Competitors are welcome: why incumbents might embrace entrants?

Barna Bakó *

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Abstract

In this article we show that the price and the profit of an incumbent firm may increase after a new firm enters its market. Our analysis suggests that a well-established firm after competition emerges on its market might benefit from excluding some consumers from the low-end segment and concentrate only on its loyal consumers.

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1 Introduction

Picture an industry where a monopolist operates initially and serves consumers who differ in their quality valuation and price elasticity. Will an entry jeopardize the incumbent's profit or should the monopolist accommodate the entry? One of the main proposition of economic theory is that competition leads to lower prices and profits. In this article we present a simple model with product differentiation where exactly the opposite happens.

We consider the following set-up: there are two segments of consumers differing in their valuation of quality and price-elasticity. A single product firm operates at the market without being able to price discriminate among segments.

*'Lendület' Strategic Interactions Research Group, Corvinus University of Budapest, Department of Microeconomics, Fővám tér 8, E225-A, Budapest, 1093, Hungary, e-mail: barna.bako@uni-corvinus.hu

Our results show that if a low quality firm enters the market and captures a part of the price sensitive segment it might lead to price and profit increase. More specifically, if the difference in quality valuation is high enough the incumbent is better off after entry. Furthermore, we show that as the price-sensitive segment decreases the equilibrium prices increase. Hence, the incumbent may benefit from excluding some of its most price-sensitive consumers. Our main finding suggests that a high-quality firm quits the low-end market entirely if the quality valuation is high enough and the price-sensitive segment size is sufficiently low. These results indicate that an entry can be beneficial for the incumbent firm.

This paper contributes to the literature on price-increasing competition. The main body of this literature (e.g. Rosenthal (1985), Inderst (2002), Chen and Riordan (2008)) concentrates mostly on price changes after competition picks up. The literature closest to our article deals with the profit increasing effect of the competition and the strategies an incumbent can pursue in order to increase competition and its profit. Our first result echoes Gelman and Salop (1983) findings. In their article they claim that an entrant can secure entry accommodation by adopting a strategy of *judo economics*. This strategy refers to a capacity choice sufficiently limited, which restricts the entrant!s market share after entry. In this case, the incumbent choosing a higher price than the entrant still can sell its product and under certain conditions be better off by accommodating the entry. Their model, however, applies only if the entrant can make credible capacity limitation commitments. As we show in this article there is no need for capacity limitation to achieve this result.

A few other papers show findings similar to our results. By using a model with a single manufacturer serving a market through a strategic retailer Kumar and Ruan (2006) show that a manufacturer by complementing the retail channel with an online channel effectively can induce retailers to enhance their support level for the manufacturer‘s product which increases demand and consequently its profit. Similar findings were presented by Ishibashi and Matsushima (2009), who analyzed the competition between low-end and high-end firms. In both quantity and price competition they show that if the low-end firms can capture the whole elastic segment of consumers that could lead to higher profits for the incumbents. In their model the existence of low-end firms functions as a credible threat which induces high-end firms not to overproduce. In our model we show that the existence of these kind of threats is not necessary for this result.

Alexandrov (2012) analyzes the question of de-marketing in a segmented market and arrives to the conclusion that horizontally differentiated firms can be better off by forbidding a group of consumers from patronizing the firm and leaving that segment to be served by the other firm or a new entrant. However quitting the low-end segment by all the firms does not constitute an equilibrium. If a firm stops serving the price-sensitive consumer group, the firm‘s competitor is much better off since she benefits from higher margins together with higher volumes. Thus, firms opt for a unilateral quit by their competitor and might end up serving all consumer segments which gives rise of the problem of coordination. To solve this problem we introduce asymmetric firms and analyze the effects of de-marketing in a more general model.

2 The Model

Consider a mass of consumers with a high-end (H) and a low-end (L) segment. Each consumer group is uniformly distributed on the $[0, 1]$ interval. The mass of high-end market is normalized to 1 and the total number of consumers in the low-end market is μ. In order to consume, each consumer has to travel to a manufacturer where the desired product can be purchased, and further we assume that the transportation costs are quadratic in distance. The two groups differ fundamentally in (a) their travel cost and (b) their valuation for the quality of service they receive while shopping. The high-end segment has a transportation cost of t_H, and the low-end group of t_L, and consistent with the above mentioned $t_H > t_L > 0$. That is, the low-end consumer group is more price sensitive than the high-end group. Furthermore, we assume that consumers from the high-end group value the service as s_H while the price-sensitive group as s_L, where $s_H > s_L$. Consumers in H demand only a product with complementary service, while consumers from the low-end group are indifferent between a product with or without service. Both consumer group has a reservation utility of v for the product and each consumer demands, at most, one unit. We assume that v is high enough to ensure that all consumers buy one product in equilibrium.[1] To simplify our calculation we normalize the value of t_H to 1 and set s_L to zero. Furthermore, we assume that $s_H - s_L > t_H - t_L$, that is consumers are more differentiated in the way they value the services as they are in travel costs.

2.1 The monopoly case

Suppose, there is a single firm located at 0 producing a product and selling it by providing a complementary service to it without being able to price discriminate between the consumers. Furthermore, we assume that the monopolist is obligated to cover the whole market[2]. The production marginal cost is $c > 0$, while the fixed costs are zero.

A consumer of group j ($j = L, H$) located at x obtains a surplus from buying the manufacturer‘s product as follows

$$CS_j = v + s_j - t_j x^2 - p \tag{1}$$

Thus, in order to maximize its profit a monopolist sets a price of

$$p^M = v - t_L \tag{2}$$

and its profit is

$$\pi^M = (1 + \mu)(v - t_L - c) \tag{3}$$

[1] In the subsequent analysis we give the exact lower bound of such a v.

[2] Universal service obligations or USOs are not uncommon in monopoly regulation. Their use is especially widespread in the area of postal services, utilities and telecommunications. For a detailed discussion on definitions of universal service, see Alleman *et al.* (2010)

2.2 The duopoly case

Now consider that a low-quality firm, l, with no marginal cost enters to the market and offers a product without any additional service. In the further analysis we refer to the product without any complementary service as low-quality product, and to the incumbent's product as high-quality product[3]. We consider the polar case of quality differentiation and without loss of generality we assume that the firm l is located at 1, while the incumbent firm (from now on denoted as firm h) is located at 0.[4]

Since consumers in H demand only the product with an additional service they keep purchasing the product from firm h., and the surplus of a consumer located at x obtained from consumption is

$$CS_H = \begin{cases} v + s_H - x^2 - p_h & \text{if she buys from firm } h \\ 0 & \text{if she buys from firm } l \end{cases} \tag{4}$$

where p_h is the price of the product with complementary service.

Consumers in L value both products similarly, and for that reason they are indifferent which product to consume as far as their price is equal. Denoting the price of the low-quality product by p_l, the utility of a consumer in L at x can be given as

$$CS_L = \begin{cases} v - t_L x^2 - p_h & \text{if she buys from firm } h \\ v - t_L(1-x)^2 - p_l & \text{if she buys from firm } l \end{cases} \tag{5}$$

Consumers purchase the product which yields them to the highest surplus. Thus, the consumer i from the low-end market located at x buys from firm h if $x_i \leq \frac{1}{2} - \frac{p_h - p_l}{2t_L}$, otherwise she buys from firm l. Hence, the demand functions of the firms are as follows

$$D_H(p_h, p_l) = 1 + \mu\left(\frac{1}{2} - \frac{p_h - p_l}{2t_L}\right) \tag{6}$$

and

$$D_L(p_h, p_l) = \mu\left[1 - \left(\frac{1}{2} - \frac{p_h - p_l}{2t_L}\right)\right] \tag{7}$$

Using (6) and (7) the profit functions of the firms can be given as

$$\pi_h = \left[1 + \mu\left(\frac{1}{2} - \frac{p_h - p_l}{2t_L}\right)\right](p_h - c) \tag{8}$$

[3]We do not make here any assumption about market coverage; in practice, oligopolies do not face as strict regulation as monopolies. However, our result will show that even absent regulation, the firms will provide full market coverage.

[4]This assumption based on d'Aspremont *et al.* (1979). The authors show that in location games with quadratic transportation costs the equilibrium locations are the two extremes.

$$\pi_l = \mu\left(\frac{1}{2} + \frac{p_h - p_l}{2t_L}\right)p_l \tag{9}$$

Solving the first-order conditions, leads to

Proposition 1 *In equilibrium firms charge*

$$p_h^D = \frac{1}{3}\left[3t_L + 2c + \frac{4t_L}{\mu}\right] \qquad \textit{and} \qquad p_l^D = \frac{1}{3}\left[3t_L + c + \frac{2t_L}{\mu}\right].$$

These are equilibrium prices only if the market is fully covered. For that we need the surplus of the consumer from group H located at 1 to be non-negative with the given prices. By evaluating this we set the lower bound of v consistent with the model. Thus, we need, that

$$v + s_H - 1 - \frac{1}{3}\left[3t_L + 2c + \frac{4t_L}{\mu}\right] \geq 0 \tag{10}$$

Simplifying (10) yields

$$v \geq \underline{v} \equiv 1 + t_L + \frac{2}{3}c + \frac{4}{3}\frac{t_L}{\mu} - s_H \tag{11}$$

That is, if (11) is satisfied, the market is fully covered in equilibrium and prices given by Proposition 1 are indeed the equilibrium prices.

Corollary 1 *More differentiation results in higher equilibrium prices.*

Proof.

$$\frac{\partial p_j^D}{\partial t_L} > 0 \qquad \text{for every} \quad j = h, l.$$

■

Corollary 2 *If the price sensitive segment is increasing the equilibrium prices are decreasing.*

Proof.

$$\frac{\partial p_j^D}{\partial \mu} < 0 \qquad \text{for every} \quad j = h, l.$$

■

The intuition behind these corollaries is that as the differentiation between products increases the substitution is becoming more difficult which softens the

competition in the market. This gives the firms the incentives and the possibilities to increase their prices. However, as the more elastic group is becoming more dominant relative to the less price sensitive segment the equilibrium prices drop.

Substituting the equilibrium prices into the profit functions given by (8) yields to

Proposition 2 *In equilibrium firms profits are*

$$\pi_h^D = \frac{\mu}{18t_L}\left(3t_L - c + \frac{4t_L}{\mu}\right)^2 \qquad \textit{and} \qquad \pi_l^D = \frac{\mu}{18t_L}\left(3t_L + s - c + \frac{2t_L}{\mu}\right)^2$$

Using the result obtained so far we can evaluate the conditions under which an incumbent is better off by having a low-quality competitor than serving the consumers from each segment by itself. For this we need

$$(1+\mu)(v - t_L - c) < \frac{\mu}{18t_L}\left(3t_L - c + \frac{4t_L}{\mu}\right)^2 \tag{12}$$

that is

$$v < v^D \equiv \frac{\mu}{18t_L(1+\mu)}\left(3t_L - c + \frac{4t_L}{\mu}\right)^2 + t_L + c \tag{13}$$

If $v \in (\underline{v}, v^D)$ the incumbent profit increases if a low-quality firm enters the market. Although, for this v^D has to be higher than the lower bound of the reservation prices ($\underline{v}$), hence, we have to check if

$$1 + t_L + \frac{2}{3}c + \frac{4}{3}\frac{t_L}{\mu} - s_H < \frac{\mu}{18t_L(1+\mu)}\left(3t_L - c + \frac{4t_L}{\mu}\right)^2 + t_L + c \tag{14}$$

Rearranging (14), yields to

$$s_H > s_H^D \equiv 1 + \frac{1}{3}c + \frac{4}{3}\frac{t_L}{\mu} + \frac{\mu}{18t_L(1+\mu)}\left[t_L\left(3 + \frac{4}{\mu}\right) - c\right]^2 \tag{15}$$

Proposition 3 *If the differentiation in quality valuation is high enough a high-quality firm is better off if a low-quality firm enters to the market than covering the market as a monopolist.*

This above proposition suggests that a firm can be worse off by being a monopolist than allowing a low-end firm to enter the market. As the entrant enters the market and captures the price-sensitive consumers the incumbent serves mostly its most loyal consumers. Since these consumers have significantly higher reservation utility the incumbent can rise its price which offsets the demand loss. In other words, losing the price-sensitive consumers because of the competition in the low-end segment gives the incumbent the opportunity

to set a higher price for the loyal consumers who exhibit a substantially higher reservation utility.

To show that equilibrium prices in the duopoly case are higher than the monopoly price, we need

$$\frac{1}{3}\left(3t_L + 2c + \frac{4t_L}{\mu}\right) > v - t_L \qquad \text{and} \qquad \frac{1}{3}\left(3t_L + c + \frac{2t_L}{\mu}\right) > v - t_L. \quad (16)$$

From the left-hand side inequality in (16) we have that $v < 2t_L\left(1 + \frac{2}{3\mu}\right) + \frac{2}{3}c$. This needs to be higher than the lower bound of the reservation utilities, which holds whenever $s_H > 1 - 3t_L$. In the same way we can calculate the condition when the equilibrium price of the low-end firm is higher than the incumbent monopoly price. This yields that $s_H > 1 - 3t_L + \frac{1}{3}c$. The result is formulated in the following

Proposition 4 *If consumer differentiation in service valuation is significant, equilibrium prices charged by a low-end and a high-end firm are higher than the prices charged by a monopolist who covers the market fully.*

3 Strategic demarketing

In fact, under certain conditions the incumbent firm has the incentive to deviate from the equilibrium given in Proposition 1. To illustrate this consider the following.

From (2) follows

Corollary 3 *The high-quality firm benefits from excluding some consumer of the most price sensitive segment if the size of this segment is less than moderate.*

Proof.

$$\frac{\partial \pi_h^D}{\partial \mu} = \frac{1}{18t_L}\left[(3t_L - c)^2 - \left(\frac{4t_L}{\mu}\right)^2\right]$$

This is negative whenever $\mu < \mu^S \equiv \frac{4t_L}{3t_L - c}$. ■

Corollary 3 suggests that the high-quality producer might be better off by quitting the more elastic segment. In this case prices and profits can be easily calculated, since in both segments only a specific firm operates and therefore it will charge a price which binds consumers reservation utility.

Formally, the firms profits can be given as follows

$$\pi_h = (p_h - c)D_H(p_h) \qquad \text{and} \qquad \pi_l = p_l D_L(p_l) \quad (17)$$

where $D_H(p_h)$ and $D_L(p_l)$ stands for the demands faced by firm h and l, respectively. Since consumer‘s reservation utilities are high enough to provide

non-negative surplus even for the consumer farthest away from the company she buys from, in equilibrium firms charge prices that consumers with the biggest distance from the company can still afford. Formally, we can state the following

Proposition 5 *Suppose firm h quits the low-end segment. Equilibrium prices and profits are as follows:*

$$p_h^S = v + s_H - 1 \qquad p_l^S = v - t_L$$

and

$$\pi_h^S = v + s_H - 1 - c \qquad \pi_l^S = \mu(v - t_L)$$

Comparing the results given in Proposition 2 and 5 we can determine conditions under which strategic demarketing is indeed an equilibrium. For this we need

$$\frac{\mu}{18t_L}\left(3t_L - c + \frac{4t_L}{\mu}\right)^2 < v + s_H - 1 - c \tag{18}$$

A different way to write this is

$$s_H > s_H^S \equiv \frac{\mu}{18t_L}\left(3t_L - c + \frac{4t_L}{\mu}\right)^2 - v + 1 + c \tag{19}$$

Hence, we have the following result

Proposition 6 *The high-quality firm stops serving the low-end segment if the consumers differ fundamentally in their complementary service valuation and if the more price-sensitive segment size is sufficiently low.*

The intuition behind Proposition 6 is the following. To serve any of the consumers from L firm h has to lower its price below the reservation utility of the least valuable consumer from H. The price decrease is more significant if the service provided by the firm is more valuable to the consumers. Hence, there is a significant consumer surplus what the high-end consumers obtain because of the low prices. By quitting the low-end segment, firm h is not facing any competition from the low-quality firm and therefore can set its price higher. However, if the low-segment is remarkable is size quitting the price-sensitive group can hurt the firm‘s profit, since the price increase cannot offset the loss caused by the major demand loss. Actually, the same happens when consumers reservation utility is high enough. Softening the competition by leaving a segment and operating only on one segment, drives prices higher. As the demand loss is not significant, the profit rises as well.

Notice that when strategic de-marketing is profitable it always leads to higher average prices as well. This is because the low-end prices are unchanged after a low-quality firm enters the market and the high-end consumers pay more for their products..

4 Conclusion

We summarize our results in the following table. As you can see from the table the incumbent monopolist is better off by accommodating a low-quality entrant, if its quality is valued highly by a group of consumers. Allowing the low-end firm

	$s_H < s_H^D$	$s_H^D < s_H < s_H^S$	$s_H^S < s_H$
$\mu < \mu^S$	$\pi^M > \max\{\pi_h^D, \pi_h^S\}$	$\pi_h^D > \max\{\pi^M, \pi_h^S\}$	$\pi_h^S > \pi_h^D > \pi^M$
$\mu^S < \mu$	$\pi^M > \max\{\pi_h^D, \pi_h^S\}$	$\pi_h^D > \max\{\pi^M, \pi_h^S\}$	$\pi_h^D > \max\{\pi^M, \pi_h^S\}$

to capture the low-end market gives the incumbent the possibility to increase its price aggressively which offsets the loss from demand decrease. Moreover, if the price sensitive segment is not significant in size the manufacturer is even better of by quitting the low-end market entirely. To achieve this goal the incumbent could (1) forbid the price-sensitive consumers to purchase its product, (2) pursue a negative de-marketing campaign or (3) launch a low quality product by itself and segment its consumers effectively. Our results suggest that competition can be beneficial for the incumbents. In other words, established firms should not necessarily get involved in price competition after a new entrant enters their market but rather focus on (de-)marketing strategies.

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