Perceptual Position and Competitive Brand Strategy

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Abstract

This paper analyzes competition between two brands in a two-dimensional perceptual space in which buyer tastes differ and brands compete with all elements of the marketing mix. We investigate how optimal competitive brand strategies and profits depend on the perceptual positions of both brands, and how brands can reposition to increase profits.

Assuming that brand positions can be represented by locations in two dimensions, buyer preferences can be summarized by individual-level ideal points, and buyers maximize utility, we show that in general

- Brands positioned close to the mode of consumer preferences or far from the competitor optimally price higher, spend more on advertising and distribution, and earn greater profit than less distinctly or less well positioned rivals.
- The optimal repositioning strategy depends on whether brands compete most intensely on product positions, promotional spending, or prices. Repositioning towards the mode of consumer preferences is optimal regardless of competitive reaction, if product positioning or promotional competition is intense. If price competition is intense, brands optimally reposition toward different rather than similar positions.

Suggestions are given for extending the analysis theoretically and for using it as a basis for empirical decision models.

1. INTRODUCTION

Formulating competitive brand strategy is an important problem for marketing managers. Designing successful strategies requires an understanding of buyer perceptions and competitive reaction. Optimal prices, advertising and distribution spending all depend importantly on brands' perceived positions. The relative positioning of Coke and Pepsi in the soft-drink market, for example, significantly influences both brands' promotional strategies and profits. Moreover, brands' repositioning incentives also depend heavily on buyer perceptions and competition. Ignoring either buyer or competitive reaction can produce spectacular failures, such as Frontier Airlines' recent repositioning as a "no frills" carrier (which led to an intense price war, a shift of profitable business travelers to competitors, and ultimately losses rather than gains in profit for Frontier).

Examining how optimal brand strategies and profits depend on buyer perceptions and competition is the purpose of this paper. More specifcally, we consider two established brands competing with the full marketing mix in a perceptual space like Figure 1. For both brands, we analyze two fundamental and related strategic marketing questions:

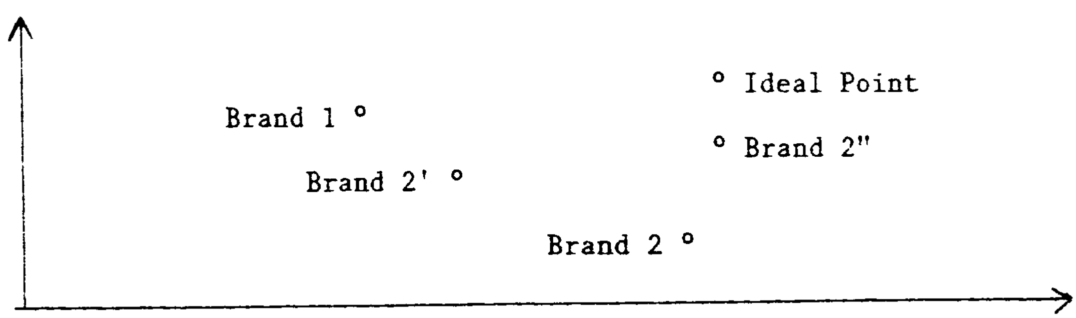

Figure 1. Hypothetical perceptual map for brands 1 and 2, with one position for brand 1 and three alternative positions for brand 2.

First, how do brands' optimal competitive marketing mixes and profits depend on the positioning of brands? Others have considered similar questions for competition between one established brand and one new entrant (Hauser and Shugan 1983; Kumar and Sundarshan 1985), or between two brands that compete intensely on price (e.g., Economidies 1981; Moorthy 1983). These analyses produce important insights, such as how entry of a new brand affects the defending brand's price and how similar brand positions can lead to price-cutting and low profits. However, the generalizability of these results to other competitive situations is problematic. For example, do similar brand positions lead to price-cutting and low profits if brands comppete with the full marketing mix and advertising (rather than price) competition is intense?

We analyze this and related questions by examining optimal strategies and profits for two established brands competing with the full marketing mix in a perceptual space like Figure 1. We derive how optimal brand strategies and profits depend on brand positions in a variety of competitive situations, such as intense advertising or price competition. For example, we show that similar brand positions for brands 1 and 2 in Figure 1 always leads to low prices, but not necessarily to low profits, and we otuline those conditions. This and similar results yield important new managerial insights, in addition to generalizing previous findings to markets in which brands compete with the full marketing mix.

Second, we examine how brands can reposition to increase profits and, if they do, how optimal competitive strategies and profits change. For instance, is it profitable for brand 2 to move close to the ideal point if brand 1 changes its marketing mix, repositions, or both?

Competitive positioning has been examined extensively beginning with Hotelling (1929), who examined competition between two brands differentiated by a single attribute, such as location on a street. Hotelling claimed that at equilibrium brands locate next to each other. This so-called Principle of Minimum Differentiation became widely cited as the reason for the similarity of brands in many markets. Despite the principle's tremendous intuitive appeal, it was shown to be invalid as a general rule (d'Aspremont, Gabszewicz, and Thisse 1979). When prices are fixed and brands compete only on positions, competition still produces minimum differentiation; but when brands compete on both prices and positions, price-cutting becomes lucrative which produces instability rather than equilibrium and invalidates Hotelling's principle.

Recent analyses of this problem show that optimal positions do exist for product and price competition, but in a dramatically different configuration from Hotelling's: Positioning in distinct segments or even maximally different segments is optimal. This Principle of Maximum Differentiation as some call it is surprisingly robust; it can be obtained with a variety of models including a modification of Hotelling's finite ideal point model (e.g., Economidies 1981), a "quality" or infinite ideal point model (e.g., Moorthy 1983), or the DEFENDER consumer model (Hauser 1985). These studies suggest that positioning brands in isolated segments minimizes price-cutting and thus maximizes profits. The hub-and-spoke routing system in the airline industry is one example of such segmentation; by locating hubs in different cities (e.g., American in Dallas, Delta in Atlanta), airlines segment air travelers and thus avoid additional pressure to lower fares.

The robustness of this new principle raises an intriguing question, however. If maximum differentiation is optimal in a wide variety of cases, why do we observe minimum differentiation in so many markets? Even in the intensely price-competitive airline industry, multiple carriers operating from the same hub, like Delta and Eastern Airlines in Atlanta, schedule and price flights identically on overlapping routes. Why, if they clearly understand the benefits of segmentation, do they compete head-to-head? Said more generally, what produces minimum differentiation in some cases but maximum differentiation in others?

Our analysis reveals the market and competitive conditions under which minimum versus maximum differentiation is optimal as a repositioning strategy. We derive the optimal repositioning strategy in each of the competitive situations considered. In doing so, we show that minimum differentiation can be optimal even if brands compete on price and even if brands anticipate the competitor's reaction and the profit implications of such a policy. This is a surprising result, given that maximal differentiation is widely regarded as the optimal policy under such conditions. Nevertheless, it is intuitively appealing. Furthermore, we show the conditions under which maximal differentiation is optimal, and how previous results are special cases of our model.

We begin our analysis in the following section by constructing a model of consumer response. Based on that, we build a model of optimal competitive brand strategy in Section 3. Sections 4 and 5 use this model to show how optimal competitive marketing mix levels and profits depend on brand positions. We next apply those results in Sections 6 and 7 to outline optimal repositioning policies. We conclude with a discussion of extensions to the model and a summary of our results.

2. CONSUMER RESPONSE MODEL

Assumptions

Our model of consumer response rests on three assumptions about the dimensions of the space in which brands compete, the distribution of consumer tastes over that space, and the rules buyers use in brand choice.

A1. Buyer perceptions of both brands can be represented by positions in two-dimensional space.

A2. Buyer preferences can be summarized by individual-level ideal points that are unimodally and symmetrically distributed over the perceptual space; the distribution is assumed to be increasing toward the mode.

A3. Buyers choose brands to maximize utility, which depends on a brand's distance from the buyer's ideal point, its price and promotional expenditure, and a random component; if no brand is sufficiently close to the buyer's ideal point (based on a reservation distance), no brand is chosen.

A1 through A3 are well accepted, empirically-supported assumptions. Two dimensional brand representations are common in marketing (e.g., Urban and Hauser 1980; Wind 1982), as is assuming a distribution of ideal points over such a space (e.g., Cooper 1983). Our restrictions on the shape of that distribution imply that one most frequently preferred attribute combination exists, which we call simply the ideal point, and that the number of buyers preferring brands a fixed distance from the ideal point is equal in any direction. These conditions simplify our analysis considerably and focus it on markets with such taste distributions or on portions of multi-segment markets. Even so, some of our results apply to these other markets; see Section 8. Finally, A3 incorporates an element of sequential or hierarchical choice into our model, consistent with studies of market structure (e.g., Urban, Johnson and Hauser 1984) and with studies suggesting that closely positioned brands compete intensely (e.g., Wind and Robinson 1972). Section 8 describes how relaxing these assumptions may affect our results.

Model Formulation

Let x and y be the two dimensions buyers use to evaluate brands. Define $\ell_i = (x_i, y_i)$ as the location or position of brand i and $s_i = (p_i, m_i)$ as its strategy consisting of a price, p_i, and advertising and distribution outlay, m_i. Let I_n (n = 1,2,...,N) be individual n's ideal point. These ideal points are distributed throughout the space according to f(·), which has mode I. Utility for buyer n of brand i is denoted $u_{in} = v_{in}(s_i, D_{in}) + e_{in}$ where v_{in} is the deterministic component of utility that increases in m_i and decreases in p_i and D_{in}, the distance between ℓ_i and I_n; and e_{in} is a random variable, which is assumed to be small relative to v_{in} (cf. Guadagni and Little 1983).

The probability that buyer n chooses brand i, θ_{in}, is then simply

$$\theta_{in} = \begin{cases} 1 & \text{for } D_{in} \leqq D_{min},\ D_{jn} > D_{min} \\ \text{Prob}\,[u_{in} > u_{jn}] & \text{for } D_{in} \leqq D_{jn} \leqq D_{min} \\ 0 & \text{for } D_{in} > D_{min} \end{cases} \qquad i,j = 1,2;\ i \neq j$$

where Prob [·] is a probability function, and D_{min} is the reservation distance. Among all buyers, brand i's share of total consumer choices is

$$\theta_i = (1/N) \sum_{n=1}^{N} \theta_{in} \qquad i = 1,2.$$

and sales for brand i are

$$q_i = Q\theta_i \qquad i = 1,2$$

where Q is total market potential.

For convenience, we assume in the remaining analysis that interactions between marketing mix elements in q_i are sufficiently small so they can be ignored. This requires that $\partial^2 q_i/\partial p_i \partial m_j = \partial^2 q_i/\partial m_i \partial p_j = 0$ (i,j = 1,2), which simplifies our analysis and, fortunately, does not exclude relationships between optimal prices and promotional expenditures. We leave exploration of these interactions as future work. See Section 8.

Model Properties

This sales response function has three important properties as shown in the Appendix (Lemma 1). First, sales for brand i are higher the closer brand i is to the mode of consumer preferences, I, other things equal. Closer to I, brand i serves more buyers because f(·) is increasing toward the mode, so that θ_i is correspondingly larger and so is q_i. Greater sales closer to the ideal point is well accepted as a generalization (e.g., Wind 1982).

Second, sales of brand i decrease the closer brand j is to brand i, even though utility for brand i does not depend on the distance between brands. Brand i competes for buyers whose ideal points surround its position. As brand j moves closer to i's position, the utility of brand j increases for some brand i buyers, because brand j is now closer to their ideal points. As a result, brand j wins some of brand i's customers and thus reduces brand i's sales. This implies that total market volume depends on the positioning of brands; distinctly positioned brands serve different buyers, so total volume is large when brands compete in different segments, all else equal.

Third, brand i's sales increase as its promotional outlay or increases or as brand j's decreases. Promotional expenditures increase utility by attaching to brands other intangible features buyers value such as images or moods. Greater spending increases a brand's relative attractiveness and hence its sales, but leaves brand positions unaffected. We consider promotional spending devoted to brand repositioning separately in Section 6. Additionally, brand i's sales decline as its price rises and brand j's price falls.

Given these three properties, we can rewrite q_i conveniently as

$$q_i = q_i(s,D) \quad i = 1,2$$

where $s = (p_1,m_2,p_2,m_2)$ is the vector of brands' strategies, and $D = D(\ell) = (D_{1I},D_{2I},D_{12})$ is the vector of distances between brand i and I, $D_{iI}(i=1,2)$, and between brands, D_{12}, and $\ell = (\ell_1,\ell_2,I)$ is the vector of brand and ideal-point locations.

3. OPTIMAL COMPETITIVE BRAND STRATEGY

Based on this consumer response model, we next construct a profit function for each brand. Profits for each brand are simply

$$\Pi_i = (p_i - c)q_i(s,D(\ell)) - m_i, \qquad i = 1,2 \tag{1}$$

where Π_i is brand i's profit and c is unit costs assumed fixed and equal for both brands. Equation (1) is assumed to have the following properties:[1]

A4. $\Pi_{m_i m_i}(\Pi_{p_i m_j} - \Pi_{p_i p_j}) < \Delta_{ii}$ and $\Pi_{m_i p_i}(\Pi_{p_i p_j} - \Pi_{p_i m_j})$ $< \Delta_{ii}$, where $\Delta_{ii} = (\Pi_{p_i p_i}\Pi_{m_i m_i} - \Pi_{p_i m_i})$, and

$\Pi_{m_i m_i} > (\Pi_{p_i m_i}\Pi_{p_j p_i}/\Pi_{p_j p_i})$ $(i,j = 1,2;\ i \neq j)$.

A4 simply requires that Π_i be concave in brand i's marketing mix. This is true if q_i is concave, if firms operate in the concave position of q_i, or if non-concave q_i (e.g, S-shaped) can be approximated by concave ones (as Lodish 1971 does for example). Empirical evidence suggests that concave response functions are reasonable and useful approximations (e.g., Hauser and Shugan 1983; Naert and Leeflang 1978). In addition, A4 requires that brand i's marketing mix has a greater impact on brand i's sales and profits than does brand j's marketing mix. This is consistent with econometric evidence showing significant but small competitive sales response coefficients (e.g., Carpenter, Cooper, Haussens, and Midgley 1984). This assumption effectively bounds the size of cross-price and -promotional elasticities and thus limits the scope of our analysis. Relaxing A4 and expanding the focus of our inquiry remains important future work.

Brands compete for profits in a two-stage game. Initially, product positions are fixed and brands noncooperatively select Nash equilibrium strategies to maximize current profits. Next, brands reposition, anticipating the changes in strategies and profits associated with repositioning. This framework yields a perfect-pure-price/promotion-position equilibrium. See Friedman (1977) and Moorthy (1985) for a discussion of this and related equilibrium concepts.

To maximize profits given product positions brands select prices and promotional expenditures so that

$$\partial\Pi_i/\partial p_i = \partial\Pi_i/\partial m_i = 0, \qquad i = 1,2$$

given $D(\ell)$.[2] When this condition holds, neither brand can by itself earn more profit with an alternative strategy. The pricing and promotional spending rules that generate the Nash-equilibrium price-promotion vector satisfying these conditions, s^*, are our first result:[3]

PROPOSITION 1. The unique optimal competitive price-promotion strategy given positions for each brand under A1 through A4 is

$$p_i^* = c\eta_i^*(1 + \eta_i^*)^{-1}, \qquad i = 1,2 \tag{2}$$

$$m_i^* = (p_i^* - c)q_i^*\mu_i^*, \qquad i = 1,2 \tag{3}$$

where p_i^* is the optimal price for brand i, η_i^* is its price-sales elasticity evaluated at s^*, m_i^* is brand i's optimal promotional outlay, $q_i^* = q_i\ (s^*,D)$, and μ_i^* is brand i's promotion-sales elasticity evaluated at s^*.

Proposition 1 demonstrates the existence, characterization, and uniqueness of optimal (Nash equilibrium) prices and promotional levels given brand positions. Existence alone is not trivial in this case. As discussed earlier, the nonexistence of equilibrium strategies in the Hotelling model prompted much of the recent research. Our result shows that for finite price elasticities, prices remain above marginal costs; and for positive costs, prices remain positive. Similarly, promotion levels remain positive so long as margins, sales, and the promotional-sales elasticity are positive. The form of equations (2) and (3) also shows that Proposition 1 generalizes the well-known Dorfman-Steiner (1954) theorem to include competition and buyer perceptions.[4]

The remaining analysis is based on one important feature of (2) and (3). Both define the optimal strategy, s^*, implicitly in terms of brand positions; that is, $s^* = s^*(\ell)$. This enables us to derive how brand strategies depend on the configuration of brands in perceptual space. For example, we can derive how the distance between a brand and the ideal point, D_{1I} for example, affects brand 1's strategy as well as brand 2's. Furthermore, using it we can show how profits change with these differences in strategies resulting from different brand locations. We exploit this property extensively to derive how brand strategies, profits, and incentives for repositioning depend on brand positions.

4. DISTANCE FROM THE IDEAL POINT

Consider first the distance between a brand and the ideal point, as given in Figure 2, our hypothetical product market for brands 1 and 2. Figure 2 shows brand 2's position and two alternative positions for brand 1, both of which are equidistant from brand 2's location but one is closer to the ideal point. What is the difference in the optimal brand strategies for both brands given these alternative positions for brand 1?

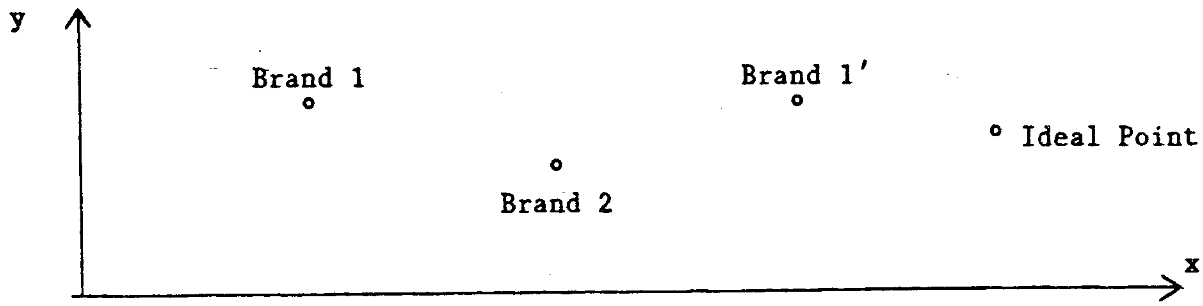

Figure 2. Hypothetical perceptual map for brands 1 and 2 with two alternative locations for brand 1.

Brand One

The optimal price and promotional outlay for each brand depends on Brand 1's position given the implicit definition of s*. For Brand 1, the optimal price and promotional outlay differ as formally stated in Propositions 2 and 3.

PROPOSITION 2. The optimal competitive price is higher the closer a brand is to the ideal point.

Intuitively, Proposition 2 says that the more preferred a product -- the more ideal its perceptual location -- the higher its optimal competitive price. Being closer to the ideal point implies higher sales, lower values for the price-sales elasticity because sales are higher and, consequently, higher prices. Evidently, gaining a perceptual advantage relative to a competitor supports a higher price.

PROPOSITION 3. The optimal competitive advertising and distribution expenditure is higher the closer a brand is to the ideal point.

Intuitively, Proposition 3 suggests that the greater a brand's perceptual advantage, the more one should promote it. Being closer to the ideal point leads to higher sales (a larger q_i^*) and thus a larger incentive to promote. See equation (3). Thus, more preferred brands optimally advertise and distribute more aggressively.[5] Proposition 3 also implies that a brand's optimal promotional spending depends explicitly on its perceptual location, even if perceptions and advertising and distribution affect sales independently.

Brand Two

Brand 2's strategy also depends on brand 1's distance from the ideal point.

PROPOSITION 4. The optimal competitive price is lower the closer a competitor is to the ideal point.

The intuition of Proposition 4 is quite simple. When brand 1 is located closer to the ideal point more buyers prefer it; its sales are higher and brand 2 is at a perceptual disadvantage. As a result brand 2's price sensitivity is greater and so, to attract buyers, it must charge a lower price. Therefore, maintaining a lower price is competitively optimal if a competitor maintains a superior perceptual location, other things equal.

PROPOSITION 5. The optimal competitive advertising and distribution outlay is lower the closer a competitor is to the ideal point.

Though at first glance Proposition 5 may seem counterintuitive, it is indeed quite logical -- especially given Proposition 3. The closer brand 1 is to the ideal point, the greater its incentive to spend on advertising and distribution. It maintains a more advantageous perceptual location. Correspondingly, brand 2 is at a relative disadvantage so that its promotional effectiveness and consequently its optimal expenditure on advertising and distribution is lower. Less well positioned, it should promote less aggressively. This suggests that the effectiveness of promotional expenditures (and consequently the optimal outlay) depends on the location of <u>both</u> brands in perceptual space, even if perceptual position and advertising and distribution spending affect sales independently. Evidently, the effectiveness of promotion decreases if a competitor gains a superior perceptual location.[6]

<u>Profits</u>

Profits for brand 1 depend on its distance from the ideal point and on the basis of competition between brands. If brands compete principally on price, then brand 1's profits <u>decline</u> the closer it is to the ideal point. Closer to the ideal point, brand 1 sells more, but brand 2's price will be lower, reducing brand 1's sales and profits.

If sales and profits respond largely to promotion and product positioning[7], a more intuitive finding results that is summarized as Proposition 6.

PROPOSITION 6. Profits for a brand increase the closer it is to the ideal point if brands compete principally on product positions and promotional expenditures.

The intuition behind Proposition 6 is simple: If promotional and positioning competition is intense, brand 1 will have higher sales when it is closer to the ideal point, boosting its profits. It will also promote more heavily (Proposition 3) as brand 2 promotes less (Proposition 5) leading to still greater sales for brand 1. Combined with the larger sales due to positioning and the effect of promotion, profits for brand 1 are unambiguously higher.

Being closer to the ideal point is an often sought goal. Proposition 6 demonstrates that it is indeed optimal, but only if price competition is limited. If sales and profits are highly sensitive to prices, the benefits of an apparently more desirable perceptual position can be more elusive than real.[8]

The profits of brand 2 also depend on brand 1's distance from the ideal point. Under intense non-price competition, the difference in brand 2's profits as given in Proposition 7 are determined by the differences in brand 1's strategy.

PROPOSITION 7. Profits for a brand decrease the closer a competitor is to the ideal point if brands compete principally on promotional expenditures and brand positions.

The lower profits for brand 2 are a logical outcome of the differences in brand 1's strategy. Brand 1 advertises and distributes more aggressively when it is closer to the ideal point; that reduces brand 2's sales and consequently its profits. Thus brand 2's sales and profits fall even if it optimally readjusts its price and promotional expenditures, which demonstrates important limits to changes in strategies.

Summary

Taken together, Propositions 2 through 7, summarized in Table 1, provide important insights for a theory of competitive brand management and for managing brands competitively. Higher prices, higher promotional spending, and larger profits result from being closer to the ideal point when price competition is limited. A competitor further from the ideal point optimally prices lower, promotes less aggressively, and earns lower profits. Thus, achieving a perceptual advantage may yield a competitive advantage that is both costly and difficult to duplicate. But more fundamentally the effectiveness and success of a brand's strategy depends on the perceptual location and strategy of its rival. A previously successful strategy can become unprofitable if one's rival gains a perceptual advantage.

5. DISTANCE BETWEEN COMPETITORS

Consider, next, the distance between brands in perceptual space. To illustrate the discussion, see Figure 3, our hypothetical perceptual space. Figure 3 shows one position for brand 1 and two alternative locations for brand 2, both equidistant from the ideal point, but one closer to brand 1 than the other. How does the distance between brand 1 and brand 2 affect p_i^* and m_i^* $(i = 1,2)$ and the profits both earn?

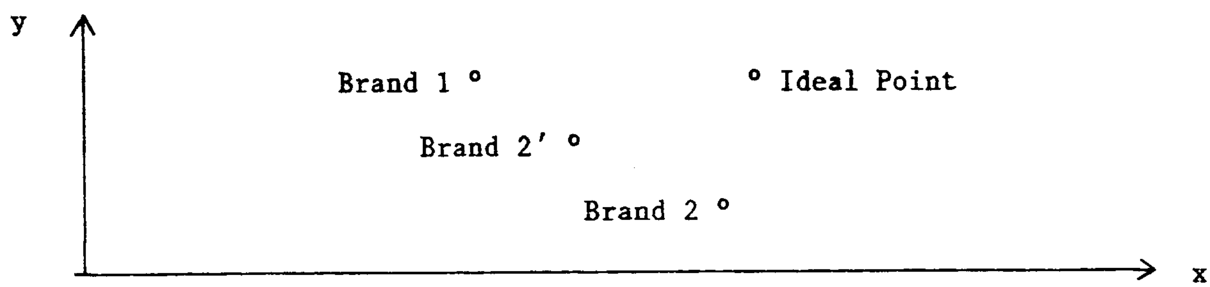

Figure 3. Hypothetical perceptual map for brands 1 and 2 with two alternative locations for brand 2.

Pricing

Optimal prices for both brands depend on the distance between them given the definition of s^*. Not surprisingly, we have a similar result for both brands.

PROPOSITION 8. Optimal competitive prices for both brands are lower the more closely brands are positioned in perceptual space.

The logic behind Proposition 8 is quite simple. The closer two brands, the less differentiated they are; both occupy a less unique position, thus both compete more intensely. Brands are perceived to be more alike, buyers for both are more price sensitive, and thus optimal competitive prices are lower.

Advertising and Distribution

PROPOSITION 9. Optimal competitive advertising and distribution expenditures for both brands are lower the more closely brands are positioned in perceptual space.

Intuitively, Proposition 9 suggests that when two brands occupy indistinct perceptual positions, they are undifferentiated, have little incentive to promote, so the optimal promotion outlay for both is lower. Apparently, the more distinct a brand, the greater the incentive to promote it.

Profits

Profits for brand 1 depend on brand 2's position and on the basis of competition between the two brands. If both compete principally based on advertising and distribution, and if brand 2 adopts a less distinct position, it will promote less aggressively and increase brand 1's sales and consequently its profits, all else equal. On the other hand, if both compete based on price or perceptual location, brand 1's profits will be lower if brand 2 adopts the closer position because sales of both are lower, and prices are lower which means still lower profits. Both effects reduce profits. A similar result is obtained for brand 2. Together these results are Proposition 10.

PROPOSITION 10. Profits of both brands are lower the closer brands are positioned if they compete principally based on price or product location, but higher if brands compete intensely on promotional expenditures.

Intuitively, Proposition 10 says that more differentiated brands earn higher profits when price or positioning competition is intense, other things equal, which is consistent with previous analyses of spatial competition. But, in contrast, Proposition 10 shows that promotional competition may fundamentally change the nature of competition. Brands have an incentive to adopt similar, not differentiated, positions if promotional competition is intense. This result has important implications for competitive brand repositioning strategy.

6. COMPETITIVE BRAND REPOSITIONING

Repositioning a brand towards the ideal point is an often pursued strategy. Indeed, we have shown that profits increase as a brand moves closer to the ideal point if price competition is limited, assuming that the competitor does not also reposition. But if a rival responds -- possibly optimally including repositioning -- does repositioning towards the ideal point remain lucrative?

To analyze this question we now consider stage two of the competitive game in which brands consider repositioning to increase profits, anticipating the new equilibrium strategies they must play, their competitor will play, and the associated profit. Figure 4 illustrates the discussion and the competitive repositioning problem faced by both brands. Suppose for discussion that brands 1 and 2 are currently located some distance from the ideal point, but can reposition closer to the ideal point at some fixed cost.[9] First, consider the decision of brand 1. Should it reposition given that brand 2 will respond optimally -- including possibly repositioning?

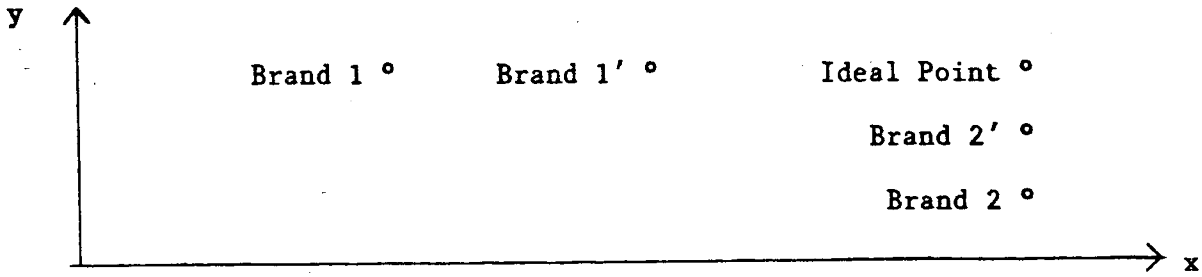

Figure 4. Hypothetical perceptual map for brands 1 and 2 with two possible perceptual positions for brand 1 and for brand 2.

Positioning and Promotional Competition

When brands compete principally on product position and promotional expenditures the repositioning problem produces an interesting situation for both brands much like the Prisoner's Dilemma. If brand 1 advances toward the ideal point and both brands optimally readjust strategies, brand 1's profits will increase and brand 2's will decrease because brand 1 now has a perceptual advantage (see Propositions 6 and 7). If brand 1 remains distant and brand 2 advances toward the ideal point, then brand 2 will prosper at the expense of brand 1. If both reposition towards the ideal point, both may suffer because they are closer together (Proposition 10) even though both are closer to the ideal point.

This dilemma has a simple solution. Consider brand 1 in our hypothetical example. If brand 1 repositions and brand 2 does not, brand 2 will cut price and advertising spending, but brand 1's gain in sales from repositioning will exceed lost sales due to brand 2's price cut because price competition is limited. Thus, brand 1's profits increase as it moves closer to the ideal point. But if brand 2 repositions, brand 1's profits still increase in the direction of the ideal point; hence repositioning is still optimal. Thus, regardless of the position brand 2 selects, brand 1 should move toward the ideal point. Brand 2 has precisely the same incentives, so moving toward the ideal point is always competitively optimal for it as well. Therefore, repositioning towards the ideal point is competitively optimal for both brands, even if total profits are higher when both brands are more distinctly positioned. This is Proposition 11:

PROPOSITION 11. Repositioning towards the ideal point is competitively optimal for both brands when price competition is limited, even if total profits for both brands are higher at different positions.

Proposition 11 suggests that rivalry compels brands into head-to-head competition in markets with intense non-price competition, limited price competition, and unimodally distributed ideal points. Brands face strong incentives, whatever the actions of other brands, to move towards the ideal point and more intense competition. Brands which resist this compulsion are placed at a competitive disadvantage; profits are lower or possibly negative. A brand must reposition and join what may well be vicious competition to avoid these costs. Failing to do so may produce a shake-out candidate from a formerly profitable and successful brands.

This result also shows that Hotelling's Principle of Minimum Differentiation is valid in markets in which brands compete with all elements of the marketing mix, so long as price competition is limited and preferences are unimodal. And recall that "limited price competition" means only that price elasticities are small relative to positioning and promotion elasticities. Price elasticities can still be large in an absolute sense, and buyers can still be price-sensitive, so long as they are more sensitive to positioning and promotion. Under these conditions, brands converge toward the ideal point, even if they foresee the price cutting that may result. Competition compels them to adopt similar positions in much the same way defect-defect is an equilibrium in the Prisoner's Dilemma. Furthermore, once brands converge to the ideal point, neither has any incentive to unilaterally move away. Profits decrease in that direction. Thus, unlike the instability in Hotelling's model, minimum differentiation is an equilibrium in this case.

The shape of the preference function and the intensity of competition on advertising and distribution spending play important roles in this result. By virtue of its unimodal shape, the distribution of ideal points yields a large number of buyers to brands that locate close to its mode. If the distribution increases sufficiently fast as one approaches the mode, gains from increased sales can offset losses due to encroaching on a competitor's position and price cuts. Intense advertising and distribution competition also provide an added incentive for brand convergence. In the extreme case where promotional competition dominates both positioning and price competition, profits for both brands increase as either moves toward the ideal point <u>or</u> towards the competitor (Propositions 6 and 10). In this way, promotional competition reduces the cost of adopting similar product positions. Including both unimodally distributed ideal points and promotional competition thus fundamentally affects brands' repositioning incentives and leads to a stable minimum differentiation equilibrium.

<u>Price Competition</u>

Brands' repositioning incentives differ significantly if brands 1 and 2 compete more intensely on prices and less so on product positions and promotional outlays. Figure 4 once again illustrates this problem. If brand 1 repositions and brand 2 responds optimally by dropping its price (Proposition 4), brand 1's profits will be lower. If brand 2 repositions and brand 1 responds optimally, brand 2 will lose profits. If both advance toward the ideal point, optimal prices for both are lower because they are closer in perceptual space (Proposition 8), so their profits are lower. Therefore, neither brand has any incentive to reposition towards the ideal point. Remaining some distance from it, seeking a market niche,[10] is competitively optimal:

PROPOSITION 12. Seeking a market niche is competitively optimal if price competition is intense.

This result is consistent with other analyses in which brands adopt distinct or maximally different positions (e.g., Economidies 1981; Hauser 1985; Moorthy 1983). Price competition drives brands toward separate positions and thus results in segmented markets. These results and Proposition 12 are produced under a wide variety of assumptions, indicating that segmentation from price competition is robust to variations in the modeling assumptions, including our extentions to competition with all elements of the marketing mix.

7. RESPONSE TO COMPETITIVE REPOSITIONING

Many brands face a different repositioning problem, one posed by one brand advancing toward the perceptual position of another. This situation is illustrated in Figure 5 where brand 2 is advancing towards the location of brand 1. What is the best response of brand 1 to brand 2?

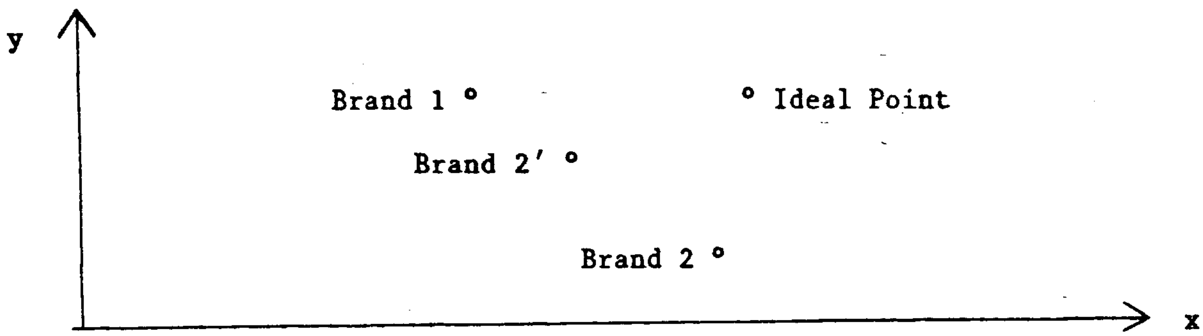

Figure 5. Hypothetical perceptual map for brands 1 and 2, with brand 2 repositioning toward brand 1.

Positioning and Promotional Competition

The optimal competitive response of brand 1 consists of three parts if competition is principally limited to product positions and promotional outlays: First, the optimal price and advertising and distribution spending for brand 1 are lower because brand 2 is closer to brand 1 and equidistant from the ideal point (Propositions 8 and 9). Brand 1 also earns less profit (Proposition 10). Second, profits for brand 1 increase as it moves away from brand 2 (Proposition 10) and toward the ideal point (Proposition 6). So repositioning toward the ideal point and away from brand 2 is optimal. Third, at its new location, brand 1's optimal prices and promotional levels are higher because it is both closer to the ideal point and further away from its rival (Propositions 2, 3, 8 and 9). Its profits are also greater than at its past location (Propositions 6 and 10), and brand 2's profits fall (Proposition 7). This repositioning strategy is Proposition 13:

PROPOSITION 13. When brands compete principally on promotion and perceptual position, and a competitor advances toward your perceptual position, repositioning towards the ideal point with an increase in price and promotional spending produces maximum profit increase.

Intuitively, Proposition 13 states that when a rival advances towards your perceptual location, repositioning to increase product differentiation and gain a perceptual advantage is optimal. By approaching your position and reducing your profits, the encroaching rival increases your incentive to move towards the ideal point. Capitalizing on this by repositioning towards the ideal point, and thus reducing your rival's profits, is optimal.

The first stage of this repositioning strategy is consistent with Hauser and Shugan's (1983) analysis of the optimal strategy for an established brand defending itself against a new entrant, but our analysis applies to two established brands and is more general. For an established brand defending itself against a new entrant, Hauser and Shugan (1983) show that the optimal response includes dropping price, reducing spending on advertising and distribution, and repositioning toward the brand's strength (away from the entrant). In doing so they assume market volume is fixed, perceptions are scaled by price, and the entrant does not react to the defensive strategy of the extant brand. Hauser (1985) relaxes the competitive reaction assumption and suggests that these results remain unchanged. Our analysis shows that, initially, dropping price, reducing advertising and distribution spending, and repositioning toward the ideal point are optimal for competition between two established brands even if market volume is variable, the reaction of the advancing brand is considered, and preferences are characterized by ideal points.

Proposition 13 also suggests that for two established brands the optimal post-repositioning marketing mix adjustment is quite different from this initial response. After moving closer to the ideal point, the defending brand maintains a competitive advantage over the advancing one. Its optimal price, promotional expense and, most important, its profit are all higher than at its pre-repositioning location. The advancing brand on the other hand is at a greater competitive disadvantage after repositioning; its rival is better positioned, and its price, promotional outlay, and profits are all optimally below pre-repositioning levels.

Price Competition

The optimal response to an advancing brand in terms of marketing mix readjustment and repositioning are significantly different if brands compete most intensely on price. Once again consider Figure 5. Brand 1's response consists of three parts. First, optimal prices, promotional outlays, and profits for both are lower because brand 2 is now closer to brand 1. Second, profits for brand 1 increase as it moves away from brand 2, as before, and away from the ideal point because price competition dominates. Therefore, repositioning away from brand 2 and away from the ideal point produces the greatest increase in profit. Third, brand 1 is further away from brand 2 at that new position so its optimal price, promotional expense, and profits are all higher. Brand 2's profits are also lower. This repositioning strategy is summarized as our final result:

PROPOSITION 14. Repositioning away from the advancing brand and from the ideal point is optimal when a competitor advances toward your position if brands compete principally on price. After repositioning, optimal prices, advertising and distribution spending, and profits are all higher.

Summary

Taken together, Propositions 11 through 14 show that the optimal repositioning strategy depends importantly on the basis of competition between brands. If product positions, advertising and distribution spending, or price is the principal competitive weapon, the optimal direction of repositioning and marketing mix adjustment are substantially different.

8. FUTURE WORK

Theoretical Extensions

Our analysis necessarily has focused on a relatively simple but rich problem. Considering more complex problems by relaxing our assumptions may provide even richer models and afford other relevant insights into a theory of competitive brand strategy. Four theoretical extensions appear especially attractive.

Multiple Rivals. Establishing the existence of equilibrium brand positions for more than two brands has met with mixed results (Eaton and Lipsey 1975). Recently, however, equilibria have been shown to exist for a variety of models for three or more brands (e.g., Economidies 1981; Hauser 1985). Preliminary analysis of our model suggests that the principle results remain unchanged when a third brand is included. Our fundamental result, Proposition 1, easily generalizes to n brands, suggesting the remaining results will too. However, confirming that conjecture remains future work.

Signals. Evidence and observation also suggest that in some cases buyer perception of brands may be influenced by the strategies brands select; buyers may use price and promotional levels as signals of the positioning of competing brands (e.g., Carpenter 1985; Moore and Winer 1984). Generalizing our analysis to capture these effects is important for building a comprehensive theory of brand strategy.

Multiple Products and Segments. Often markets consist of many segments where brands sell multiple products under a single brand name. Many of our results may apply to these cases, such as maximum differentiation, but important issues such as competition between products of the same brand cannot be considered. For example, is it optimal for a brand to position all its products around one segment's ideal point (a focus strategy), or is positioning across all segments with a broad product line competitively optimal? Examining these issues in more detail may reveal important insights for competitive product-line management.

Dynamics and Uncertainty. Dynamics and uncertainty can change the nature of competition in many markets in at least two important ways. First, in a dynamic version of our model both brands have an incentive to cooperate, to avoid intense price wars, and to segment the market rather than compete head-to-head. This cooperation may develop in repeated play of a static game if rivals are uncertain about the number of periods for which they will compete (Axelrod 1981), which suggests that maximum differentiation -- segmentation -- can arise from either price competition or cooperation. Second, brands may develop unique or repeated patterns of competitive behavior over time. Each may cultivate a reputation for a certain ability (such as low-cost production, innovativeness, or quick competitive duplication), or for a mode of competition (swift and sure competitive retaliation, for example), which add yet another dimension to competition. Brands have both an incentive to acquire them and, once acquired, to exploit them. Extending our analysis to include this dimension of competition, and to consider the emergence of cooperation among rivals, may provide important insights into the role of uncertainty and dynamics in competition and repositioning.

Empirical Application

Even without these extensions, our analysis can be applied empirically. Sales, price, advertising and perceptual data can be constructed from scanner data panels to estimate response functions (e.g., Carpenter and Lehmann 1985; Guadagni and Little 1983; Moore and Winer 1984). Using them, competitive strategy models can be estimated and solved, assuming cost data are available. (For such an application without perceptual data, see Carpenter, Cooper, Hanssens, and Midgley 1984.) Doing so would test the richness of our model by empirically evaluating Propositions 2 through 10. If sufficiently rich, our model may provide a basis for empirical decision models. Moreover, these tests may demonstrate empirically the importance of our insights for a theory of brand strategy and for managing established brands which compete in perceptual space.

9. SUMMARY

Buyers' perceptions affect optimal competitive pricing, promotional outlays, incentives to reposition, and profits for established brands. Our analysis investigates these relationships between perceptions, strategies, and profits. It produces four especially interesting insights.

1. Simple profit-maximizing competitive pricing and promotional spending rules given the positioning of brands in perceptual space exist for a large class of markets. We construct and solve a competitive marketing mix model where brands select prices and promotional expenditures subject to a configuration of product positions and considering a competitor's decision. Solving the model produces simple optimal competitive pricing and promotional-spending decision rules. Both decision rules express competitive brand strategy as a function of the rival's strategy and of buyer perceptions of both brands. These results generalize the Dorfman and Steiner (1954) theorem to include competition and buyers' perceptions.

2. Analysis of this model for markets in which brands principally compete based on product positions and promotional expenditures reveals two generalizations about the impact of perceptions on brand strategy and profits. First, the optimal competitive price, advertising and distribution expenditure, and profit are higher the closer a brand is to the ideal point. Brands with superior perceptual positions earn price-premiums, have greater incentive to promote, and earn higher profits. Second, optimal competitive prices, promotional outlays, and brand profits are lower the closer two brands are to one another or the closer a competitor is to the ideal point. Brands with either indistinct or inferior perceptual positions optimally price discount, have less incentive to promote, and earn lower profits.

3. Seeking a market niche -- a position of maximum differentiation -- is an optimal competitive strategy in markets with intense price competition. Competitive prices decrease as brands become more perceptually indistinct, and profits drop because of greater competition.

Attempts to reposition towards the ideal point and earn higher profits can be thwarted easily by competitive price cutting. Brands can consequently maintain profits by seeking differentiated market positions and by resisting the temptation of higher profits through repositioning.

4. Repositioning towards the ideal point -- even if it results in minimally different brand positions -- is competitively optimal under limited price competition, even if some other configuration of product locations exists which enlarges total profits for both brands. Profits for each brand increase as it approaches the ideal point but decrease as rivals do. By repositioning toward the ideal point, a brand can capture some of those high profits and actually impose reduced profits on more timid competitors. But if all brands converge toward the ideal point, all will be less distinct and all will compete more intensely, so that brand profits may actually be <u>lower</u> than before repositioning. Higher profits, thus, may be an irresistible temptation yet difficult to realize; even so, competition compels brands toward head-to-head competition in markets with a single ideal point.

Taken together this analysis indicates that perceptual position and competition can be successfully integrated to reveal important insights about competitive brand strategy formulation. Simple decision rules for competition pricing and promotional spending exist given buyers' perceptions. The effectiveness of a brand's strategy and consequently its optimal price and promotional outlay depend on the strategies and perceived location of all competitors. Optimal repositioning strategies depend importantly on the basis of competition between brands. And for many markets high profits are earned by brands that achieve a superior perceptual position, even though high profits may be more elusive than real, and the reward for competing aggressively may be still greater competition.

TABLE 1

SUMMARY OF IMPACT OF DIFFERENCES IN PERCEPTUAL POSITIONS
ON OPTIMAL COMPETITIVE STRATEGIES AND PROFITS
UNDER PRICE AND NON-PRICE COMPETITION

Positioning Difference	Price		Promotional Spending		Profits	
	Price Competition	Non-Price Competition	Price Competition	Non-Price Competition	Price Competition	Non-Price Competition
Brand closer to ideal point	+	+	+	+	-	+
Rival closer to ideal point	-	-	-	-	+	-
Brand closer to rival	-	-	-	-	-	+/-*

*If positioning competition dominates promotional competition, then profits decrease as brands move closer; if promotional competition dominates, brand profits are higher.

APPENDIX

LEMMA 1. Under A1 through A3, $q_i = q_i(s,D)$ $(i = 1,2)$ such that $\partial q_i/\partial D_{iI} \leq 0$, $\partial q_i/\partial D_{ij} \geq 0$, $\partial q_i/\partial p_i \leq 0$, $\partial q_i/\partial m_i \geq 0$, $\partial q_i/\partial p_j \geq 0$, $\partial q_i/\partial m_j \leq 0$ $(i = 1,2;\ i \neq j)$.

PROOF. $q_i = Q\theta_i$, and θ_i increases as D_{iI} decreases because $f(\cdot)$ increases toward the mode; hence $\partial q_i/\partial D_{iI} \leq 0$. Likewise, θ_i decreases as D_{ij} decreases for $D_{ij} \leq D_{min}$ because θ_{in} decreases; hence, $\partial q_i/\partial D_{ij} \geq 0$. θ_{in} decreases in p_i and increases in m_i because u_{in} does; hence, $\partial q_i/\partial p_i \leq 0$, $\partial q_i/\partial m_i \geq 0$. Finally, u_{jn} decreases in p_j and increases in m_j so that θ_{in} increases in p_j and decreases in m_j; therefore, $\partial q_i/\partial p_j \geq 0$, $\partial q_i/\partial m_j \leq 0$. Q.E.D.

PROOF OF PROPOSITION 1. Differentiating Π_i with respect to m_i and p_i $(i = 1,2)$ produces four first-order conditions:

$$\partial\Pi_i/\partial p_i = (p_i - c)(\partial q_i/\partial p_i) + q_i = 0, \qquad i = 1,2 \qquad \text{(A.1)}$$

$$\partial\Pi_i/\partial m_i = (p_i - c)(\partial q_i/\partial m_i) - 1 = 0, \qquad i = 1,2 \qquad \text{(A.2)}$$

A vector $s^* = (p_1^*, m_1^*, p_2^*, m_2^*)$ exists that simultaneously satisfies (A.1) and (A.2) under A1 though A4 (Friedman 1977). Then (A.1) can be rewritten as $(p_i^* - c)(\partial q_i^*/\partial p_i^*)(p_i^*/q_i^*) = -p_i^*$ or

$$p_i^* = c\eta_i^*(1 + \eta_i^*)^{-1}$$

where $q_i^* = q_i(s^*,D)$ and $\eta_i^* = (\partial q_i^*/\partial p_i^*)(p_i^*/q_i^*)$. Likewise, (A.2) can be rewritten as $(p_i^* - c)(\partial q_i^*/\partial m_i^*)(m_i^*/q_i^*) = m_i^*/q_i^*$ or

$$m_i^* = (p_i^* - c)q_i^*\mu_i^*$$

where $\mu_i^* = (\partial q_i^*/\partial m_i^*)(m_i^*/q_i^*)$.

Next, to show uniqueness, let $s = w(s)$ be the system of four competitive reaction functions defined by (A.1) and A.2), let J be the Jacobian of w, and define the norm of J as $||J|| = \max_k \sum_\ell |j_{k\ell}|$. Then, by the implicit function theorem and A4, $||J|| < 1$. Hence, w is a contraction (Franklin 1980), and therefore s* is unique (Friedman 1977). Q.E.D.

LEMMA 2. Given that s^* is unique, $g(s^*(D),D)$ defines s^* as an implicit function of $D(\ell)$ where

$$g(s^*(D),D) = H^* ds^* + h_1^* dD_{1I} + h_2^* dD_{2I} + h_3^* dD_{12} = 0$$

and where H^* is the matrix of derivatives of (A.1) and (A.2) with respect to each element of s evaluated at s^*, and H^* is given by

$$H^* = \begin{pmatrix} \Pi_{p_1p_1} & \Pi_{p_1m_1} & \Pi_{p_1p_2} & \Pi_{p_1m_2} \\ \Pi_{m_1p_1} & \Pi_{m_1m_1} & 0 & 0 \\ \Pi_{p_2p_1} & \Pi_{p_2m_1} & \Pi_{p_2p_2} & \Pi_{p_2m_2} \\ 0 & 0 & \Pi_{m_2p_2} & \Pi_{m_2m_2} \end{pmatrix};$$

$ds^* = (dp_1^*, dm_1^*, dp_2^*, dm_2^*)'$ is a vector of simple differentials of s evaluated at s^*; h_1^*, h_2^*, and h_3^* are vectors of the partial derivatives of (A.1) and (A.2) with respect to each element of D evaluated at s^* where

$$h_1^* = \begin{pmatrix} \Pi_{p_1D_{1I}} \\ 0 \\ 0 \\ 0 \end{pmatrix}, \quad h_2^* = \begin{pmatrix} 0 \\ 0 \\ \Pi_{p_2D_{2I}} \\ 0 \end{pmatrix}, \quad h_3^* = \begin{pmatrix} \Pi_{p_1D_{12}} \\ 0 \\ \Pi_{p_2D_{12}} \\ 0 \end{pmatrix},$$

and dD_{1I}, dD_{2I}, dD_{12} are simple differentials of the elements of D.

PROOF. Totally differentiating (A.1) and (A.2) produces $g(s^*(D),D) = 0$ which implicitly defines s^* as a function of $D(\ell)$, and by excluding interactions in $q_i (i = 1,2)$, H^* and $h_i^* (i = 1,2,3)$ as given above follow directly. Q.E.D.

LEMMA 3. Let $\Delta = \det H^*$ and $\Delta_{ij} = \det H_{ij}^*$ where H_{ij}^* $(i,j = 1,2)$ are the (2×2) submatrices of H^* given by

$$H^* = \begin{bmatrix} H_{11}^* & H_{12}^* \\ H_{21}^* & H_{22}^* \end{bmatrix}$$

Then, $\Delta_{ii} > 0$ $(i = 1,2)$, and $\Delta > 0$.

PROOF. By A4, Π_i are concave $(i = 1,2)$ so that Δ_{11} and Δ_{22} are positive. Second, H is positive definite so that $\Delta > 0$, because s^* is unique. Q.E.D.

PROOF OF PROPOSITION 2. First assume that brand 2 remains both a fixed distance from brand 1 and from the ideal point so that $dD_{2I} = dD_{12} = 0$. Then by Lemma 2, $H^* ds^* = -h_1^* dD_{1I}$. This system of equations can be solved for dp_1^*/dD_{1I}. By Cramer's rule and Lemma 2,

$$dp_1^*/dD_{1I} = \Delta^{-1} \begin{vmatrix} -\Pi_{p_1 D_{1I}} & \Pi_{p_1 m_1} & \Pi_{p_1 p_2} & \Pi_{p_1 m_2} \\ 0 & \Pi_{m_1 m_1} & 0 & 0 \\ 0 & \Pi_{p_2 m_1} & \Pi_{p_2 p_2} & \Pi_{p_2 m_2} \\ 0 & 0 & \Pi_{m_2 p_2} & \Pi_{m_2 m_2} \end{vmatrix}$$

which simplifies to

$$dp_1^*/dD_{1I} = \Delta^{-1}(-\Pi_{p_1 D_{1I}})\Pi_{m_1 m_1}\Delta_{22}.$$

As shown before, $\Delta > 0$, $\Delta_{22} > 0$; $\Pi_{m_1m_1} < 0$ by the A4, and by direct computation

$$-\Pi_{p_1D_{1I}} = -(\partial/\partial D_{1I})[(p_1^* - c)(\partial q_1^*/\partial p_1^*) + q_1^*] = -\partial q_1^*/\partial D_{1I} \geq 0$$

by Lemma 1. Therefore, $dp_1^*/dD_{1I} \leq 0$. Q.E.D.

REMARK. Proofs of Proposition 3, 4, 5, 8, and 9, which follow the above proof very closely, are given in the Technical Appendix that is available directly from the author.

PROOF OF PROPOSITION 6. Consider brand 1 and define $\Pi_1^*(D) = \Pi_1(s^*(D),D)$. Then

$$\partial\Pi_1^*/\partial D_{1I} = (\partial\Pi_1/\partial p_1^*)(dp_1^*/dD_{1I}) + (\partial\Pi_1/\partial m_1^*)(dm_1^*/dD_{1I}) + (\partial\Pi_1/\partial D_{1I})$$
$$+ (\partial\Pi_1/\partial p_2^*)(dp_2^*/dD_{1I}) + (\partial\Pi_1/\partial m_2^*)(dm_2^*/dD_{1I}).$$

By the optimality of s^*, $\partial\Pi_1/\partial p_1^* = \partial\Pi_1/\partial m_1^* = 0$ so that

$$\partial\Pi_1^*/\partial D_{1I} = (\partial\Pi_1/\partial D_{1I}) + (\partial\Pi_1/\partial p_2^*)(dp_2^*/dD_{1I}) + (\partial\Pi_1/\partial m_2^*)(dm_2^*/dD_{1I}).$$

By Propositions 4 and 5, $dp_2^*/dD_{1I} \geq 0$ and $dm_2^*/dD_{1I} \geq 0$, and by Lemma 1 $\partial\Pi_1/\partial m_2^* \leq 0$. Therefore $\partial\Pi_1^*/\partial D_{1I} \leq 0$ if

$$[(-\partial\Pi_1/\partial D_{1I}) - (\partial\Pi_1/\partial m_2^*)(dm_2^*/dD_{1I})] \geq [(\partial\Pi_1/\partial p_2^*)(dp_2^*/dD_{1I})],$$

which holds if price competition is limited. Q.E.D.

REMARK. Proofs of Proposition 7, 8, and 10, which are similar to the above proof, appear in the Technical Appendix.

PROOF OF PROPOSITION 11. Let ℓ_1^0 and ℓ_2^0 be the initial distant locations for brands 1 and 2, respectively, and let ℓ_1' and ℓ_2' be locations for brands 1 and 2, respectively, which are both closer to the ideal point and to each other compared to ℓ_1^0 and ℓ_2^0. And define $\Pi_i^*(\ell_1,\ell_2) = \Pi_i(s^*(D(\ell)),D(\ell))$, $(i = 1,2)$.

For brand 1, $\Pi_1^*(\ell_1',\ell_2^0) > \Pi_1^*(\ell_1^0,\ell_2^0)$ and $\Pi_1^*(\ell_1',\ell_2') > \Pi_1^*(\ell_1^0,\ell_2')$, because Π_1^* increases as D_{1I} decreases (Proposition 6) and because price competition is limited $|\partial\Pi_1^*/\partial D_{1I}|>|\partial\Pi_1^*/\partial D_{12}|$. Likewise, for brand 2, $\Pi_2^*(\ell_1^0,\ell_2') > \Pi_2^*(\ell_1^0,\ell_2^0)$ and $\Pi_2^*(\ell_1',\ell_2') > \Pi_2^*(\ell_1',\ell_2^0)$. Therefore, brands 1 and 2 have an incentive to relocate to ℓ_1' and ℓ_2', respectively, even if $\Pi_i^*(\ell_1^0,\ell_2^0) > \Pi_i^*(\ell_1',\ell_2')$ $(i = 1,2)$. Q.E.D.

REMARK. Proofs of Propositions 12, 13, and 14 follow the above proof very closely and are detailed in the Technical Appendix.

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Footnotes

1. Where convenient subscripts denote partial derivatives (e.g., $\Pi_{m_1p_1} = \partial^2\Pi_1/\partial m_1\partial p_1$).

2. In addition, we assume that brands select prices and promotional expenditures from a S, a closed bounded convex subset of R^2.

3. Proof of our essential results appear in the Appendix. A complete set of proofs appears in the Technical Appendix, which is available directly from the author.

4. To see the relationship between the Dorfman-Steiner result and equations (2) and (3), rewrite them as

$$m_i^*/p_i^*q_i^* = -\mu_i^*/\eta_i^*, \qquad i = 1,2.$$

In words, this equation says that the optimal promotion-sales ratio is equal to the absolute value of the ratio of the promotion-sales and price-sales elasticities. Dorfman and Steiner derive a similar relationship for a single brand without competition and excluding buyer perceptions. (See Schmalensee 1972 for a review of related results.) In contrast, our result is a market-wide condition; it depends on s^*, the strategies of all competitors, and it holds simultaneously for all brands. Therefore, Proposition 1 demonstrates that the Nash equilibrium price and promotional levels are given by a generalization of the Dorfman-Steiner result that includes competition and buyer perceptions.

Lambin, Naert, and Bultez (1975) also generalize the Dorfman-Steiner result to include competition. But they focus on the special case of rivalry between brands where all brands are perceptually identical and one market leader selects a strategy and all remaining rivals react to it. In contrast, all brands compete more equally in our model; no one single brand dominates the decision of the rest.

The conditions given in (2) and (3) hold for an even broader class of market response models than those defined by A1 through A4. Similar optimal conditions can be shown to hold for any model so long as (a) the market response function includes the marketing mix variables of all brands, (b) profits for each brand are a concave function of the marketing mix elements of that brand, and (c) all brands simultaneously maximize current profits. Optimal pricing and promotional spending rules generated from models in this class are all special cases of (2) and (3). For example, Carpenter, Cooper, Hanssens and Midgley (1984) construct a competitive decision model based on an MCI market share model, and the conditions they derive are special cases of (2) and (3) where price and advertising elasticities are based on the MCI model.

5. Clarke (1978) reports a finding contrary to this result in an empirical analysis of the impact of perceptual position on advertising spending due to different assumptions. Clark assumes that sales depend on a brand's effective advertising, and that more distinctly positioned brands have more effective advertising. A brand's effective advertising will increase as it moves closer to the ideal point <u>and</u> away from its rivals, so that optimal advertising spending can be reduced. In contrast, in our model sales increase as a brand is positioned closer to the ideal point and further from competitors.

6. This discussion implicitly assumes that brand 2 remains at its current position. See Figure 2. If brand 2's position were not fixed, repositioning with an increase in advertising spending would possibly be optimal. We explore that option in more detail in sections 6 and 7.

7. By "compete principally on positions and promotional expenditures" we mean that positional and promotional spending have a greater impact on a brand's sales than prices (i.e., $|\partial q_i/\partial D_{iI}|$ and $|\partial q_i/\partial m_j|$ > $|\partial q_i/\partial p_j|$ for i,j = 1,2).

8. We are implicitly assuming that brand 2 remains at its current position. We examine more fully in section 6 the optimality of being closer to the ideal point if competitors optimally reposition and adjust their marketing mix.

9. This discussion implicitly assumes that brands reposition through a one-time advertising outlay that is separate from m_i, spending devoted to simply increasing the probability of purchase. In some markets, of course, repositioning can be very expensive. However, we assume that the cost of repositioning is small relative to its benefit simply to illustrate the direction of profit increase. Whether or not the magnitude of profit increase exceeds the cost of repositioning is an empirical issue that we do not consider.

10. A market niche is defined as a market position that is both distant from the ideal point and from the competitor.