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To Brand or Not to Brand? A Theoretical and Empirical Question*

I. Introduction

A firm's brand name is a valuable asset that can greatly enhance the demand for its products. This fact is widely recognized in both the economics and marketing literatures. Surprisingly, though, little rigorous analysis has been devoted by either of these literatures to the question of when a firm will identify one of its new products with an established brand name. It is on this question that our research is focused.

The economics literature in this general area has focused on issues that are related to but quite distinct from the issue we examine. The "traditional" industrial organization literature discusses and attempts to capture empirically the relationships among advertising, brand names, and market power. (For some representative work

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We develop and test a model that predicts (1) whether a multiproduct firm will brand a new product with the established company name and (2) where the new product will be "located" in relation to the reputation established by the firm in other markets. Hotelling's (1929) model of spatial location serves as the basis for our theoretical investigation. However, we extend Hotelling's model to the case of "experience goods" whose qualities can only be known with certainty after the product is purchased and consumed. The logic that underlies our model is tested on a sample of firms from the U.S. liquor industry. We employ a mixed logit approach to capture the simultaneous decisions that are made by the firms in our sample.

and other references, see Comanor and Wilson [1974], and Scherer [1980].) More recent theoretical work has likened a firm's investment in its brand name to the posting of a bond. The brand name serves to guarantee the quality of the firm's products, since the bond is effectively forfeited if the firm reneges on this implicit guarantee because of the associated damage to its reputation (Telser 1980). A related line of research (see Kihlstrom and Riordan 1984) suggests that expenditures on brand enhancement can credibly signal the unknown quality of a firm's products.

The marketing literature has noted some of the trade-offs that a multiproduct firm faces when it decides whether to brand a new product (Gamble 1967). Extensive branding can allow a firm to reduce its overall advertising expenditures (Peckman 1971; Morein 1975) but can also "confuse" potential customers if the branded products are not very "similar," and thereby reduce demand for the products (Fry 1967; Neuhaus and Taylor 1972; Kimrey 1974; Ries and Trout 1980; Albion 1983). This possibility of "confusing" customers is explored in greater detail in the following section.

The purpose of this research is twofold. First we present a simple theoretical model (building on Hotelling's [1929] classic model of spatial competition) that predicts (1) whether a multiproduct firm will brand a new product and (2) where the new product will be "located" in relation to the reputation established by the firm in other markets. A key feature of our model is that a branded product can convey information to consumers that an unbranded product cannot. In particular, a brand name can serve to reduce uncertainty about the product's characteristics (in a sense made precise below). The formal model is developed in Section II.

Second, we attempt to capture empirically the branding decisions of firms.¹ Our empirical analysis offers reasonably strong support for the logic that underlies our theoretical model. The data set and estimating variables we employ are described in Section III. Our empirical methodology and findings are presented in Section IV. Conclusions are drawn in Section V.

II. The Basic Model

In this section we extend Hotelling's (1929) basic duopoly model of spatial competition to account for the possibility that the two firms may attract customers in a new market by drawing on a reputation previ-

1. Although we do not pursue the idea further here, the basic elements of our "branding" analysis are germane to a variety of other analyses. For example, when retailers choose which products they will sell in their stores, they consider the extent to which the products, are "consistent" with each other and with the store's image.

ously established in other markets. The reputation is "drawn on" by branding the new product, that is, by placing the same brand name on the new product that was employed on products sold in other markets. We begin with a brief review of Hotelling's basic model and then proceed to our own, making clear the fundamental differences between the two models.

The market in Hotelling's model is the line segment $[0, 1]$. Consumers are uniformly distributed along this segment. A consumer's location reflects his tastes for a particular attribute of the product being sold in the new market. Each consumer incurs a cost, c , per unit of distance when traveling from his location to the location of the firm from which a purchase is made. Each consumer is assumed to purchase at most a single unit of the product. Consumers always purchase from the closest firm since location represents the only attribute over which firms compete. In particular, the two firms may be regarded as charging the same price. Production costs are assumed to be zero for both firms.²

Note that there is no uncertainty in Hotelling's model. Each firm's location perfectly signals its product's attribute to all consumers. Thus, the products in Hotelling's model are, in Nelson's (1970) terminology, "search" goods, since all characteristics of the goods can be determined by (costless) search and inspection. Actual consumption of the good is not required to learn its qualities.

In this simplest of spatial location models, the only equilibrium is that in which each firm locates at $\frac{1}{2}$, the center of the market. If one firm (A) were to locate at some other point, say, $L_A < \frac{1}{2}$, his competitor could gain more than half the market by locating at $L_B \in (L_A, \frac{1}{2}]$. Thus, A 's profits would be lower than the level that could be ensured by locating at $\frac{1}{2}$.

It is important to emphasize that in Hotelling's model (and in the extension developed below) a customer's location serves as a proxy for his preferences. Thus, each customer has a different valuation of the characteristic over which the firms are competing. In particular, customers do not necessarily agree that an increase in the quantity of this characteristic is desirable. How dry a wine is or how tart a candy is are good examples of what this characteristic might be. Durability or the amount of costly service required to maintain a product are characteristics on which most consumers agree and are therefore not good examples for the present purposes.

Three key elements of Hotelling's model warrant brief reiteration. First, there is only one market in which firms compete. Second, no

2. The assumption of zero marginal costs is made for analytic simplicity. The basic conclusions of the analysis are completely unaltered if marginal costs are constant but strictly positive.

product characteristic is more costly to produce than another for either firm. Third, product characteristics are known perfectly to all consumers. It is these three restrictions that we relax in our formal model of spatial location. By doing so, we are able to demonstrate how branding can provide information to consumers about unknown product characteristics.

Our formal analysis presumes the existence of two distinct markets that are populated by the same consumers. Each of two firms has established its location in the first market and is currently deciding where to locate a new product in the second market and whether to brand the product.³ When they established their positions in the first market, the two firms were engaged in competition much as in Hotelling's model, but with one important difference. The costs of locating were not necessarily the same at each location for both firms. Consequently, equilibria other than the one in which both firms locate at the center of the market can arise.

Intuitively, location costs may differ if firms have different initial endowments (e.g., special skills, patents, or scarce resources) or discover different production techniques. Smaller costs of locating at a particular point in the market can be interpreted as lower fixed costs of manufacturing a product with a particular attribute. We do not present the details of the equilibrium location decision in the first market as our concern is only with how any given location decision in the first market affects the corresponding decision in the second market.

In the second market, costs of locating at each point are the same, and are identical for both firms. Where the analysis in the second market differs from Hotelling's analysis is that the firm's location is no longer a perfect indicator of its product's attribute. While a firm's location may provide some information about its product, consumers cannot be certain about the product's characteristics unless they actually purchase and consume the product. Thus, in Nelson's (1970) terminology, we are assuming that the products in the second market are, at least in part, "experience goods."

We presume that a firm's location in the second market perfectly signals the average value of its product's characteristic, but consumers perceive some variation about the mean. Intuitively, a firm can state whether its product is "soft" or "dry" or "sweet," but exactly how soft, dry, or sweet it is can only be determined with certainty through (costly) consumption. We also assume that consumers are averse to risk concerning a product's characteristics. Consequently, consumers

3. There is an additional decision that each firm must make, namely, what image to establish initially. We do not consider this decision in our formal analysis. Instead, we adopt a partial equilibrium approach and take as given the image established by each of the two firms. Our modest goal is to determine whether each firm will brand the single new product that it introduces and how closely the new product will conform with the established image of the firm.

value a reduction in uncertainty about a firm's product. Such a reduction can be afforded by branding when the two products manufactured by a firm are "similar" (in a sense to be made precise below).

For example, suppose a manufacturer describes its new vintage of wine as "very dry." While informative, this description is not a perfect indicator of all relevant qualities of the wine, so potential customers face some uncertainty about the product. However, if these customers are familiar with other vintages that the firm has labeled "very dry," they can better infer the actual characteristics of the new vintage. Hence, uncertainty about a new product can be reduced when branding invites consumers to consider their previous experience with similar products manufactured by the firm. However, when the firm's established products are largely unrelated to the new product, branding will not afford consumers much reduction in the uncertainty they face.

To explore these ideas more formally, consider the following simple formulation. The cost to the consumer located at $L_i \in [0, 1]$ in the new market of purchasing from, say, firm A has as one component $c|L_i - L_A|$, where L_A is the location of firm A in that market. This component of a consumer's costs corresponds exactly to those considered by Hotelling. We refer to these as "transportation" costs.

In addition, we consider a component of costs referred to as "image" costs. Image costs, defined formally below, are designed to capture the aforementioned incongruity between a firm's image and its new product. The metric that defines image costs employs the following definition:

DEFINITION: Firm t 's ($t = A, B$) base (L_t^*) in the new market is that location of firm t (L_t) at which the image costs incurred by consumers who purchase from firm t are minimized.

When a firm locates at its base in the new market, branding reduces uncertainty about the characteristics of its new product to the greatest extent possible. Intuitively, the firm's established image and its new product are most congruent when the firm locates at its base in the new market.

Given our definition of L_t^* , we can represent the image costs incurred by the consumer at L_i who purchases from firm t as $b_t[I_t + \bar{I}|L_i - L_t^*|]$, where $I_t \leq 0$ and $\bar{I} > 0$ are constants, and b_t takes on the value unity if firm t brands its new product and zero otherwise. Hence, it is only if a firm brands its new product that consumers may incur image costs when purchasing the product. $I_t \leq 0$ reflects the favorable reduction in uncertainty that can be effected via branding when the firm locates at its base. $\bar{I} > 0$ indicates that the possible reduction in uncertainty via branding is diminished the farther from its base the firm locates in the second market. If the new product and the firm's image are sufficiently incongruent, image costs can be positive. Obviously, the firm will never brand its new product under these circumstances.

Two technical points are worthy of brief mention. First, the mag-

nitude of the image costs incurred are assumed to be a linear function of the distance between the firm's location and its base. Second, image cost incurred by a particular customer do not depend on the physical distance between his location and the location of the firm from which he purchases. They depend only on the distance between the firm's location and its base. Hence, the reduction in uncertainty that branding can foster is the same for all customers.

In the ensuing analysis, we examine situations in which the bases of the two firms are located symmetrically about the center of the market. For simplicity, and without essential loss of generality, we focus on the case where $L_A^* = 0$ and $L_B^* = 1$. (Recall that firms may locate at positions other than the center of the first market because of technological differences.) We report four main conclusions below. Conclusions 1–3 characterize symmetric equilibria, that is, they describe situations in which $I_A = I_B$. A detailed analysis of the symmetric case allows the key features of the asymmetric case (with $|I_A| > |I_B|$) to be presented most easily. The asymmetric case is the subject of our fourth conclusion (as well as our empirical work). Many cases other than the four we consider below are conceivable. The four we present are chosen to demonstrate most clearly which relationships among the parameters of the model are crucial in determining the nature of the market equilibrium. Throughout we are concerned with Nash equilibria. Thus, locations L_A and L_B constitute an equilibrium if and only if, given the location of its competitor, neither firm strictly prefers to change its location.

CONCLUSION 1: Suppose $\bar{I} > c$ and $I_A = I_B$. Then (i) if $|I_A| > \frac{1}{2}c$, the unique equilibrium is that in which each firm brands its new product and locates at its base; (ii) if $|I_A| < \frac{1}{2}c$, the unique equilibrium is that in which both firms locate at the center of the market and do not brand; (iii) if $|I_A| = \frac{1}{2}c$, there are four possible equilibria: each firm will either locate at its base and brand its product or locate at the center of the market and not brand.

PROOF: We prove only (i). The proof of (ii) employs logic analogous to that outlined below, and the proof of (iii) is immediate once (i) and (ii) are established.

Suppose firm B locates at its base when $|I_A| > \frac{1}{2}c$. If firm A chooses not to brand, its optimal location is $L_A = (c - |I_A|)/c < \frac{1}{2}$. At this location, A only attracts those customers in the interval $[0, (c - |I_A|)/c]$. If A does brand, however, it can attract those customers in the interval $[0, 1/2]$ when it locates at its base because of the symmetry in the model. Because $\bar{I} > c$, movements away from its base reduce A 's market share.

Similar arguments reveal that it is only by branding and locating at its base that each firm can be certain to capture one-half of the market. And, since the analysis for firm B is identical to that for firm A , (i) follows. Q.E.D.

CONCLUSION 2: Suppose $\bar{I} < c$ and $I_A = I_B$. Then in equilibrium, both firms will locate at the center of the market. Furthermore, both firms will brand their new product if $|I_A| > \frac{1}{2}\bar{I}$ but choose not to brand if $|I_A| < \frac{1}{2}\bar{I}$.⁴

PROOF: If B brands and locates at $L_B \in [0, \frac{1}{2})$, A can always obtain the entire market by branding and locating at L_B . If B brands and locates at $\hat{L}_B \in (\frac{1}{2}, 1]$, A can obtain half the market by branding and locating at $1 - \hat{L}_B$, due to the symmetry in the model. Since $\bar{I} < c$, though, A can attract more than half the market if it moves to $L_A \in (1 - \hat{L}_B, \frac{1}{2}]$. It is only by locating at $\frac{1}{2}$ that B can ensure itself half the market when both firms brand.

If neither firm brands, we know from Hotelling's analysis that the unique equilibrium is one in which both firms locate at the center of the market.

Whether both firms choose to brand or choose not to brand in equilibrium depends on the sign of $|I_A| - \frac{1}{2}\bar{I}$. If its sign is negative, for example, branding will not occur in equilibrium because reductions in image costs gained through branding are outweighed by increased transportation costs to the marginal consumer, wherever the firm chooses to locate. Q.E.D.

Conclusions 1 and 2 reflect the fact that firms who brand their products must take into account two distinct effects when they move from their base. Such movement alters their physical proximity to consumers and thereby affects transportation costs. It also changes the image costs that consumers bear when purchasing from the firm. If the former effect dominates the latter ($c > \bar{I}$), the firms will gravitate to the center of the market, as in Hotelling's model. If the latter effect is predominant ($\bar{I} > c$), the firms will locate at their respective bases, provided the effects of branding are sufficiently great to ensure each firm at least half the market should its competitor decide not to brand, that is, $|I_A| > \frac{1}{2}c$.

Corner solutions are prevalent in equilibrium here because of the linearity in the model. Interior solutions are possible, but only under the razor-edge conditions cited in conclusion 3. With $\bar{I} = c$, the two aforementioned forces that come to bear when a firm brands and moves from its base exactly offset each other. In the statement of conclusion 3, a firm's boundaries are the endpoints of the line segment within which image costs to its customers are nonpositive.

CONCLUSION 3: Suppose $\bar{I} = c$ and $I_A = I_B$. Then (i) if $|I_A| < \frac{1}{2}c$, the unique equilibrium is that in which both firms locate at the center of the market and do not brand their products; (ii) if $|I_A| > \frac{1}{2}c$, any outcome in which each firm brands its product and locates within its boundary constitutes an equilibrium; (iii) if $|I_A| = \frac{1}{2}c$, each firm will be indifferent, in equilibrium, between not branding its product while locating at

4. The firms will be indifferent between branding and not branding if $|I_A| = \frac{1}{2}\bar{I}$.

the center of the market and branding its product while locating anywhere within its boundary.

The proof of conclusion 3 is similar to preceding proofs, and it is therefore omitted. Conditions (ii) and (iii) of conclusion 3 are suggestive of the wider range of equilibria that are possible when image costs are not a linear function of the distance between a firm's location and its base. These nonlinear cases are not considered in detail here, as the mathematical complexities introduced by such a general analysis outweigh the additional intuition that it provides.

Finally, note that branding effects on consumer demand may differ by firm. Such a possibility arises, for example, if one firm's established brand name is much stronger than another's in terms of attracting consumers in a new market. Put differently, uncertainty about the new product may be reduced via branding much more effectively for one firm than another. Differential effects may arise in practice because consumers are more familiar with the products of one firm than another or because the new product is more similar to the established product line of a particular firm. Such asymmetries are considered formally in conclusion 4.

CONCLUSION 4: Suppose $\bar{I} < c$ and $|I_A| > |I_B| > \frac{1}{2}\bar{I}$. Then the unique equilibrium is one in which both firms brand their new product and locate at $(|I_A| - |I_B| + \bar{I})/2\bar{I}$.

The logic behind the proof of conclusion 4 is analogous to that developed above. The fact that $|I_A|$ and $|I_B|$ both exceed $\frac{1}{2}\bar{I}$ leads directly to the conclusion that both firms will brand their new product. Furthermore, since $\bar{I} < c$, movement by each firm from its base is optimal. The remaining question is how far each firm will locate from its base in equilibrium. Conclusion 4 reports that the firm with the stronger brand name (i.e., that firm, t , for which $|I_t|$ is largest) will locate further from its base and thereby capture the larger share of the new market.

Of course, conclusions that parallel conclusions 1 and 2 (where the firms are symmetric) can easily be drawn for the case in which, as in conclusion 4, firms are not symmetric. Little insight is gained by the exercise, however, beyond that already described. Two major insights of the theoretical analysis that we consider further in our empirical investigation are (1) the stronger a firm's brand name, the farther from its base will it locate in equilibrium, *ceteris paribus*; and (2) if a firm brands its new product, it will locate closer to its base than if branding is not employed.

III. Data and Measures

In our empirical investigation of the branding decisions of firms, we consider firms that operate in the U.S. liquor industry. Many new products are introduced annually in this industry, some of which carry

the manufacturer's brand name and others of which do not. Our sample was derived from the Liquor Handbooks covering the period 1968–77. The Liquor Handbook provides annual data on advertising revenue by product in 12 distinct but similar markets, identifying the name of the product and that of the manufacturer.⁵ We eliminated from our sample the four markets in which imports account for more than 10% of sales because our data did not allow us to distinguish between a new product and a product that had previously been marketed abroad and was only being introduced into the United States for the first time by an importer.⁶ The incentives to brand in these two cases appear quite different, and our theory is most relevant in the former case.

In the remaining eight markets, we looked at all new product introductions from 1969 to 1977 by firms that had "established" brand names. To capture this properly, we only considered firms that had the same brand name (e.g., Johnny Walker Red and Johnny Walker Black) on at least two other products at the time of the introduction. The restriction to firms with established brand names was imposed in order to focus on the decision of whether or not to employ such a brand, rather than on the decision of whether to establish a brand name. The latter question is of interest, but it is not one that our theoretical or empirical analysis is designed to answer.

The names of products listed in the Liquor Handbook served as the basis of our binary branding variable, b_t , where b_t is defined to be unity if the t th observation is one in which the new product introduced bears the same name as the firm's established brand name and zero otherwise.⁷

Conclusion 4 in Section II suggests that the strength of a firm's established brand name might affect the location and brand identification of a new product. The variable A_t was introduced to explore this possibility. Postulating a strong correlation between brand strength and advertising expenditures, A_t is defined as the sum of the firm's advertising expenditures (in tens of millions of real dollars) on products sold under its established brand name in the year prior to the introduction of the t th new product.

A crucial variable in the theoretical analysis in Section II was the distance a firm locates from its base in the new market. The metric we chose to capture this variable in our empirical analysis is analogous to

5. These 12 markets are straight bourbon, bonded bourbon, blended whiskey, cordials and liquors, gin, rum, vodka, brandy, scotch, Canadian, cognac, and tequila.

6. The four markets eliminated on this ground were the lattermost four of the 12 listed in the preceding footnote.

7. Data limitations forces us to identify the year in which a new product is introduced as the first year in which the product was advertised. Thus, we do not distinguish among new products, old products that were renamed, and existing products that were initially advertised subsequent to the product's introduction.

the one employed by Fry (1967). Relative price differences are the cornerstone of this metric, which is defined as follows: let r_t be the ratio of the price of the t th new product to the average price of all products in the market in which the t th product is sold; let r_{it} be the ratio of the price of the product sold in the i th market ($i \neq t$) by the t th firm to the average price of all products in the i th market; let n_t be the number of markets (other than the one in which the t th product is sold) in which the t th firm sells products under a single brand name; and let M_t be the set of all such markets. Then, $d_t = |1/n_t \sum_{i \in M_t} r_{it} - r_t|$. Intuitively, our measure of the distance that a firm locates from its base is the extent to which its "position" (in terms of its own price relative to the average market price) in the new market differs from the average position the firm has established in other markets.⁸

Our information on prices was limited to the 1982 official price list of the Michigan Liquor Control Commission. There were two consequences of this limitation. First, we were forced to assume that relative prices throughout the sample period were the same as they were in 1982. Second, we were forced to exclude from our sample products that were introduced between 1968 and 1977 but were not sold under the original name in Michigan in 1982.⁹

One additional variable, m , was employed in the empirical analysis. If the t th new product is introduced into a market where the product's manufacturer already sells another product under the same brand name, $m_t = 1$; otherwise, $m_t = 0$. We would expect that if the firm's brand name is already employed in the market into which its new product is introduced, the firm will be less likely to brand the new product, *ceteris paribus*. In terms of our theoretical model in Section II, the previous use of the brand name in the new market might be

8. The use of price differences to capture product differentiation is, of course, not without its drawbacks. Data limitations, however, dictated that we adopt this approach. Note, though, that alternative measures of distance that are based on prices are conceivable. Nonlinear such measures are obvious candidates, as are measures in which weighted rather than simple averages are employed. Furthermore, a plausible measure of the firm's established position might account for the dispersion of positions in the various markets in which the firm sells under the same brand name. Limited experimentation along these lines, though, revealed that our estimates were not improved by the introduction of alternative measures of d_j . Note, also, the relationship between this metric and the theoretical analysis in Sec. II. $L_A = 0$ and $L_B = 1$ is consistent with the possibility that firm *A* has systematically set prices below the average and firm *B* above the average in the markets in which they operate.

9. This potential sample selection bias may actually be justified on theoretical grounds. If our purpose is to identify successful branding strategies of firms, then by eliminating from our sample products that have disappeared from the market, we may be excluding observations of branding decisions that in retrospect were "incorrect." However, it is also possible that the products we eliminate are simply regional products that are not sold in Michigan.

associated with a value of $|\bar{I}|$ close to zero. From conclusion 2, firms are unlikely to brand in a symmetric equilibrium with $|\bar{I}|$ small.¹⁰

Our final sample consisted of 39 observations. Nine firms were represented in the sample.¹¹ The number of product introductions per firm ranged between one and nine. In 16 incidents, the firm chose to identify its new product with the established brand name, whereas branding did not take place in the other 23 cases. No firm that introduced more than one new product branded all of its new products with the established name. There were two firms (one introduced three new products, the other five) that did not brand any of its new products.

IV. Empirical Methodology and Findings

Firms make two simultaneous choices in our model: (1) whether or not to brand a new product and (2) where to position the product in the new market. We capture these choices of the firm as follows. One of our estimating equations has as its dependent variable the probability that a firm will brand its new product. The dependent variable in our second equation, d_t , is the distance between a firm's new product and its base. Our approach is the mixed logit approach (see, e.g., Schmidt and Strauss 1976), that is, we estimate a simultaneous equations model in which one equation has a binary dependent variable and the other a continuous dependent variable. The binary variable is b_t and the continuous variable is d_t .

Our model is specified as follows:

$$\ln \frac{P(b_t = 1|d_t)}{P(b_t = 0|d_t)} = \beta_0 + \beta_1 m_t + \beta_2 d_t \quad (1)$$

$$d_t | b_t \sim N(\beta_0' + \beta_3 A_t + \beta_4 b_t, \sigma^2) \quad (2)$$

where $P(b_t = i|d_t)$ = probability that $b_t = i$ given d_t , $i = 0, 1$; $\beta_1, \beta_2, \beta_3, \beta_4$ = regression coefficients; and $N(\cdot, \sigma^2)$ = normally distributed random variable, with mean (\cdot) and variance σ^2 .

10. The intuition can also be shown to persist in a model where the firms are not symmetric. The firm with small $|\bar{I}|$ will generally not brand in equilibrium, while a firm with large $|\bar{I}|$ is more likely to brand. Note that in practice a "cannibalization" might explain why firms are less likely to brand a product introduced into a market where it sells another product (see Albion 1983). Cannibalization (wherein customers for the new product are those who would otherwise have bought another of the firm's products) is an example of feedback effects that are not considered formally in our theoretical model. For analytic simplicity, we chose to ignore the (feedback) effects branding a new product can have on the profits of established products, presuming these effects to be of second-order importance. (Also see n. 15 below.)

11. The nine firms are Seagrams, Publicker, Schenley, Stitzel Warner, Fleischman, Hiram Walker, Glenmore, Heublein, and National Distillers.

The likelihood function (L) that we maximize is¹²

$$L = \prod_{t \in B_0} f(b_t = 0, d_t) \prod_{t \in B_1} f(b_t = 1, d_t),$$

where

$$B_i = \{t | b_t = i\} \quad i = 0, 1,$$

$$f(b_t = 0, d_t) = \frac{f(d_t | b_t = 0) f(d_t | b_t = 1)}{f(d_t | b_t = 1) + f(d_t | b_t = 0) \exp(\beta_0 + \beta_1 m_t + \beta_2 d_t)},$$

$$f(b_t = 1, d_t) = f(b_t = 0, d_t) \exp(\beta_0 + \beta_1 m_t + \beta_2 d_t),$$

$$f(d_t | b_t = 0) = [2 \pi \sigma^2]^{-1/2} \exp[-(d_t - \beta'_0 - \beta_3 A_t)^2 / 2\sigma^2]$$

$$f(d_t | b_t = 1) = (2 \pi \sigma^2)^{-1/2} \exp[-(d_t - \beta_0 - \beta_3 A_t - \beta_4)^2 / 2\sigma^2].$$

Our regression estimates, following equations (1) and (2), are as follows:

$$\ln \frac{P(b_t = 1 | d_t)}{P(b_t = 0 | d_t)} = .69 - \frac{1.5}{(1.2)} m_t - \frac{6.2}{(4.2)} d_t, \quad (1')$$

$$d_t = .14 + \frac{.15}{(.025)} A_t - \frac{.036}{(.034)} b_t, \quad \hat{\sigma}^2 = .012. \quad (2')$$

Estimated standard errors of coefficients are given in parentheses, and $\hat{\sigma}^2$ represents the estimate of the error in equation (2'): Both equations are identified.

Note, first, that all coefficients have the expected sign. They indicate that (1) the smaller the distance a firm locates from its base, the more likely is the firm to brand the new product, *ceteris paribus*; (2) branding is more likely if the brand name is not already employed in the market into which the new product is introduced; (3) a strong brand image will allow a firm to locate further from its base (as is predicted by the logic of conclusion 4); and (4) a firm will locate closer to its base if it brands, *ceteris paribus*, since it is in this case that image costs affect the consumer's decision.

An asymptotic normal test reveals that the coefficients of m_j , d_j , and A_j are significantly different from zero at the 10% level of confidence; the lattermost is significant at the 1% level. Furthermore, a χ^2 -test indicates that the coefficients of m_j and d_j together are significant at the 10% level, whereas the coefficients of A_j and b_j together are significant at the 1% level.

12. The PRAXIS subroutine was employed to maximize the likelihood function. The LINV2F subroutine from the IMSL Library at the University of Michigan was used to invert the Hessian matrix of the log likelihood function.

Our empirical results, then, offer support for the basic logic that underlies our theoretical model.¹³ However, there are a number of caveats that we are compelled to make. First, the simple equilibrium model described in Section II contains some strong and restrictive assumptions. For example, the equilibrium concept assumes that firms move simultaneously or can costlessly reposition their products (and associated images). To the extent that this assumption is not valid, our theoretical model must be revised (perhaps along the fruitful lines of Prescott and Visscher [1977]) and the interpretation of our empirical findings reevaluated. The same is true of our empirical results if the markets we observe are not in equilibrium.

Second, we have ignored the firm's initial entry decision. To the extent that the firm's branding and location decisions vary systematically with the initial decision of whether or not to enter a market, our model does not capture the complete calculus of the firm. Furthermore, we have modeled the firm's decision as if its brand name were already established when it develops a new product, and as if the two actions are independent. In fact, our data points might represent realizations of a long-term strategy of the firm, whereby the firm simultaneously chooses a branding strategy and a sequence of future product innovations.¹⁴

One other point warrants mention. Our theoretical model neglects the possibility that the branding and location decisions of a firm in the new market might affect its profits in those markets where its brand name is already established. Apart from cases where the new product replaces the old one, such "feedback" effects are quite possible and may be influencing our empirical results. Our attempts to capture this phenomenon in our estimating equations, though, were not successful.¹⁵

13. We should also note that the magnitude and significance of our estimated coefficients were largely unaltered when additional variables of theoretical interest were added to the estimating equations. As an example, we included a variable in eq. (1) that captured the advertising intensity of other firms in the new market relative to the intensity with which the firm in question advertised in the past. Our hypothesis was that a firm would be more likely to brand its new product to gain consumer recognition (i.e., reduce image costs) when other firms advertised relatively heavily. The coefficient of this variable was insignificant, and its introduction did not substantially alter the estimates reported above.

14. As noted in Sec. III, our sample selection procedure was designed to avoid this potential pitfall.

15. We introduced a term in eq. (1') that is the product of A and d . Our hypothesis was that firms with a strong brand image (large A) would be less likely than others to "risk" their valuable asset by branding a new product, unless the new product was "very consistent" with the firm's image (i.e., unless d were very small). While there was some support for this hypothesis, other coefficients took on the wrong sign when the interaction term was introduced and the overall significance of our model declined.

V. Conclusions

Our attempt was to develop and test a simple model of the branding decisions of firms. We extended Hotelling's (1929) model of spatial competition to the case of experience goods where duopolists compete sequentially and myopically in two markets, and where past actions (advertising and location) affect current decisions (branding and location). The conclusions of our empirical model lent support to the basic logic underlying the equilibrium results derived in our theoretical model.

A number of extensions along both theoretical and empirical lines suggest themselves. First, both the nonlinear models mentioned in Section II and oligopoly models in which there are more than two firms warrant investigation. We should note, though, that the results in our model are not as sensitive to the number of firms as are the conclusions in Hotelling's model. In particular, equilibria may exist with many firms in our setting though they will not in Hotelling's (see Eaton and Lipsey 1975).

A second extension would model formally the firms' advertising and pricing decisions, analyzing the interactions between these variables and branding and "location" decisions. A third extension would formulate estimating equations in which the anticipated reactions of rivals are captured explicitly.

In closing we note that by choosing our model along the lines suggested by Hotelling, we have avoided the difficult but interesting question of how brand names are actually perceived and processed by the consumers in the course of their purchasing decisions. A better understanding of this process would, in turn, be likely to improve our understanding of the branding decisions of firms.

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