

will generally come from established company and/or industry norms (Monroe and Della Bitta 1978). The first- - period pricing problem is clearly Type IV in nature, where neither company nor industry norms are available. In this case, the authors (Rashid, Cannon, and Morgan 1987) recommend a procedure for establishing norms based on very general cost and price information such as the retail price, retail margin, and company production costs that are provided in the game. Table 2 illustrates this approach.

The pricing model suggests that the student should set price in terms of a base margin and then adjust it upward or downward, according to the following formula:

$$P = (TC + BM)I_{i,j,k} \qquad (1)$$

Where P = price,

C = total cost,

BM = base margin, and

$I_{i,j,k}$ = index for adjusting the value of the base price to reflect different pricing/volume decisions, with

i = subscript denoting the cost structure of the company (fixed versus variable cost intensive),

j = subscript denoting the relative expected volume of company sales (high, medium, or low), and

k = subscript denoting company's pricing policy (premium, parity, or lowball).

Note that cost structure, sales volume, and pricing strategy are all controllable to some extent. The cost structure is generally determined by the nature of the industry. So firms in the highly automated electronics manufacturing industry will tend to be fixed cost intensive, while a labor intensive service company will be variable cost intensive (Abratt and Pitt 1985). Nevertheless, an electronics firm may become variable cost intensive by subcontracting and/or leasing the equipment while a labor intensive service firm can become fixed cost intensive by moving to fixed price labor contracts and by becoming involved in standardized, machine-supported service procedures.

In the context of Table 2, relative volume is primarily a strategy variable; hence, a firm may choose to address the mass market as a leader or challenger (high volume strategy), be an industry follower (medium volume strategy), or become a niche marketer.

ADAPTING THE MODEL TO COMPETE

In order to utilize the model in Table 2, the parameters in formula 1 must be estimated. Since most students utilize the student manual to develop ideas about the margin that will prevail in their industry, this margin can be considered as the weighted average or base margin. The Compete industry has a variable intensive cost structure. The next task, therefore, is to modify the base margin to determine a company's pricing policy and volume decision.

The pricing strategy can be viewed as a function of competitive product quality and stage of the product life cycle. A set of rules which govern the general relationship between price-quality and life-cycle are

Table 2
A Model for Adjusting the Base Margin

Pricing Strategy	Fixed Cost Intensive			Variable Cost Intensive		
	low volume	medium volume	high volume	low volume	medium volume	high volume
Premium Pricing	very high adjustment 1	high adjustment 2	neutral adjustment 3	high adjustment 4	moderately high adjustment 5	moderately high adjustment 6
Middle of the Road Pricing	high adjustment 7	neutral adjustment 8	moderately low adjustment 9	moderately high adjustment 10	neutral adjustment 11	moderately low adjustment 12
Lowball Pricing	moderately high adjustment 13	moderately low adjustment 14	very low adjustment 15	neutral adjustment 16	moderately low adjustment 17	low adjustment 18

presented in Table 3.

Table 3
A Model for Deciding Pricing Strategy

Stage of Product Life Cycle	Competitive Product Quality		
	High	Parity	Low
Introduction	premium pricing 1	premium pricing 2	middle of the road pricing 3
Growth	premium pricing 4	premium pricing 5	middle of the road pricing 6
Maturity	middle of the road pricing 7	middle of the road pricing 8	lowball pricing 9
Decline	middle of the road pricing 10	lowball pricing 11	lowball pricing 12

Students' strategy plays a critical role at this point. The effectiveness of any specific price will be influenced by the nature of every variable in the game, certainly including product quality, advertising/ promotion, and salesforce effort. Thus, while price and volume may be inversely related, high volume and a premium price may be combined in conjunction with a strategy that includes high levels of product quality, advertising/promotion, and salesforce effort.

In Table 3 high product quality also presumes high promotional support. Parity and low quality generally call for lower promotional budgets, except in the case of products in the introductory stage and low quality products using a "penetration pricing" strategy during the growth stage of product life cycle ("lowball" price in cell 6 of Table 3), where a company might use promotion to deliver its pricing message.

The rationale underlying the model shown in Table 3 is as follows: A high-quality strategy (high product quality combined with high quality-oriented promotion, as depicted in cells 1, 4, 7, and 10) always calls for a premium price relative to that of the competition. As the category matures in its product life cycle, however, competitive pressures could be expected to drive the price down from premium to "middle of the road" levels.

In the introductory stage of the product life cycle, a parity producer can generally charge a premium price and will tend to do so in order to recover development and introductory marketing costs very quickly. A premium price is possible because there are so few competitors and consumers are so relatively ignorant of brand characteristics. As the category matures, however, consumers become aware of product differences and drive the price down relative to higher quality products.

A company with a low quality product may charge a premium price during the introductory stage of the life cycle, based on the same logic discussed for a parity product. On the other hand, the firm may choose to penetrate the market by charging a lower price. The model characterizes this as

middle of the road because the price will still be relatively higher than the lowball price charged as the market enlarges and competitive pressures increase.

Additional insight can now be learned by returning to Table 2. Since the Compete industry is variable cost intensive, the margin adjustment can vary from low (cell 18) to high (cell 4). Assuming that the lowest margin is established at the breakeven price level (with fixed costs apportioned across a volume that represents an equal division of industry sales across competing firms), the low margin for all three products would be 12%.

The base margin is 35% ($310/$890) for large-scale television, 42% ($80/$190) for home computer systems, and 44% ($18/$42) for weight control systems. Therefore, the lowest adjustment indices would be $I_{i, j, k}$ - 0.85 (1.12/1.35) for large-scale television,' 0.80 (1.12/1.42) for home computers, and 0.78 (1.12/1.44) for weight control systems.

The highest adjustment level is $I_{i, j, k}$ - 1.60. The adjustment multiple has been derived intuitively by studying prices in comparable industries. For instance, in the personal computer market, AST, can be considered as the base margin marketer. IBM personal computers, priced about 60% higher, can be considered as the high price competitive item, while generic clones sell for much less.

In the context of these minimum and maximum margins and Table 2, Table 4 provides adjustment multiples for large-scale television, given various pricing strategies and volume decision. Similarly, Table 5 contains adjustment multiples for home computer and weight control systems.

Table 4
Margin Adjustment Multiples for Price/Volume Decision (Large-Scale Television)

Volume Decision	Mkt. Share (Multiple)	Pricing Strategy (Multiple)		
		Lowball (0.92)	Middle of the Road (1.00)	Premium (1.26)
Low	under 13%/1.26	1.16	1.26	1.6
	13 to 15%/1.19	1.09	1.19	1.50
	16 to 17%/1.12	1.03	1.12	1.40
Medium	18 to 19%/1/06	0.98	1.06	1.34
	20 to 22%/1.00	0.92	1.00	1.26
	23 to 25%/0.98	0.90	0.98	1.23
High	26 to 29%/0.96	0.88	0.96	1.21
	30 to 31%/0.94	0.865	0.94	1.18
	32 to 35%/0.92	0.85	0.92	1.16

These margin adjustments assign equal importance to pricing strategy and volume decision. As discussed earlier, Table 3 provides the framework to determine which pricing policy is suitable, given the stage of the product life cycle and competitive product quality. The volume decision is determined by the tar-

Table 5
Margin Adjustment Multiples for Price/Volume Oecision
(Home Computer System/Weight Control System)

Volume Oecision	Mkt. Share (Multiple)	Pricing Strategy (Multiple)		
		Lowball (0.89)	Middle of the Road (1.00)	Premium (1.26)
Low	under 13%/1.26	1.12	1.26	1.60
	13 to 15%/1.19	1.06	1.19	1.50
	16 to 17%/1.12	1.00	1.12	1.40
Medium	18 to 19%/1/06	0.94	1.06	1.34
	20 to 22%/1.00	0.89	1.00	1.26
	23 to 25%/0.97	0.86	0.97	1.22
High	26 to 29%/0.94	0.84	0.94	1.18
	30 to 31%/0.91	0.81	0.91	1.15
	32 to 35%/0.89	0.80	0.89	1.12

geted market share of the individual firm. This table assumes five companies in a Compete industry. If a company decides to strive for 20% of the market with a middle of the road pricing policy, the margin adjustment multiple is 1.00, which means no adjustment.

If the idea is to attain this level of market share via a premium pricing policy, the margin adjustment multiple should be 1.26. With this high margin, the company will be able to support this level of market share through a greater promotional budget. The margin adjustment for high volume and premium pricing is moderately high (1,16 to 1.21 for large-scale television), which is consistent with Table 2 (cell 6). In a similar fashion, other adjustment multiples corresponding to the adjustments described in Table 2 can be derived. Thus, when a middle of the road pricing strategy is adopted along with medium volume, margin adjustment should be neutral (from 0.98 to 1.06 for targeted market shares of 25% or less down to 18%). Unless the students know the price elasticities of products, these margin adjustments will be arbitrary. They will, however, provide good initial estimates for students to "Compete" more effectively.

REFERENCES

Abratt, Russell and Leyland F. Pitt (1985), "Pricing Practices in Two Industries," Industrial Marketing Management, 14 (November), 301-306.

Alpert, Mark I. (1971), Pricing Decisions, Glenview, IL: Scott-Foresman.

Cannon, Hugh M. and Fred W. Morgan (1987), "A Normative Approach for Pricing Decision-Making," Proceedings, Southern Marketing Association, 37-41.

Faria, A. J., R. 0. Nulsen, Jr., and D. S. Roussos (1984), Compete: A Dynamic Marketing Simulation (3rd ed.), Plano, TX: Business Publications.

Kotler, Philip (1984), Marketing Management: Analysis, Planning, and Control (5th ed.), Englewood Cliffs, NJ: Prentice-Hall.

Levin, Irwin P. and Richard 0. Johnson (1984), "Estimating Price-Quality Tradeoffs Using Comparative Judgment," Journal of Consumer Research, 11 (June), 593-600.

Monroe, Kent B. and Albert J. Della Bitta (1978), "Models for Pricing Decisions," Journal of Marketing Research, 15 (August), 413-428.

Rashid, Amir, Hugh M. Cannon, and Fred W. Morgan (1987), "Developing a Pricing Decision Model for a Low-Information Environment," unpublished working paper, Wayne State University.

Rich, Stuart U. (1983), "Price Leadership in the Paper Industry," Industrial Marketing Management, 12 (April), 101-104.

Schill, Ronald L. (1985), "Managing Risk in Contract Pricing with Multiple Incentives," Industrial Marketing Management, 14 (February), 1-16.

Shoemaker, Robert W. (1986), "comment on 'Dynamics of Price Elasticity and Brand Life Cycles: An Empirical Study," Journal of Marketing Research, 23 (February), 78-82.