Generic and Brand Advertising in Markets with Product Differentiation

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Abstract

In this paper, we analyze how generic advertising affects brand advertising and firm profits in differentiated oligopoly markets. We show that in the Crespi (2007) model only the high quality firm will use brand advertising when differentiation is vertical. We also demonstrate that when differentiation is horizontal, the equilibrium is likely to be more symmetric in terms of firm profits, spending on brand advertising, and firm response to generic advertising. Finally, we point out that generic advertising will increase expenditures on brand advertising when firms play a supermodular game. The results confirm that there are many reasons why generic advertising may increase firm spending on brand advertising.

KEYWORDS: generic advertising, vertical differentiation, horizontal differentiation, supermodular games

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1. Introduction

Although there is an extensive body of work on the economics of advertising, most of this research focuses on brand advertising in imperfectly competitive markets. Previous work has considered markets with differentiated products, whether real or subjective, and has clearly developed models to explain the mechanism by which advertising affects consumer choice. That is, advertising may change tastes through persuasive means or provide consumers with useful information that reduces the search cost of finding a brand with desirable characteristics. It may also serve as a complement to output by creating a desirable image or by raising the social status of the product. This body of work explains and predicts how brand advertising might affect firm behavior and the welfare of society.¹

Research on the economics of generic commodity advertising and its relationship to brand advertising has just begun. Generic advertising is common in markets for agricultural products, where producers frequently cooperate to supply a joint advertising campaign. Such campaigns are commonly financed through an institutional structure known as a commodity checkoff program that imposes a mandatory assessment on producers in the form of a sales or per-unit tax.² Marketing boards within the program develop and promote advertising campaigns designed to emphasize the universal characteristics of the product and increase market demand. When products are perfectly homogeneous, such mandatory programs avoid the free-rider problem associated with the public nature of generic advertising and distribute program benefits equitably among producers.³

In markets with commodity checkoff programs, it is becoming more and more common for major producers to use brand advertising to differentiate their products. This raises questions about the relationship between generic and brand advertising. It also provides one reason for lawsuits by almond, peach, mushroom, plum, beef, and pork producers over mandatory generic advertising programs (Chakravarti and Janiszewski, 2004). In these markets, some producers that have differentiated their brands oppose mandatory programs because they fear that generic advertising provides a disproportionate benefit to non-branded producers. This can occur, for example, if generic advertising causes consumers to believe that branded and non-branded goods are of like quality. If true, such inequalities

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¹ See Bagwell (2005) for an excellent review of the literature on brand advertising, and see Stivers and Tremblay (2005) for a review of the welfare effect of brand advertising.
² Most assessments are based on a per-unit basis and constitute less than 1 percent of the dollar value of the good (Ward, 2006).
are a concern to marketing boards, as one of their goals is to assure that generic advertising produces an equitable distribution of benefits among producers (Ward, 2006).

These issues have motivated a series of recent theoretical papers on the economics of generic and brand advertising. Notable examples include the research by Crespi and Marette (2002), Hunnicutt and Israelsen (2003), Bass et al. (2005), and Crespi (2007).

Although the theoretical models developed in these papers make important contributions to our understanding of generic and brand advertising, they either analyze limiting cases or make substantive errors. Hunnicutt and Israelsen (2003) develop a useful model of generic and brand advertising in a monopolistically competitive industry. Their model clearly shows how the free-rider problem associated with firm advertising diminishes with product differentiation and demonstrates that the industry’s optimal level of generic advertising diminishes when products become more differentiated.

The main limitation of the Hunnicutt and Israelsen model is that the type of product differentiation characterized by monopolistic competition is not always consistent with that found in agricultural and other food markets. It assumes that consumer preferences are symmetric and that one brand is an equally good substitute for any other brand. Archibald and Rosenbluth (1975) argue that this type of differentiation is most likely to occur in markets where the characteristic space is very large. In agricultural and food markets, however, brands compete on a limited number of characteristics. These might include quality (e.g., premium versus generic brands of bananas, almonds, soft drinks, etc.) or a simple taste characteristic (e.g., sweet versus tart apples). In addition, because product demand does not derive directly from consumer utility functions, the model does not explain why consumers respond to advertising.

The paper by Bass et al. (2005) uses optimal control methods to analyze the effects of generic and brand advertising in a duopoly market. Each firm sets its price, generic advertising level, and brand advertising level. Although they ignore checkoff programs, their model shows that generic advertising suffers from the free-rider problem and that a stronger firm is more likely to invest in generic advertising. This result is consistent with the U.S. brewing industry, for example, where the industry leader, Anheuser-Busch, began investing in generic advertising in 2006 once its market share approached 50 percent (Modern Brewery Age Weekly, 2006). Their model also predicts that a firm’s market share

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4 For a discussion of the type of product differentiation found in monopolistically competitive models, see Beath and Katsoulacos (1991).
5 As Bagwell (2005, p. 3) indicates, “An economic theory of advertising can proceed only after this question is confronted.” For example, advertising might lower consumer search costs or change consumer tastes.
is primarily determined by brand advertising. Like Hunnicutt and Israelsen, the Bass et al. model does not explain why consumers respond to advertising. It is also of limited use when analyzing issues important to agricultural markets because the model assumes that commodity checkoff programs do not exist and that the effects of generic and brand advertising are separable.

The papers by Crespi and Marette (2002) and by Crespi (2007) are related, so we discuss them together. Both start with models of consumer preferences, which explicitly show how generic and brand advertising affect utility (by changing tastes through persuasion) and formally characterize product differentiation as being vertical (i.e., there are real and subjective quality differences between brands). Firms play a three-stage game: (I) a marketing board sets the assessment rate,\(^6\) (II) firm(s) choose brand advertising levels, and (III) firms choose prices. Backwards induction is used to identify the sub-game perfect Nash equilibrium. In the Crespi and Marette model, the goal of the marketing board is to choose an assessment rate (or the level of generic advertising) to maximize industry profits. The model assumes that a single high quality firm uses brand advertising; all other firms produce homogeneous goods of low quality and cannot use brand advertising.

In the more recent model by Crespi, there are two firms, one with a high and the other with a low quality brand, and both can use brand advertising. To facilitate comparative static analysis in the recent Crespi model, firms are assumed to have no control over the assessment rate (\(g\)). The models in both papers demonstrate that generic advertising may influence subjective product differentiation and benefit the low quality firm(s) more than the high quality firm. This is an important result that is consistent with concerns raised by many brand name producers of agricultural products about the adverse effects of generic advertising.

In spite of their contributions, however, the Crespi and Marette and the Crespi models also have weaknesses. The Crespi and Marette model assumes that low quality producers cannot use brand advertising, a constraint that does not generally exist in real world markets and an assumption that may or may not be consistent with optimal behavior.

Although this constraint is relaxed in the more recent Crespi paper, the new model contains an error that incorrectly implies that the low quality firm will choose a positive level of brand advertising (i.e., \(B_2^* > 0\)). Specifically, Crespi misinterpreted this firm’s first-order condition with respect to advertising (equation 6), which must always be negative, implying that the low quality firm will never use brand advertising (i.e., \(B_2^* = 0\)). Thus, the equilibrium will be

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\(^6\) Because the level of generic advertising (\(G\)) is defined as the assessment rate (\(g\)) times total industry output, determining the optimal \(g\) also determines the optimal \(G\) at the Nash equilibrium level of output.
asymmetric, with only the high quality firm investing in brand advertising, a standard result in models of vertical product differentiation and brand advertising (e.g., Tremblay and Martins-Filho, 2001; Tremblay and Polasky, 2002). The reader can obtain the correct comparative static results by setting $\partial B_2^*/\partial g = 0$ in equations (8) through (12) of the Crespi paper. Nevertheless, the main conclusions of Crespi’s paper still hold. Namely, when differentiation is vertical, generic advertising can benefit both firms if generic advertising has no effect on product differentiation but may harm the high quality firm if it diminishes product differentiation.

What is missing from the literature is a model of generic and brand advertising in markets where differentiation is horizontal, which may be more appropriate in many agricultural markets. In the sections to follow, we develop such a model and show how the notion of supermodularity provides insight into the relationship between generic and brand advertising.

2. A Duopoly Model with Horizontal Differentiation

Consider a market with two firms (1 and 2) that produce products that are horizontally differentiated, described by a simple linear-city or address model (Hotelling, 1929; d’Aspremont et al., 1979). Brands 1 and 2 differ in a single horizontal characteristic, $\theta \in [\theta_1, \theta_2]$ and $0 \leq \theta_1 < \theta_2 \leq 1$. There are $N$ consumers with preferences identified by $\theta$ who are uniformly distributed over the interval $[0, 1]$. A consumer’s ideal level of $\theta$ identifies the consumer’s type or location. Unlike the case with vertical differentiation, consumers disagree over which value of a product’s $\theta$ is ideal or most preferred.

The market for breakfast cereal provides one example where there are real horizontal differences among brands. To illustrate, consider a market with just two brands, unsweetened corn flakes (brand 1, located at $\theta_1 = 0$) and sweetened corn flakes (brand 2, located at $\theta_2 = 1$). If the price of good 1 ($P_1$) equals the price of good 2 ($P_2$), then consumers who prefer a sweeter cereal (with preference locations $\frac{1}{2} < \theta < 1$) will prefer brand 2 and consumers who prefer a cereal that is less sweet (with preference locations $0 \leq \theta < \frac{1}{2}$) will prefer brand 1.

The premium cola market provides a good example of a market where horizontal differentiation is subjective or perceived. Following Tremblay and Polasky (2002), assume two brands, Coke (brand 1) and Pepsi (brand 2). An important horizontal characteristic appears to be youth appeal, which is nonexistent without advertising. Let $\theta$ index the degree of youth appeal, where $\theta_1$

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7 Crespi and Marette (2003) develop a model of generic advertising in agricultural markets when differentiation is horizontal, but their model does not include brand advertising.
8 To aid comparison, we use the same notation as Crespi (2007), except that $\theta$ is now a horizontal rather than a vertical taste parameter.
\[ \theta_2 = \frac{1}{2} \] when firms do not advertise. In this setting, firms face the Bertrand paradox where Nash prices are competitive and profits are zero. To avoid this paradox, Coke developed a marketing theme that emphasizes family values, lowering \( \theta_1 \), while Pepsi promoted a theme that appeals to a more rebellious consumer, raising \( \theta_2 \). As long as the benefits from the reduction in price competition, resulting from the creation of subjective differentiation, exceed the cost of advertising, firms will use advertising in this way to create subjective horizontal differentiation.

In agricultural markets, horizontal differentiation may exist when one brand is organic and the other is not. Although many consumers may prefer organic foods, others may prefer non-organic foods. The latter group may not believe that organic foods are superior and may be concerned that organic brands are linked to a liberal, environmental image to which they prefer not to identify.\(^9\) Thus, the presence of organic and non-organic brands creates horizontal differentiation over an environmental characteristic. In such a market, generic advertising may exist to boost market demand, while individual firms use brand advertising to create a pro- or anti-organic/environmental image. Examples of agricultural products with both marketing orders and differentiation that is primarily horizontal include table grapes, peaches, plums, and nectarines that can differ in color, sweetness, or intended use (eating fresh versus making preserves).

In order to link advertising to consumer utility as well as to demand, we begin by describing consumer preferences in a horizontally differentiated market. In the linear city model, the indirect utility function for a particular consumer who is considering brand \( i \) is

\[ V_i = y - P_i - t d_i, \]

where \( y \) is consumer income, \( P_i \) is the price of brand \( i \), and \( t > 0 \) is the disutility associated with purchasing a brand that is less than ideal. The \( d_i \) parameter is the distance between the consumer’s ideal brand (i.e., the consumer’s location or type) and the \( \theta \) associated with brand \( i (\theta_i) \). In the Coke and Pepsi example, \( d_1 \) (Coke) will be large relative to \( d_2 \) (Pepsi) for more rebellious consumers.

Demand depends on consumer preferences, income, product characteristics, and market prices. To simplify derivation of the demand functions, we assume that consumers have unit demands and that the market is covered (i.e., income is sufficiently high, and each consumer buys one unit of either brand 1 or brand 2). Demand for each brand depends on the location of the marginal consumer \( (\theta_M) \), located where \( V_1(\theta_M) = V_2(\theta_M) \). Assuming that a firm’s horizontal

\(^9\) Similarly, in the early 1990s Anheuser-Busch created a blue-collar image for its Budweiser brand of beer, while Coors created a white-collar image for its flagship brand (Tremblay and Tremblay, 2005).
\(^10\) For a discussion of this issue, see the web page of The Food Standards Agency (www.food.gov.uk).
location is arbitrary and that $0 \leq \theta_1 \leq \frac{1}{2} \leq \theta_2 \leq 1$, the marginal consumer is defined as

$$\theta_M = \left[ t(\theta_1 + \theta_2) - P_t + P_2 \right]/2t.$$  \hfill (1)

With $N$ consumers located within the preference interval, the demand functions are

$$D_1 (P_1, P_2, \theta_1, \theta_2) = Nd_1 = N(\theta_M - \theta_1) = N \left[ t(\theta_2 - \theta_1) - P_t + P_2 \right]/2t,$$  \hfill (2)

$$D_2 (P_1, P_2, \theta_1, \theta_2) = Nd_2 = N(\theta_2 - \theta_M) = N \left[ t(\theta_2 - \theta_1) + P_t - P_2 \right]/2t.$$  \hfill (3)

In this model, $\theta_2$ and $\theta_1$ represent each brand’s perceived or subjective location. Without brand advertising $\theta_2 = \theta_1 = \frac{1}{2}$ (i.e., there is no product differentiation).\footnote{We could have also assumed that $\theta_i$ consisted of a real and a perceived component, which would have complicated the model without adding any important insights.} We assume that firm $i$’s brand advertising ($B_i$) can increase the subjective horizontal differentiation of its brand through persuasive means, such that $\partial \theta_1/\partial B_1 < 0$ and $\partial \theta_2/\partial B_2 > 0$.$^{12}$ Generic advertising is assumed to have an informative and a persuasive component. At least one expert supports the informative viewpoint (Ward, 2006, p. 55), stating that “Generic advertising is all about information – information about a specific commodity and its underlying characteristics.” The informative component is assumed to attract new customers to the market, $\partial N/\partial g > 0$. This can occur, for example, if the market consists of two sets of people: (1) those who know of a product’s existence and (2) those who do not know of a product’s existence (e.g., an unusual fruit such as lychee). If consumers are defined as informed people, the market could be covered in that each consumer purchases one or another brand of lychee. The informative component of generic advertising then attracts new people to the market, increasing $N$.

Crespi (2007) makes a strong case that generic advertising may also have a persuasive component. At issue is the effect of generic advertising on each firm’s brand advertising and profit levels under two scenarios.$^{14}$

\footnote{We assume that second-order conditions hold, $\partial^2 \theta_1/\partial B_1^2 > 0$ and $\partial^2 \theta_2/\partial B_2^2 < 0$. This implies diminishing returns to brand advertising.}

\footnote{Even the popular “Got Milk” ads, which are designed primarily to capture attention, provide some information. For example, in magazine ads Batman states that “milk’s 9 essential nutrients” give him strength; Superman says that calcium in milk makes strong bones; the recording artist, Alondra, says that “Milk provides potassium, minerals, and vitamins needed for growth.”}

\footnote{A third scenario is also possible, one where $g$ increases horizontal differentiation (i.e., $\partial \theta_2/\partial g - \partial \theta_1/\partial g > 0$). As this is a non-issue with generic advertising, we ignore this case. If $g$ were to increase product differentiation, whether differentiation is vertical or horizontal, both firms would benefit from and support commodity checkoff programs.}
Scenario 1: Generic advertising attracts new customers but has no effect on subjective horizontal differentiation. Thus, $\partial N/\partial g > 0$; $\partial \theta_2/\partial g - \partial \theta_1/\partial g = 0$.

Scenario 2: Generic advertising attracts new customers and decreases subjective horizontal differentiation. Thus, $\partial N/\partial g > 0$; $\partial \theta_2/\partial g - \partial \theta_1/\partial g < 0$.

In order to focus on strategic issues, we specify simple firm cost functions. Costs include only marketing expenditures; unit production costs are assumed to be the same for both firms and are normalized to 0. Given the degree of symmetry in the model, we can write the profit equation for firm $i = 1, 2$ as

$$\pi_i = (P_i - g)Q_i - B_i$$

where the firm's output $Q_i \equiv D_i$. Firms are assumed to play a three-stage game. In the first stage, the marketing board sets $g$. In the second stage, firms compete in brand advertising. In the final stage, they compete in price. Firms are assumed to have perfect and complete information. That is, each firm knows the profits of each player, the history of play, and structure of the game (Gibbons, 1992).

We use backwards induction to obtain the sub-game perfect Nash equilibrium to the game, which produces a Nash equilibrium in each sub- or stage-game. At each stage, we assume that a unique equilibrium exists. Working backwards, the Nash equilibrium prices and profits in the final stage are

$$P_1^* = t\left(\theta_2 - \theta_1\right) + g,$$

$$P_2^* = t\left(\theta_2 - \theta_1\right) + g,$$

$$\pi_1^* = \frac{1}{2}Nt(\theta_2 - \theta_1)^2 - B_i,$$

$$\pi_2^* = \frac{1}{2}Nt(\theta_2 - \theta_1)^2 - B_2.$$  

Notice that in the limit as $\theta_1$ approaches $\theta_2$, the degree of product differentiation diminishes and the Nash equilibrium approaches simple Bertrand, where price equals marginal cost and profits are zero.

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15 Thus, price in this model can be thought of as the markup of price over the marginal cost of production.

16 Because we are only interested in comparative static analysis and not in obtaining a closed form solution, the objective of the marketing board is ignored. This is consistent with Crespi (2007).
With perfect and complete information, firms are able to look forward and reason back to forecast Nash prices and profits in the final stage of the game. Given this information, the first-order conditions in the second stage are

\[
\frac{\partial \pi_1^*}{\partial B_1} = N t (\theta_1 - \theta_2) \frac{\partial \theta_1}{\partial B_1} - 1 = 0, \tag{9}
\]

\[
\frac{\partial \pi_2^*}{\partial B_2} = N t (\theta_2 - \theta_1) \frac{\partial \theta_2}{\partial B_2} - 1 = 0. \tag{10}
\]

Unlike the case with vertical differentiation, both firms will use brand advertising in a horizontally differentiated market as long as the marginal benefits from advertising are sufficiently high.\(^{17}\) Furthermore, if each firm has equally effective brand advertising (i.e., \(\frac{\partial \theta_2}{\partial B_2} = -\frac{\partial \theta_1}{\partial B_1}\)), then the level of brand advertising will be the same for both firms. This is consistent with the outcome in the market for premium cola, where the amount of advertising spending by Coke and Pepsi is nearly the same (Tremblay and Polasky, 2002).

Analyzing the effect of generic advertising on the optimal level of brand advertising (\(B^*\)) is more complex when differentiation is horizontal rather than vertical, because both firms advertise in the horizontal case. Given the structure of the game and the fact that both firms advertise, the first-order conditions with respect to brand advertising are interdependent. Under these conditions, comparative static results are derived by implicitly differentiating both first-order conditions with respect to \(g\) and then applying Cramer’s rule.\(^{18}\) This produces the following comparative static results:

\[
\frac{\partial B_1^*}{\partial g} = \frac{\begin{vmatrix} -\pi_{1g} & \pi_{12} \\ -\pi_{2g} & \pi_{22} \end{vmatrix}}{|\Pi|} = \frac{-\pi_{1g} \pi_{22} + \pi_{2g} \pi_{12}}{|\Pi|}, \tag{11}
\]

\(^{17}\) Notice that the marginal benefits are positive for both firms. For firm 1, \(N\) and \(t\) are positive, while \((\theta_1 - \theta_2)\) and \(\frac{\partial \theta_1}{\partial B_1}\) are negative. For firm 2, \(N, t, (\theta_2 - \theta_1)\), and \(\frac{\partial \theta_2}{\partial B_2}\) are positive.

\(^{18}\) Because \(B_2^*\) is constant and equal to zero when differentiation is vertical, there are no interaction effects. Thus, one can simply apply the implicit-function theorem to firm 1’s first-order condition alone to obtain \(\frac{\partial B_1^*}{\partial g}\) in the vertical differentiation case. For a discussion of comparative static techniques when both optimization and (Nash) equilibrium conditions hold, as is the case with horizontal differentiation, see Bulow et al. (1985) and Baldani et al. (2005, Chapter 6).
For notational convenience, we define \( \pi_{ij} \) to equal the second derivative of firm \( i \)'s profit function with respect to \( B_i \) and variable \( j \).\(^{19}\) For the Nash equilibrium to be stable, the determinant of matrix \( \Pi \) must be positive. Thus, the

\[
\text{sign } \frac{\partial B_2^*}{\partial g} = \text{sign} \left( -\pi_{1g} \pi_{22} + \pi_{2g} \pi_{12} \right),
\]

(13)

\[
\text{sign } \frac{\partial B_1^*}{\partial g} = \text{sign} \left( -\pi_{11} \pi_{2g} + \pi_{1g} \pi_{12} \right).
\]

(14)

For the second-order conditions of profit maximization to hold, \( \pi_{11} \) and \( \pi_{22} \) must be negative. Because \( \partial \theta_1/\partial B_1 < 0 \) and \( \partial \theta_2/\partial B_2 > 0 \) in this model, \( \pi_{12} \) and \( \pi_{21} \) are positive. This implies that \( B_1 \) and \( B_2 \) are strategic complements (Bulow et al., 1985), such that an increase in \( B_i \) increases the marginal returns to \( B_j \) and causes \( B_j^* \) to increase.

Given these conditions, the signs of \( \partial B_1^*/\partial g \) and \( \partial B_2^*/\partial g \) are determined by the sign of \( \pi_{ig} \), which depends upon how generic advertising affects demand. Under scenario 1, generic advertising attracts new consumers (i.e., \( \partial N/\partial g > 0 \)) but has no effect on horizontal differentiation (i.e., \( \partial \theta_2/\partial g - \partial \theta_1/\partial g = 0 \)). In this case,

\[
\pi_{ig} \equiv \frac{\partial^2 \pi_i}{\partial g \partial B_i} = t \left( \theta_i - \theta_j \right) \frac{\partial \theta_i}{\partial B_i} \frac{\partial N}{\partial B_i} > 0.
\]

(15)

Thus, generic advertising increases the brand advertising of both firms.\(^{20}\) This and Crespi’s (2007) results demonstrate that generic advertising can increase brand advertising without reducing vertical or horizontal product differentiation.

Comparative static analysis is more complex under scenario 2, where generic advertising attracts new customers (\( \partial N/\partial g > 0 \)) and reduces horizontal differentiation (\( \partial \theta_2/\partial g - \partial \theta_1/\partial g < 0 \)). In this case,
As discussed previously, the first set of terms on the right hand side of equations (16) and (17) are positive. The second set of terms are negative, however, and the signs of the third set of terms are unknown. Thus, generic advertising may raise or lower brand advertising under scenario 2. If generic advertising and brand advertising are strategic complements, however, the third set of terms will be positive and sufficiently large so that both $\pi_{ig}$ and $\partial B^*_j / \partial g$ are positive. This means that under scenario 2, generic advertising will lead to an increase in brand advertising when it sufficiently raises the marginal effectiveness of brand advertising.

Next, we explore the effect of generic advertising on each firm’s profit function that is anticipated from the second-stage of the game ($\pi^{**}$). Given that profits are similar for both firms, we can write the comparative static effect generally as

$$
\frac{\partial \pi^{**}}{\partial g} = \frac{1}{2} t (\theta_j - \theta_i)^2 \frac{\partial N}{\partial g} + N t (\theta_j - \theta_i) \left[ \frac{\partial \theta_j}{\partial B^*_j} \frac{\partial B^*_j}{\partial g} + \frac{\partial \theta_j}{\partial g} \frac{\partial B^*_j}{\partial g} - \frac{\partial \theta_i}{\partial g} \right] \frac{\partial B^*_i}{\partial g}.
$$

Assuming the first-order conditions hold, this simplifies to

$$
\frac{\partial \pi^{**}}{\partial g} = \frac{1}{2} t (\theta_j - \theta_i)^2 \frac{\partial N}{\partial g} + N t (\theta_j - \theta_i) \left[ \frac{\partial \theta_j}{\partial B^*_j} \frac{\partial B^*_j}{\partial g} + \frac{\partial \theta_j}{\partial g} \frac{\partial B^*_j}{\partial g} - \frac{\partial \theta_i}{\partial g} \right].
$$

Under scenario 1, the profits of both firms will increase with generic advertising. With complete symmetry, where the brand advertising of each firm is equally effective at creating subjective differentiation and the effect of generic advertising on the amount of brand advertising is the same for both firms, the

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21 This result is driven by the fact that $\partial N/\partial g$ is always be positive by assumption, implying that the optimal value of $g$ is infinite. In the real world, there will be an upper bound on $N$, and firm profits will reach a maximum at the value of $g$ that just reaches this maximum $N$. 

http://www.bepress.com/jafio/vol5/iss1/art6
effect of \( g \) on profits will be the same for both firms. Under scenario 2, the effect is indeterminate, because \( \partial B_j^*/\partial g \) may be positive or negative and because \((\theta_j - \theta_i) \cdot (\partial \theta_j/\partial g - \partial \theta_i/\partial g) < 0\).

Given the degree of symmetry inherent in this model, generic advertising is more likely to have a symmetric effect on the brand advertising and profits of each firm when differentiation is horizontal rather than vertical. An asymmetric result can occur with horizontal differentiation, however, if generic advertising induces one firm to use more brand advertising than the other firm. In this case, the heavy advertiser will have relatively lower profits, because both firms benefit equally from brand advertising that increases horizontal differentiation but only one firm pays for it. It could also occur if generic advertising attracts relatively more consumers who favor one brand, say brand 2 (i.e., it skews the distribution toward \( \theta_2 \)), generating relatively greater gains for firm 2. This outcome would be of obvious concern to firm 1 and may motivate legal action to eliminate mandatory checkoff programs.

3. Generic and Brand Advertising in a Supermodular Setting

An alternative way to analyze the relationship between generic and brand advertising in an oligopoly setting is to assume that firms play a supermodular game. As the analysis above indicates, the effect that generic advertising has on brand advertising depends critically on whether or not one agent’s advertising raises the marginal returns of another agent’s advertising. When the effect is positive, these choice variables are strategic complements, a critical feature of a supermodular game. In a supermodular setting, comparative static results emerge from a relatively general model, even when the assumptions of the implicit function theorem do not hold (Milgrom and Roberts, 1990; Milgrom and Shannon, 1994; Shannon 1995; Vives, 1999).

To illustrate, consider the case of a smooth supermodular game where best reply functions are differentiable.\(^{22}\) Firms compete in a two-stage game. In the first stage, a marketing board sets generic advertising (\( g \)). In the second stage, two or more firms in a market compete by simultaneously choosing price (\( P \)) and brand advertising (\( B \)). For the game to be supermodular, the following assumptions must hold for each firm \( i = 1, 2, 3, \ldots \) and each of its rivals, indexed by \( j \) (Milgrom and Roberts, 1990, p. 1264).

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\(^{22}\) Alternatively, instead of smooth functions one could assume that best-replies are complete lattices without affecting the main conclusions, as discussed in Milgrom and Roberts (1990), Milgrom and Shannon (1994), and Vives (1999).
(A1) **Bounded Strategies:** $P_i$ and $B_i$ each lie within a closed interval where $\{P_i \mid 0 < P_{IL} \leq P_i \leq P_{IH} < \infty \}$ and $\{B_i \mid 0 < B_{IL} \leq B_i \leq B_{IH} < \infty \}$.

(A2) **Differentiability of the Profit Equation:** Firm $i$’s profit ($\pi_i$) equation is twice continuously differentiable with respect to $P_i$ and $B_i$.

(A3) **Complementary Strategies:** $\frac{\partial^2 \pi_i}{\partial P_i \partial B_i} \geq 0$.

(A4) **Strategic Complementarity Strategies:** $\frac{\partial^2 \pi_i}{\partial P_i \partial P_j} \geq 0$, $\frac{\partial^2 \pi_i}{\partial P_i \partial B_j} \geq 0$, $\frac{\partial^2 \pi_i}{\partial B_i \partial P_j} \geq 0$, and $\frac{\partial^2 \pi_i}{\partial B_i \partial B_j} \geq 0$.

(A5) **Complementary Exogenous Variable:** $\frac{\partial^2 \pi_i}{\partial P_i \partial g} \geq 0$ and $\frac{\partial^2 \pi_i}{\partial B_i \partial g} \geq 0$.

The key assumptions are A3-A5. When strictly positive, A3 implies that $P_i$ and $B_i$ are complements in the demand function, which assures that there are increasing differences or increasing marginal returns between the pair of firm $i$’s strategies ($P_i$ and $B_i$). This means that an increase in $P_i$ ($B_i$) causes the optimal value of $B_i$ ($P_i$) to increase. When the restrictions in A4 are strictly positive, the best reply functions have a positive slope with respect to a firm’s own and its rival’s strategies. In other words, the pairs of strategies $P_i-P_j$, $P_i-B_j$, $B_i-P_j$, and $B_i-B_j$ are strategic complements. When the restrictions in A5 are strictly positive, there are increasing marginal returns between the exogenous variable $g$ and each strategic variable of firm $i$, $P_i$ and $B_i$.

When these assumptions hold, Milgrom and Roberts prove that the game will have at least one Nash equilibrium. Assuming a unique solution and that strict inequalities hold for A3-A5, they also prove that an increase in the exogenous variable $g$ will cause Nash equilibrium prices ($P^*$) and brand advertising ($B^*$) to increase for each firm (Milgrom and Roberts, 1990, Theorem 6). This result holds for a discrete as well as a continuous change in $g$, in markets with one or more firms, and in markets with homogeneous or differentiated goods.

The Milgrom-Roberts theorem is driven by the fact that the market exhibits super-complementarity. That is, assumptions A3-A5 imply that the exogenous variable and all strategic variables in the model are complements. Because of increasing marginal returns, an increase in generic advertising causes $P_i^*$ ($B_i^*$) to increase. The increase in $P_i^*$ ($B_i^*$) in turn causes $B_j^*$ ($P_j^*$) to rise because the firm’s own choice variables are complements (A3). It also causes $P_j^*$ and $B_j^*$ to increase for all $j$ because rival choice variables are strategic complements (A4). Finally, this causes a chain of feedback effects: the resulting increases in $P_j^*$ and $B_j^*$ cause further increases in $P_i^*$ and $B_i^*$, etc. Because all of these direct and indirect effects work in the same direction, an increase in $g$ will cause the Nash level of brand advertising to unambiguously increase for each firm.

The recent claim that generic advertising has forced some producers to respond by increasing their brand advertising raises questions concerning the motivation for this response. According to Supreme Court testimony in a case involving tree fruit, one high quality producer claims to have increased brand
advertising in order to undo the negative impact of generic advertising on product
differentiation (Glickman v. Wileman Brothers & Elliot, 1997; Crespi, 2007). As
Crespi (2007, p. 8) points out, however, this need not be the only reason why
brand advertising increases in response to generic spending. Another possibility is
that and advertisers spend more to take advantage of gains in the marginal
effectiveness of brand advertising produced by generic advertising.23

4. Conclusion

This paper extends previous work and produces several new insights concerning
the relationships between generic advertising and a firm’s brand advertising and
profitability. In a duopoly model with vertical product differentiation, we show
that only the high quality firm will use brand advertising. In this case, generic
advertising is likely to benefit the low quality firm more than the high quality firm
when generic advertising lowers product differentiation and induces the high
quality firm to spend more on brand advertising.

In a duopoly model with horizontal differentiation, we show that both
firms advertise to promote their brands and that a symmetric outcome is more
likely. When this occurs, profits and expenditures on brand advertising will be the
same, and each firm will respond in the same way to an increase in generic
advertising. This suggests that producers will be more likely to be either
uniformly in favor or uniformly opposed to commodity checkoff programs when
differentiation is horizontal. Asymmetries can arise in the horizontally
differentiated model, however, if generic advertising induces one firm to spend
more on brand advertising than the other firm. In this case, the heavy advertiser
will have lower profits. Differences in profits can also occur if generic advertising
increases the demand for one brand relative to that of the other brand.

Finally, we discuss how the relationship between generic advertising and
brand advertising is clear when the structure of the model is supermodular as in
Milgrom and Roberts (1990). That is, generic advertising will induce firms to
spend more on brand advertising when firms play a supermodular game. This
requires that generic and brand advertising are strategic complements, which
occurs when generic advertising increases the marginal returns of brand
advertising. Regardless of the type of differentiation, the results confirm Crespi’s
conjecture that generic advertising may induce firms to spend more on brand
advertising even when generic advertising does not reduce perceived product
differentiation.

23 Unfortunately, the Milgrom and Roberts result is not powerful enough to rule out the possibility
that generic advertising increases brand advertising when the game in not supermodular. Thus,
other explanations are still possible.
Future research might move in two directions. First, our theoretical analysis identifies conditions under which generic advertising will have symmetric and asymmetric effects on brand advertising and firm profits. Future research might focus on empirically estimating these relationships for different horizontally and vertically differentiated industries to determine if model predictions are consistent with the data, as in Crespi and Marette (2002). One could also test whether firms behave as if generic and brand advertising are strategic complements or substitutes, as in Seldon et al. (1993). Second, to date brand advertising has been assumed to be purely persuasive. In future research we plan to analyze the relationship between generic and brand advertising when brand advertising is purely informative, as in the brand advertising model developed by Stivers and Tremblay (2005).

5. References


