Comparison-Advertising and Competition

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Abstract

This paper investigates the market consequences of comparison-advertising. We show that comparison-advertising weakens price competition between brand-producing firms by enhancing the degree of product differentiation in consumer preferences. We also demonstrate that semicollusion intensifies the use of comparison-advertising thereby further weakening price competition.

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1. Introduction

Advertising constitutes a main strategic tool in addition to price. Advertising utilizes a wide variety of media, including direct (junk) mail, newspapers, magazines, radio and television, and more recently, direct electronic messages and the Internet.

Comparison-advertising is defined as one in which the advertised brand and its characteristics are compared with those of the competing brands. Comparison-advertising, whether persuasive or informative, attempts to reduce the value of competing brands relative to the advertised brand.

In this paper we study the effects of comparison-advertising on price competition between two brand-producing firms. The advertising level of each firm monotonically reduces the value of the competing brand compared to the advertised brand. In equilibrium, comparison-advertising by both firms is shown to increase the degree of product differentiation and therefore the local monopoly power of each brand-producing firm.

The intensity of comparison advertising varies among industries and among countries. Advertising of non-Aspirin pain relievers attempts to point out the side-effects of the use of Aspirin. Aspirin producers tend to advertise the usefulness of Aspirin to people who suffer from heart problems compared to non-Aspirin products. Muehling et al. (1990) note that around 40 percent of all advertising is comparative. Others (Pechmann and Stewart 1990, and references) suggest that the majority of all ads are indirectly comparative (60 percent, as opposed to 20 percent that contain direct comparative claims; the rest are noncomparative).

In most industrialized countries, the use of comparison-advertising intensified after the deregulation of the local telecommunication markets, mainly in the market for international phone calls, cellular, and Internet industries, where companies regularly report that consumers will end up paying more for services offered by the competitors. In most countries where comparative advertising is legal, it is closely monitored and regulated by government agencies. Different studies suggest different figures on the relative use of comparison-advertising.

In the United States, no law has ever prevented the use of comparison-advertising. How-

ever, advertisers were reluctant to use it (Boddewyn and Marton 1978). Only in the early 1970s, did television networks begin to broadcast comparison advertisements. Since then, comparison ads have become popular in the printed media as well as in the broadcast media.

The EEC also began to address the issue of comparison-advertising in the late 1970s, suggesting that comparison-advertising should be legal as long as it compares material and verifiable details and is neither misleading nor "unfair."

Section 2 sets up a model of comparison-advertising employed by two brand-producing firms. Section 3 solves for brand prices and the level of comparison-advertising in a non-cooperative equilibrium. Section 4 solves for a semicollusion equilibrium where both firms cooperatively determine the advertising level of each firm, but then set their prices in a noncooperative equilibrium. Section 5 concludes.

2. A Model of Competitive Comparison-Advertising

Consider two firms, indexed by i ($i = 1, 2$), selling two brands of a *potentially* homogeneous product. By potentially homogeneous we mean that, in the absence of comparison advertising, these brands are viewed as identical from consumers' point of view. However, what comparison-advertising does is to "convince" consumers that the brands are differentiated. Thus, our interpretation of comparison-advertising by a brand-producing firm is an investment that convinces consumers that the other brand differs from their "ideal" brand which makes the other brand less valuable.

2.1 Consumers and comparison-advertising

Let p_i denote the price of brand i, and A_i denote the level of comparison-advertising invested by firm i, $i = 1, 2$. Consumer types are uniformly distributed on the interval $[0, 1]$ with density of n consumers per type. Thus, the total number of consumers in this market is n.

The utility of each consumer indexed by x ($0 \leq x \leq 1$) is defined by[1]

$$U_x \overset{\text{def}}{=} \begin{cases} \beta - p_1 - \lambda\sqrt{A_2}\, x & \text{if buys brand 1} \\ \beta - p_2 - \lambda\sqrt{A_1}\,(1-x) & \text{if buys brand 2.} \end{cases} \tag{1}$$

The parameter $\beta > 0$ reflects consumers' basic valuation for the product when there is no advertising.[2] The "location" index number x is the widely used differentiation characteristic parameter of a consumer. However, our modification here is that this differentiation *depends on and varies with* the level of comparison-advertising of the *competing* firm. For example, in the extreme case where both firms do not advertise ($A_1 = A_2 = 0$) the brands are homogeneous. Therefore, the role of comparison-advertising is to inform the user of the competing brand of the precise features that make the competing brand different from the consumer's chosen brand. Thus, a more intensive advertising reduces the utility from consuming the competing brand as it informs the consumer that the competing brand is more "distant" in terms of its characteristics from the consumer's chosen brand. Finally, the parameter $\lambda > 0$ controls the effectiveness of comparison advertising. More precisely, if $\lambda = 0$, the degree of brand differentiation is unaffected by the level of comparison-advertising (in fact, the brands are homogeneous). A higher $\lambda > 0$ implies that comparison-advertising is more effective as it increases the degree of differentiation between the brands from consumers' point of view.

Let $\hat{x}$ denote a consumer type who, given prices and advertising levels, is indifferent between purchasing brand 1 and brand 2. The utility function (1) implies that

$$\hat{x} = \frac{\lambda\sqrt{A_1} - p_1 + p_2}{\lambda\left(\sqrt{A_1} + \sqrt{A_2}\right)}. \tag{2}$$

Therefore, all consumer types indexed by $x \in [0, \hat{x}]$ buy brand 1, and all consumers indexed by $x \in (\hat{x}, 1]$ buy brand 2. Further, (2) reveals that firm 1 can increase its market share by increasing its level of comparison-advertising since it makes brand 2 less attractive. Similarly, firm 2 can increase its market share by increasing A_2. Clearly, the market is equally divided between the two firms if $p_1 = p_2$ and $A_1 = A_2$.

[1] Appendix A analyzes consumers who have the option of not purchasing any brand (i.e., a finite-reservation utility case).

[2] In general, the parameter β should depend on the advertising levels A_1 and A_2. von der Fehr and Stevik (1998) call it the utility enhancing effect of persuasive advertising.

2.2 Brand-producing firms

There are two brand-producing firms located at the ends of the interval $[0, 1]$.[3] Let c denote the unit production cost of each brand-producing firm. Comparison-advertising is costly to firms. We assume that the cost of advertising of level A_i to firm i, is $\phi \cdot A_i$, for $i = 1, 2$, and $\phi > 0$. Therefore, the profit functions of the firms are given by

$$\pi_1 \stackrel{\text{def}}{=} (p_1 - c)n\hat{x} - \phi A_1 = (p_1 - c)n\frac{\lambda\sqrt{A_1} - p_1 + p_2}{\lambda\left(\sqrt{A_1} + \sqrt{A_2}\right)} - \phi A_1 \tag{3a}$$

$$\pi_2 \stackrel{\text{def}}{=} (p_2 - c)n(1 - \hat{x}) - \phi A_2 = (p_2 - c)n\frac{\lambda\sqrt{A_2} + p_1 - p_2}{\lambda\left(\sqrt{A_1} + \sqrt{A_2}\right)} - \phi A_2. \tag{3b}$$

2.3 Timing and interaction

The two firms interact according to the following two-stage game: In Stage I, each brand-producing firm i sets its advertising level, A_i In Stage II, each firm sets its price p_i. We solve for a subgame-perfect equilibrium (SPE) for this game where the objective of each firm is to maximize its profit level, (3a) and (3b), respectively.

3. Market Competition in Prices and Comparison-Advertising

We solve this game backwards beginning with stage II (price competition stage). Each profit function π_i is strictly concave with respect to p_i. The first-order conditions yield the price best-response functions $p_i = (\lambda\sqrt{A_i} + c + p_j)/2$, for $i, j = 1, 2$ and $i \neq j$. The best-response functions reveal that the price actions are strategically complements (each firm increases its price in response to an increase of the rival firm's price). Also, each best response function shifts upward with an increase in its level of the comparison-advertising. Solving the two best-response functions yields the stage II equilibrium prices given by

$$p_1 = \frac{2\lambda\sqrt{A_1} + \lambda\sqrt{A_2}}{3} + c \quad \text{and} \quad p_2 = \frac{\lambda\sqrt{A_1} + 2\lambda\sqrt{A_2}}{3} + c. \tag{4}$$

Equation (4) reveals that the markup (the amount by which the price exceeds unit production cost) depends only on the levels of the comparative advertising of both firms. More

[3] In view of the utility function (1) this does not imply that the brands are differentiated since $A_1 = A_2 = 0$ implies that the brands are homogeneous from consumers' point of view.

precisely, if both firms do not advertise, consumers view the two brands as identical homogeneous products which means that price competition results in unit-cost pricing and zero profits. Thus, comparison-advertising relaxes price competition by making the brands more differentiated.

Substituting (4) into the profit functions (3a) and (3b) yield

$$\pi_1(A_1, A_2) = \frac{\lambda n \left(2\sqrt{A_1} + \sqrt{A_2}\right)^2}{9\left(\sqrt{A_1} + \sqrt{A_2}\right)} - \phi A_1 \quad \text{and} \quad \pi_2(A_1, A_2) = \frac{\lambda n \left(\sqrt{A_1} + 2\sqrt{A_2}\right)^2}{9\left(\sqrt{A_1} + \sqrt{A_2}\right)} - \phi A_2. \tag{5}$$

In stage I, each firm i takes firm j's advertising level, A_j, as given and chooses A_i to maximize $\pi_i(A_1, A_2)$ given in (5). After verifying that $\partial^2 \pi_i / \partial (A_i)^2 < 0$, we find that the unique symmetric equilibrium levels of comparison-advertising are given by

$$A_1 = A_2 = \frac{25\lambda^2 n^2}{576\phi^2}. \tag{6}$$

Notice that (6) implies that the equilibrium advertising levels are independent of the unit production cost parameter, c. Further, notice that (6) implies that the equilibrium advertising levels rise quadratically with the density of consumers n, simply because the cost of advertising is independent of n. Substituting (6) into (4) and (5) yields

$$p_1 = p_2 = \frac{5\lambda^2 n}{24\phi} + c \quad \text{and} \quad \pi_1 = \pi_2 = \frac{35\lambda^2 n^2}{576\phi}. \tag{7}$$

Therefore, we can state the following proposition.

Proposition 1

In a market structure where firms compete in prices and comparison-advertising , the equilibrium prices and profit levels (a) increase with the advertising intensity parameter, λ; (b) increase with the population density, n; and (c) decrease with the cost of advertising, ϕ.

Proposition 1(b) highlights the difference between the present model and the ordinary Hotelling-type models where the density of consumers n does not affect equilibrium prices and profit levels in symmetric equilibria. Here, since advertising rises quadratically with n, firms can raise prices because the intensified use of advertising makes the brands more differentiated thereby increasing the monopoly power of the brand-producing firms.

4. Semicollusion

Clearly, collusion on prices constitutes a price-fixing violation of the antitrust law and is therefore unlikely to be exercised by the two brand-producing firms. In contrast, collusion on advertising levels can be achieved in an explicit manner, or implicitly by having both firms employing the same advertising agency. We therefore make the following definition.

Definition 1

*A **semicollusive** market structure is a game where in stage II both firms compete noncooperatively on prices given the level of advertising decided in the first stage. In the first stage, both firms maximize joint profit given the price functions calculated in the second stage.*

The second stage equilibrium prices have already been calculated in (4). Substituting $A = A_1 = A_2$ into (5), in the first stage, the firms choose a uniform advertising level A to maximize

$$\Pi \stackrel{\text{def}}{=} \pi_1 + \pi_2 = \sqrt{A}\left(\lambda n - 2\sqrt{A}\phi\right). \tag{8}$$

Verifying that $\partial^2\Pi/\partial A^2 < 0$, the semicollusive comparison-advertising level of each firm is

$$A_1^* = A_2^* = \frac{\lambda^2 n^2}{16\phi^2}. \tag{9}$$

Notice again that, just like in the non-collusion case, (9) implies that the collusive advertising levels are independent of the unit production cost parameter, c. Substituting (9) into (4) and (5) yields

$$p_1^* = p_2^* = \frac{\lambda^2 n}{4\phi} + c, \quad \text{and} \quad \pi_1^* = \pi_2^* = \frac{\lambda^2 n^2}{16\phi}. \tag{10}$$

Comparing (9) with (6), and (10) with (7) yields our main proposition.

Proposition 2

(a) The semicollusive level of comparison-advertising exceeds the noncooperative level. Formally, $A_i^* > A_i$, $i = 1, 2$. (b) Semicollusion increases equilibrium prices and profit levels.

Proposition 2 highlights the anticompetitive effects of semicollusion in comparison-advertising. In a large number of conventional advertising models, collusion may lead to a reduction in advertising levels in order to reduce the cost of advertising. In contrast, this paper shows

that since comparison-advertising is used to weaken price competition it is enhanced under collusion. All this means is that antitrust authorities must monitor industries where comparison-advertising is widely used since in these industries competition is likely to be weakened.

5. Discussion

Our analysis focused on one particular type of advertising, called comparison-advertising. We modeled comparison-advertising as a costly information mechanism that reduces consumers' valuation of the competing brand. Our interpretation of this market has been that the two brands are homogeneous from consumers' point of view and, just like the case for other types of advertising, the role of comparison advertising is to make them differentiated in a particular way. However, following Meurer and Stahl (1994) we can also interpret this market as if the brands are differentiated but potential consumers must be informed of the differences by being exposed to informative advertising.

Appendix A. Finite Reservation Utility

Suppose now that the utility function (1) includes the option of not purchasing at all. That is, a consumer of any type gains a utility of $U_x = 0$ if no brand is purchased. Let $\beta > c$ (otherwise, production cost exceeds a consumer's basic valuation for the product). Under this reservation utility constraint, the fully-served market equilibrium described by (6) and (7) exists only if

$$\lambda < 4\sqrt{\frac{\phi(\beta - c)}{5n}}, \tag{11}$$

which means that the effectiveness of comparison advertising parameter should be bounded away from the square root of the difference between basic valuation and unit cost, or that the consumer population is sufficiently small. Condition (11) is found by substituting $\hat{x} = 1/2$, p_1 and A_2 from (6) and (7) into the first row of (1) and then solving $U_{0.5} = 0$.

The common purpose of adding a reservation utility to a model is to generate a partially-served market equilibrium where some consumers do not buy any brand. However, in this

appendix we demonstrate that a partially-served market equilibrium does not exist in the present environment. By a way of contradiction suppose that there exists an equilibrium where all consumer types indexed on $[0, \hat{x}_1]$ buy brand 1 and all types indexed on $[\hat{x}_2, 1]$ buy brand 2, and that $\hat{x}_1 < \hat{x}_1$ (meaning that all consumer types indexed on $(\hat{x}_1, \hat{x}_2)$ do not buy any brand). The utility function (1) implies that $\hat{x}_1 = (\beta - p_1)/(\lambda\sqrt{A_2})$. Maximizing $\pi_1 = (p_1 - c)\hat{x}_1 - \phi A_1$ with respect to p_1 yields $p_1 = (\beta + c)/2$, therefore $\pi_1 = (\beta - c)^2/(4\lambda\sqrt{A_2}) - \phi A_1$. Maximizing now with respect to A_1 yields $A_1 = 0$ (this follows from the fact that firm 1's market share is affected only by A_2 and not by A_1.

So far we have shown that if a partially-served market equilibrium exists, then $A_1 = A_2 = 0$. However, note that this implies that the brands are homogeneous meaning that in the second stage prices must fall to $p_1 = p_2 = c$ so each firm earns zero profit. But, the utility function (1) implies that if firm 1 sets $A_1 = \epsilon > 0$ where ϵ is a small number, it can become a local monopoly setting the price $p_1 = (\beta + c)/2$ calculated above. This proves that a partially-served market equilibrium does not exist in this model. □

References

Boddewyn, J. J., and K. Marton. 1978. *Comparison Advertising.* New York: Hastings House Publishers. Hotelling, H. 1929. "Stability in Competition." *Economic Journal* 39: 41–57.

Meurer, M., and D. Stahl. 1994. "Informative Advertising and Product Match." *International Journal of Industrial Organization* 12: 1–19.

Muehling, D., J. Stoltman, and S. Grossbart. 1990. "The Impact of Comparative Advertising on Levels of Message Involvement." *Journal of Advertising* 19: 41–50.

Pechmann C., and D. Stewart. 1990. "The Effects of Comparative Advertising on Attention, Memory, and Purchase Intentions." *Journal of Consumer Research* 17: 180–191.

von der Fehr, N.-H. M., and K. Stevik. 1998. "Persuasive Advertising and Product Differentiation." *Southern Economic Journal* 65: 113–126.