Strategic segmentation: creating monopolies can increase welfare

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Abstract

In this article we show that a well-established firm might benefit from excluding some consumers and concentrating only on its loyal consumers. Our analysis suggests that the price and the profit of a high-quality firm may further increase after quitting the low-quality segment. Moreover, we claim that de-marketing leads to repositioning of the products and strategic de-marketing can increase social welfare.

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1 Introduction

Picture an industry where firms providing low and high quality versions of the same good serve consumers who differ in their quality valuation and price elasticity. Will they compete for the lower valuation segment or should the high-quality firm tend only to its most loyal customers? One of the main propositions of economic theory is that competition increases welfare. 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 high-quality and a low-quality firm operates in the market without being able to price discriminate between segments. We show that as the price-sensitive segment decreases the equilibrium prices increase. Hence, the high-quality firm 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. In addition, our results suggest that this leads to an increase in social welfare.

Our paper contributes 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. 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 a firm in a horizontally differentiated market 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.

Pazgal et al. (2013) show that it may help firms if less loyal consumers leave the market, thus loosing a segment can be profitable. Our findings reflect a similar theme, however we also investigate the strategic implications of such exits. We find that the loss of consumer segments may lead to brand repositioning which could be beneficial from a social viewpoint.

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.\footnote{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.} 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 when it might be profitable to introduce pseudo-generics, and also the relationship between the existence of pseudo-generics and brand positioning. 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 the high-end market is normalized to 1 and the total number of consumers in the low-end market is \(\mu\). 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 the products can be provided with or without a complementary service and that consumers from the high-end group value the service as $s_H$ while the price-sensitive group as $s_L$, where $s_H > s_L ≥ 0$. Consumers in $H$ demand only a product with complementary service, while consumers from the low-end group are willing to buy 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.\(^2\) To simplify our calculation we normalize the value of $t_H$ to 1 and set $s_L$ to zero, thus we assume that consumers from the low-end segment are indifferent between buying a product with or without additional service. Moreover, 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. Firms choose their location first, then set their prices and finally the market clears. We solve the game for its subgame perfect equilibrium using backward induction.

### 2.1 Competition in the lower segment

Suppose there is a high-quality firm located at $a ∈ [0, 1]$ producing a product and selling it by providing a complementary service to it without being able to price discriminate between the consumers. The production marginal cost is $c > 0$, while the fixed costs are zero. Also consider a low-quality firm, $l$, with no marginal cost, located at $b ∈ [0, 1]$, offering the product without any additional service. In the following analysis we refer to the product without any complementary service as low-quality product, and to the high-end firm’s product as high-quality product.

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.

\(^2\)In the subsequent analysis we give the exact lower bound of such a $v$. 

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Proof: See d’Aspremont et al. (1979).

Without loss of generality we assume that firm $l$ is located at 1, while the high-quality firm (from now on denoted as firm $h$) is located at 0.

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

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

(1)

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 prices are 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

$$CS_L = \begin{cases} v - t_L x^2 - p_h & \text{if she buys from firm } h \\ v - t_L (1-x)^2 - p_l & \text{if she buys from firm } l \\ 0 & \text{if she does not buy the product} \end{cases}$$

(2)

Consumers purchase the product which yields them the highest surplus. Thus, 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 are as follows

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

(3)

and

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

(4)

Using (3) and (4) the profit functions can be given as

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

(5)

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

(6)

Solving the first-order conditions leads to
Proposition 1. In equilibrium firms charge

\[ p^D_h = \frac{1}{3} \left[ 3t_L + 2c + \frac{4t_L}{\mu} \right] \quad \text{and} \quad p^D_l = \frac{1}{3} \left[ 3t_L + c + \frac{2t_L}{\mu} \right]. \]

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 at the given prices. By evaluating this we set the lower bound of \( v \) consistent with this equilibrium. Thus we need that

\[ v + s_H - 1 - \frac{1}{3} \left[ 3t_L + 2c + \frac{4t_L}{\mu} \right] \geq 0 \quad (7) \]

Simplifying (7) yields

\[ v \geq v \equiv 1 + t_L + 2 \frac{c}{3} + \frac{4t_L}{3\mu} - s_H \quad (8) \]

That is, if (8) 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:

\[ \frac{\partial p^D_j}{\partial t_L} > 0 \quad \text{for every} \quad j = h, l. \]

\[ \blacksquare \]

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

Proof:

\[ \frac{\partial p^D_j}{\partial \mu} < 0 \quad \text{for every} \quad j = h, l. \]

\[ \blacksquare \]

The intuition behind these corollaries is that as the differentiation between products increases the substitution is becoming more difficult which
softens 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, pricing strategies reflect a stronger emphasis on price sensitive consumers and therefore equilibrium prices drop.

Substituting the equilibrium prices into the profit functions given by (5) yields

**Proposition 2** In equilibrium firms profits are

\[
\pi^D_h = \frac{\mu}{18t_L} \left(3t_L - c + \frac{4t_L}{\mu}\right)^2 \quad \text{and} \quad \pi^D_l = \frac{\mu}{18t_L} \left(3t_L + s - c + \frac{2t_L}{\mu}\right)^2
\]

Notice that as the size of price sensitive segment grows, equilibrium prices are decreasing, however, profits increase. Prices are falling since with the larger consumer base there is a stronger incentive to decrease prices. On the other hand, the quantity effect dominates the price effect, hence profits are increasing.

### 2.2 Strategic de-marketing

In fact, under certain conditions the high-quality firm has the incentive to deviate from the outcome 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:

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

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

\[ \pi_h = (p_h - c)D_h(p_h) \quad \text{and} \quad \pi_l = p_lD_l(p_l) \]  

(9)

where \( D_h(p_h) \) and \( D_l(p_l) \) stands for the demands faced by firm \( h \) and \( l \), respectively. Since consumers’ reservation utilities are high enough to provide non-negative surplus even for the consumer furthest away from the company she buys from, in equilibrium firms charge prices that consumers with the biggest distance from the company can still afford buying the product.

Notice that instead of a duopoly, we have in fact two separate monopolies in two separate markets. The choices of location therefore will be different from the duopoly case. Since a monopolist can maximize its profit by minimizing the distance from the furthest consumer, it chooses its location at the middle point of the unit line, i.e. the monopolist chooses the product characteristics according to the preferences of the median customer. Hence, instead of the maximum product differentiation that we have seen in the duopoly case, here we see both firms choose the same product characteristics.

Formally, we can state the following

**Proposition 3** Suppose firm \( h \) quits the low-end segment. In equilibrium firms will choose their respective location at the midpoint of the unit interval and equilibrium prices and profits are as follows:

\[ p_h^S = v + s_H - \frac{1}{4} \quad p_l^S = v - \frac{t_L}{4} \]

and

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

Comparing the results given in Proposition 2 and 3 we can determine conditions under which strategic de-marketing is indeed an equilibrium. For this we need

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

(10)

A different way to write this is

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

(11)

Hence, we have the following result
Proposition 4 The high-quality firm stops serving the low-end segment if consumers differ fundamentally in their valuations of the complementary service and if the more price-sensitive segment size is sufficiently low.

The intuition behind Proposition 4 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 that 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-end segment is remarkable in 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. Notice that when strategic de-marketing is profitable it always leads to higher average prices as well.

Additionally, choosing de-marketing has important implications regarding product characteristics. Competition with a low-quality provider will 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 result also has consequences regarding social welfare, since lower aggregate transportation costs necessarily imply higher aggregate welfare. Thus we can state the following

Proposition 5 De-marketing increases aggregate welfare.

3 Conclusion

We have shown that under certain conditions allowing the low-end firm to capture the low-end market gives the high-quality firm 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 high-quality firm 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. In other words, established firms should not necessarily get involved in price
competition with a low-quality competitor in the low-end segment but rather focus on (de-)marketing strategies.

We have also shown that de-marketing is accompanied by repositioning of the products and this repositioning leads to an increase in aggregate welfare. Our findings therefore carry a caveat that in certain cases de-marketing could be considered desirable by regulators.

References


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