Strategic segmentation: when two monopolies are better than one

Barna Bakó* András Kálecz-Simon†

July 28, 2014

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. We also find that strategic de-marketing can increase social welfare.

JEL codes: D43, L11, M31
Keywords: product differentiation, consumer segmentation, marketing strategy

---

*Department of Microeconomics, Corvinus University of Budapest and MTA-BCE „Lendület" Strategic Interactions Research Group, 1093 Budapest, Fővám tér 8., *e-mail:* barna.bako@uni-corvinus.hu. This research was supported by the European Union and the State of Hungary, co-financed by the European Social Fund in the framework of TÁMOP-4.2.4.A/ 2-11/1-2012-0001 'National Excellence Program'.

†Corvinus University of Budapest, Department of Macroeconomics, Fővám tér 8, E225-A, Budapest, 1093, Hungary, e-mail: revelation.principle@gmail.com

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 propositions 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. 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 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. In addition, our results suggest that this leads to an increase in social welfare.

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.

Our paper also relates to the literature of segmentation. Several papers have appeared recently in this field which studied related questions. 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 a low-end and a high-end firm. In both quantity and price competition they show that if the low-end firm can capture the whole elastic segment of consumers that could lead to higher profits for the incumbent. In their model the existence of low-end firm functions as a credible threat which induces high-end firm not to overproduce. In our model we show that the existence of these kind of threats is not necessary to obtain 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 better off since it 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 to a coordination problem. To solve this issue we introduce asymmetric firms and analyze the effects of de-marketing in a more general model.

Rodrigues et al. (2014) present a model with vertical and horizontal differentiation to explain the phenomenon of pseudo-generics in the pharmaceutical industry. Our model in some context answers a similar question, however with a different approach and somewhat contradicting conclusions.[1] While the authors focus on the competitive aspect of introducing pseudo-generics, we show that segmentation might play an even more important role. Our model thus is able to explain why it might be profitable to introduce pseudo-generics, even if there is no competition. Similarly to their paper we find that introduction of generics and pseudo-generics lead to price

[1] A technical question might arise regarding this paper's assumptions about costs and locations; linear transportation costs would not be consistent with locations chosen at endpoints. To avoid this problem, we used quadratic costs.

increases[2], however we show that the repositioning induced by market entry and exit it could increase social welfare. We aim to contribute to this literature, believing that studies of the pharmaceutical industry (e.g. Grabowski and Vernon (1992)) support the emphasis on our focus on the segmentation of the markets.

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 we assume that 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 $s_H > s_L \geq 0$. 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 groups have 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.[3] To simplify our calculation we normalize the value of t_H to 1 and set s_L to zero. Morover, we assume that $s_H - s_L > t_H - t_L$, hence consumers are more differentiated in the way they value the services as they are in travel costs.

We consider the following game. First firm choose their location, then set a price subject to market regulations, finally the market clears. We solve the game for its subgame perfect equilibrium using backward induction.

[2] Consistent with the findings of Ward et al. (2002) in the food industries.

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

2.1 Benchmark: the monopoly case

Suppose, there is a single firm located at $a \in [0, 1]$ producing a product and selling it by providing a complementary service to it without being able to price discriminate between the consumers. In line with the previous literature we consider fully covered market. I.e. we assume that the monopolist is obligated to cover the whole market.[4] The production marginal cost is $c > 0$, while the fixed costs are zero. Pricing is therefore not a decision variable for the monopolist, since they have to set prices to match the lowest valuation. On the other hand, the monopolist does have a meaningful choice: that of location.[5]

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 chooses its location at the middle point of the unit line[6] and sets a price of

$$p^M = v - \frac{t_L}{4} \tag{2}$$

while its profit equals to

$$\pi^M = (1 + \mu)\left(v - \frac{t_L}{4} - c\right) \tag{3}$$

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

[4]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. Even though universal service obligation does not prohibit prices that lead to foreclosure per se, keeping up the service without customers would not be reasonable, making such pricing unfeasible. For a detailed discussion on definitions of universal service, see Alleman *et al.* (2010)

[5]As usual, besides the literal geographical interpretation, the choice of location can also be understood in terms of product differentiation.

[6]I.e. the monopolist chooses the product characteristics according to the preferences of the median customer.

analysis we refer to the product without any complementary service as low-quality product, and to the incumbent‘s product as high-quality product.[7]

In this duopoly game, the two firms make their decision on both location and pricing. Tackling the first question, we make use of

Lemma 1 *In location games with quadratic transportation costs the equilibrium locations are the two extremes.*

Proof: See d'Aspremont *et al.* (1979). ■

Without loss of generality we assume that firm l is located at 1, while the incumbent firm (from now on denoted as firm h) is located at 0. Notice that unlike in the monopoly case, we see maximum product differentiation here.

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

$$CS_H = \begin{cases} v + s_H - x^2 - p_h & \text{if she buys the product from firm } h \\ 0 & \text{if she does not buy the product} \end{cases} \tag{4}$$

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

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

[7] 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, firms will provide full market coverage.

and

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

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

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

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

Solving the first-order conditions, leads to

Proposition 1 *In equilibrium firms charge*

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

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

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

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

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

that is

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

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

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

Rearranging (14), yields to

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

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

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

From the left-hand side inequality in (16) we have that $v < t_L \left(\frac{5}{4} + \frac{4}{3\mu} \right) + \frac{2}{3}c$. This needs to be higher than the lower bound of the reservation utilities, and lower than v^D, that is, $v \in (\underline{v}, v^D)$, which holds whenever $s_H > \max\{s_H^D, 1 - \frac{t_L}{4}\}$. 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 $s_H > \max\left\{ s_H^D, 1 - t_L \left(\frac{1}{4} - \frac{2}{3\mu} \right) + \frac{1}{3}c \right\}$. 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.*

3 Strategic de-marketing

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 Proposition 2 we have

Corollary 3 *The high-quality firm benefits from excluding some consumers 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

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

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.

Notice that instead of a duopoly, we have in fact two separate monopolies in two separate markets. The choices of location therefore will reflect that of the monopoly case, each firm setting product characteristics to cater to the median customer. Formally, we can state the following

Proposition 5 *Suppose firm h quits the low-end segment. In equilibrium firms will locate at the middle of the unit interval and equilibrium prices and profits are as follows:*

$$p_h^S = v + s_H - \frac{1}{4} \qquad p_l^S = v - \frac{t_L}{4}$$

and

$$\pi_h^S = v + s_H - \frac{1}{4} - c \qquad \pi_l^S = \mu\left(v - \frac{t_L}{4}\right)$$

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

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

A different way to write this is

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

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.

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

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 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 off 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.

Additionally, choosing de-marketing has essentially different implications regarding product characteristics. The entry of a low quality provider would most likely lead to maximum product differentiation. In the case of de-marketing, however, both firms will cater to the tastes of the median consumers of their respective segments. Notice that due to convex costs, in this case we end up with lower aggregate transportation costs.

This latter result also has consequences regarding social welfare. In our model, lower aggregate transportation costs necessarily mean higher aggregate welfare. Hence de-marketing could lead to higher social welfare than just an entrance of a new competitor. Our findings therefore carry a caveat that in certain cases de-marketing could be considered desirable by regulators.

References

Alleman, J.; Rappoport, P. and Banerjee, A. (2010), 'Universal service: A new definition?', *Telecommunications Policy*, 34(1-2), 86-91.

d'Aspremont, C.: Gabszewicz, J. J. and Thisse, J. F. (1979), 'On Hotelling's "Stability in Competition"', *Econometrica*, 47(5), 1145-1150.

Alexandrov, A. (2012), 'No Shirt, No Shoes, No Service', working paper

Chen, Y. and Riordan, M. H. (2008), 'Price-increasing competition', *The RAND Journal of Economics*, 39(4), 1042-1058.

Gelman, J. R. and Salop, S. C. (1983), 'Judo economics: capacity limitation and coupon competition', *The Bell Journal of Economics*, 14(2), 315-325.

Grabowski, H. G. and Vernon, J. M. (1992). 'Brand loyalty, entry, and price competition in pharmaceuticals after the 1984 Drug Act', *Journal of Law and Economics*, 35(2), 331-350.

Inderst, R. (2002), 'Why competition may drive up prices', *Journal of Economic Behavior and Organization*, 47(4), 451-462.

Ishibashi, I. and Matsushima, N. (2009), 'The Existence of Low-End Firms May Help High-End Firms', *Marketing Science*, 28(1), 136-147.

Kumar, N. and Ruan, R. (2006), 'On manufacturers complementing the traditional retail channel with a direct online chanel', *Quantitative Marketing and Economics*, 4(3), 289-323.

Rodrigues, V.: Goncalves, R., and Vasconcelos, H. (2014). 'Anti-Competitive Impact of Pseudo-Generics', *Journal of Industry, Competition and Trade*, 14(1), 83-98.

Rosenthal, R. W. (1985), 'A Model in which an Increase in the Number of Sellers Leads to a Higher Price', *Econometrica*, 48(6), 1575-1579.

Ward, M. B.: Shimshack, J. P.: Perloff, J. M., and Harris, J. M. (2002). 'Effects of the private-label invasion in food industries', *American Journal of Agricultural Economics*, 84(4), 961-973.