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Cost leadership and pricing in conspicuous goods markets

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Abstract

We study competitive positioning and pricing strategies in markets with negative consumption externalities. Negative consumption externality is modeled as a decrease in preference for a product as more consumers purchase the same product. Using a two stage Hotelling type model, we show that a cost leader prices higher than the cost disadvantaged firm when the magnitude of negative consumption externality in the market is below a threshold otherwise the cost leader prices lower than the cost disadvantaged firm. Also, increase in population density decreases price differential between the cost leader and the cost disadvantaged firm.

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1 Introduction

It has been known for a long time that consumers' product or service choices are affected by the choices of other consumers (Veblen 1899). In some product categories, the utility of each consumer increases with an increase in the total number of consumers purchasing the same brand and in such a case consumers' preferences are said to exhibit positive consumption externalities (Katz and Shapiro 1985). On the other hand, for conspicuous products, consumers' need for uniqueness prevails and each of them values the product less as more consumers own it, thus exhibiting negative consumption externalities. Examples of conspicuous products markets include jewelry, perfumes, watches, high-end cars, collectibles, etc. where exclusivity is fundamental to the value of the product.

There has been quite a bit of research done in the area of consumption externalities (see David and Greenstein 1990, Shy 2001 for review). Negative consumption externalities have long been a favorite topic of economic inquiry, but studies have normally abstracted from strategic behavior on the production side (Hackner and Nyberg 1996). However, negative externalities affects the strategic decisions of firms in many ways. For example, use of uniqueness appeals in advertising becomes more prevalent for conspicuous goods (Pollay 1984). Firms may also strategically decide to restrict availability in discount channels (Marketing Week 1997) or limit sales over the Internet (Curtis 2000). Moreover, negative consumption externalities are likely to be important in markets for private goods and services in that they affect the *strategic interaction* between firms. Integrating the research on spatial competition with consumption externalities literature, Grilo et al. (2001) show that negative externalities relaxes price competition. With a different consumer mix, Amaldoss and Jain (2005) reach similar conclusions. But these results are obtained when firms are ex-ante identical but in reality a number of factors (such as a firm's proprietary technology, preferential access to suppliers, degree of vertical integration, or learning from related activities, etc.) could distinguish firms from each other. We assume that this asymmetry translates to cost difference among competing firms. When firm differences are considered but consumption externalities are ignored, Tyagi (2001) shows that in a horizontally differentiated market, a cost leader charges a higher price in equilibrium. But, in reality, the relationship between cost leadership and pricing is not unambiguous. For example, Noble and Gruca (1999) surveyed pricing practices of 270 managers and found that in competitive pricing situations, a cost advantaged firm (due to lower supplier cost) prices lower than the competitor. But, there are also instances where a cost leader in a horizontally differentiated market might charge higher prices. For example, it is often argued that Procter & Gamble is the cost leader in many categories but often charges higher prices in markets that typify horizontal differentiation. This absence of a clear relationship between cost leadership and pricing suggests the need to incorporate other dimensions of consumers utility which affects firms' strategic behavior. Our starting point for this research is to understand the positioning and pricing decision of *asymmetric firms*, given the "social need" among consumers for uniqueness. This paper shows that in markets with negative consumption externalities, if firms: (i) compete on horizontally-differentiable product characteristics alone, and (ii) choose their product positions simultaneously before competing on prices, then a cost leader charges higher than the cost disadvantaged firm only when the magnitude of negative consumption externality is below a threshold. Thus, this paper extends the result obtained previously and presents a way to reconcile the discrepancy between extant theoretical result and empirical evidence.

2 Model

We use the Hotelling framework (Hotelling 1929) and assume that the market consists of two firms A and B, each offering one product recognized by subscripts A and B respectively. Consider the following sequence of decisions. First, firms A and B, simultaneously choose locations a and b respectively. After the firms have made their location choices, firms simultaneously choose their prices, p_A and p_B and consumers buy the product that maximizes their utility. The specific model assumptions are described below in greater detail.

1. We assume that the consumers are distributed uniformly in the unit interval [-0.5, 0.5] and the total number of consumers is N.

2. We assume that the intrinsic utility of the product to every consumer is denoted by V, and it is the same for both products A and B. Let us define β to be the negative consumption externalities parameter $(\beta < 0)$. Let n_A represent the customer base of firm A and n_B represent the customer base of Firm B ($n_A + n_B = N$). We assume that the consumer reservation price is $V + \beta n_A$ for product A and $V + \beta n_B$ for product B. Therefore, each consumer is worse off as the number of consumers purchasing from the same store increases. The consumer reservation price is assumed to be sufficiently large so that all consumers buy one of the two products.

3. Consumers incur a quadratic transportation cost i.e. a consumer located at x incurs a cost of $t\,(x - x_i)^2$ to purchase from the firm located at x_i $(x_i = a, b)$ where t is the transportation cost parameter. This is more realistic as the consumer's marginal disutility of consuming a product away from their ideal point is increasing (Neven 1985).

4. Following Tabuchi and Thisse (1995), firms are not restricted to locate within the interval of consumers' ideal points. Also, as firms choose locations simultaneously, our analysis excludes the possibility of any first mover advantage. Firms A and B incur marginal costs c_A and c_B respectively to manufacture the products $(c_B > c_A)$. We assume that firms have perfect information about costs, both their own as well as their competitors.

5. Once firms' locations and prices are determined, the consumers have perfect information about them. Each consumer's choice problem is to purchase one and only one product from the firm which provides him/her with the highest utility.

3 Analysis

Without loss of generality, assume that the cost leader (Firm A) is located to the left of the other firm (Firm B). The location of the marginal consumer is given by

$$\tilde{x} = \left(p_B - p_A + t\left(b^2 - a^2\right)\right) / \left(2t\,(b - a) - 2N\beta\right) \tag{1}$$

where $\tilde{x} \in [-0.5, 0.5]$. All consumers to the left of the marginal consumer purchase from the cost leader.

Given the marginal consumer, the profits of the two firms are given by

$$\pi_A = (p_A - c_A)\, N \left(\frac{1}{2} + \frac{(p_B - p_A)}{2t\left(b - a - \frac{\beta N}{t}\right)} + \frac{b^2 - a^2}{2\left(b - a - \frac{\beta N}{t}\right)} \right), \text{ and} \tag{2a}$$

$$\pi_B = (p_B - c_B)\, N \left(\frac{1}{2} - \frac{p_B - p_A}{2t\left(b - a - \frac{\beta N}{t}\right)} - \frac{b^2 - a^2}{2\left(b - a - \frac{\beta N}{t}\right)} \right). \tag{2b}$$

where $(c_B - c_A)$ is restricted to the interval $(0, \frac{9t}{4} - 3N\beta]$ to ensure that both firms get positive market shares in equilibrium.[1]

The first order condition for profit maximization leads to the following equilibrium prices[2]

$$p_A = -\frac{1}{3}ta^2 - ta + \frac{1}{3}tb^2 + tb + \frac{2}{3}c_A + \frac{1}{3}c_B - N\beta, \text{ and} \tag{3a}$$

$$p_B = \frac{1}{3}ta^2 - ta - \frac{1}{3}tb^2 + tb + \frac{1}{3}c_A + \frac{2}{3}c_B - N\beta. \tag{3b}$$

Given the prices, the profits of the firms can be simplified in terms of their location choices as follows:

$$\pi_A = \frac{1}{18}N\frac{\left(c_A - c_B + 3N\beta + a^2t - b^2t + 3at - 3bt\right)^2}{t\,(b-a) - N\beta},$$

$$\pi_B = \frac{1}{18}N\frac{\left(-c_A + c_B + 3N\beta - a^2t + b^2t + 3at - 3bt\right)^2}{t\,(b-a) - N\beta}.$$

The first order conditions of profit maximization leads to the following equilibrium locations[3]

$$a^* = -\frac{3}{4} + \frac{(c_B - c_A)}{3t - 4N\beta}, \text{ and} \tag{4a}$$

$$b^* = \frac{3}{4} + \frac{(c_B - c_A)}{3t - 4N\beta}. \tag{4b}$$

[1] Note that as $|\beta|$ increases, the interval increases.

[2] One can check that $\frac{\partial^2 \pi_i}{\partial p_i^2} = -\frac{N}{t(b-a) - N\beta} < 0, i = A, B$, (as $\beta < 0$). Therefore, the second order condition is satisfied.

[3] One can check that at these solutions, $\frac{\partial^2 \pi_A}{\partial a^2} = -\frac{Nt\left(32N^2\beta^2 + 4tc_A - 4tc_B + 27t^2 - 60Nt\beta\right)(9t + 4(c_B - c_A) - 12N\beta)}{18(3t - 2N\beta)(-3t + 4N\beta)^2}$ and $\frac{\partial^2 \pi_B}{\partial b^2} = -\frac{Nt(9t - 4(c_B - c_A) - 12N\beta)\left(32N^2\beta^2 - 4tc_A + 4tc_B + 27t^2 - 60Nt\beta\right)}{18(3t - 2N\beta)(-3t + 4N\beta)^2}$. Since $(c_B - c_A) \in (0, 9t/4 - 3N\beta]$, $\frac{\partial^2 \pi_A}{\partial a^2} < 0$ and $\frac{\partial^2 \pi_B}{\partial b^2} < 0$ and the second-order condition is satisfied. Among the three other possible roots to the first order conditions, profits are zero at two of the roots and $\frac{\partial^2 \pi_A}{\partial a^2} = \frac{\partial^2 \pi_B}{\partial b^2} = 0$ at $a = -\frac{1}{2Nt\beta}\left(N^2\beta^2 - tc_A + tc_B\right)$ and $b = \frac{1}{2Nt\beta}\left(N^2\beta^2 + tc_A - tc_B\right)$.

The cost advantaged firm cannot make higher profits by undercutting the competing firm and driving it out of the market.[4] To see this, consider the situation where it has the highest possible marginal cost advantage over the competitor, i.e. $c_B - c_A = \frac{9t}{4} - 3N\beta$. The cost advantaged firm needs to beat the delivered price of the competitor by $N|\beta|$ (so as to make the marginal consumer indifferent) which implies that the cost advantaged firm can *at most* make a profit of $N\left(\frac{9t}{4} - 2N\beta\right)$ with complete market coverage. Using the equilibrium locations in $(4a)$ and $(4b)$, the cost advantaged firm makes a profit of $N(3t - 2N\beta)$, ensuring undercutting is not profitable.

Using these equilibrium locations in the pricing reaction functions, gives the equilibrium prices as

$$p_A = \frac{\left(24N^2\beta^2 + 6tc_A + 12tc_B + 27t^2 - 54Nt\beta - 16N\beta c_A - 8N\beta c_B\right)}{18t - 24N\beta}, \text{ and} \tag{5a}$$

$$p_B = \frac{\left(24N^2\beta^2 + 12tc_A + 6tc_B + 27t^2 - 54Nt\beta - 8N\beta c_A - 16N\beta c_B\right)}{18t - 24N\beta}. \tag{5b}$$

which gives $p_B - p_A = \frac{1}{3(3t-4N\beta)}(3t + 4N\beta)(c_A - c_B)$.

This leads to the following result.

Proposition 1 *If the magnitude of negative consumption externalities is less than a threshold* $\left(|\beta| < \frac{3t}{4N}\right)$, *a cost leader charges higher prices otherwise it charges lower prices.*

Proof. *Follows from (5a) and (5b).* ■

The intuition for this result is as follows. When $|\beta|$ increases, higher market share is undesirable. Therefore, the cost leader moves away from the center of distribution of consumers providing the cost disadvantaged firm with an opportunity to increase market share which in turn, forces the cost leader to lower prices in order to increase profits.

Because population density also plays a role in how negative consumption externalities affects consumers' willingness to pay, we study the impact of population density on firm prices and profits. If consumption externalities were ignored, firms' pricing decision is not affected by population density. We find that

$$\frac{d}{dN}(p_A - p_B) = \frac{d}{dN}\left(\frac{(3t + 4N\beta)(c_B - c_A)}{3(3t - 4N\beta)}\right) = 8t\frac{\beta}{(3t - 4N\beta)^2}(c_B - c_A) < 0, \text{ and} \tag{6a}$$

$$\frac{d}{dN}(\pi_A - \pi_B) = \frac{4}{3(3t - 4N\beta)^2}(c_B - c_A)\left(8N^2\beta^2 - 12Nt\beta + 9t^2\right) > 0. \tag{6b}$$

This leads to the following result.

Proposition 2 *In a market with negative consumption externality, as population density increases, the profit differential between the cost leader and the cost disadvantaged firm increases but the price differential goes down.*

Proof. *Follows from (6a) and (6b).* ■

[4] I thank an anonymous reviewer for this suggestion.

Note that as population density increases, the cost leader as well as the cost disadvantaged firm have an incentive to raise their prices in order to further reduce their customer base. Furthermore, the cost leader's market share decreases because an increase in population makes the cost leader's product relatively less attractive. This reduction in disparity in the market shares of two firms coupled with higher prices reduces the incentive to engage in price competition. Therefore the price differential decreases as population density increases. But, the total customer base of the cost leader increases at a faster rate as the population density increases.[5] Therefore, the profit differential increases.

Thus, this analysis provides a richer understanding of the forces driving pricing decisions of firms in conspicuous goods markets compared to standard models of product differentiation.

4 Conclusions

This paper studies the pricing decisions of asymmetric firms competing in horizontally differentiated product markets where negative consumption externalities exist. The paper shows how if firms: (i) compete instead on horizontally-differentiable product characteristics alone, and (ii) choose their product positions simultaneously before competing on prices, then a cost leader charges higher than the cost disadvantaged firm only when the magnitude of negative consumption externality is below a threshold. We also find that as the population density increases, the price differential between the cost leader and the cost disadvantaged firm decreases. Thus, the results suggests that whether one should expect a cost leader in a horizontally differentiated market to charge a price lower than its competitors (and the extent of price differences) depends on the relative magnitude of negative consumption externality and the population density in that market

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[5] $\frac{dn_A}{dN} = \frac{\left(16N^2\beta^2-4tc_A+4tc_B+9t^2-24Nt\beta\right)}{2(3t-4N\beta)^2} > \frac{dn_B}{dN} = \frac{\left(16N^2\beta^2+4tc_A-4tc_B+9t^2-24Nt\beta\right)}{2(3t-4N\beta)^2}$

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