Anticompetitive Impact of Pseudo-Generics*

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Abstract

A puzzling feature of pharmaceuticals markets is that sellers of branded drugs will, sometimes, sell generic versions of their own branded products, either directly or through license agreements. This paper proposes a new theoretical rationale for the fact that the introduction of these pseudo-generics may have anti-competitive effects. In a model that combines horizontal and vertical product differentiation, we show that the producer of the branded product will not sell the pseudo-generic unless faced with competition and that, if she does so, in some circumstances, all prices raise to the benefit of all competitors and the detriment of consumers.

Keywords: Pseudo-Generics; Product Differentiation; Pharmaceutical Pricing

JEL Codes: D43; L13; L44

1 Introduction

In recent decades, generics became an important competitive force in pharmaceutical markets, gaining considerable market share from branded products. Generics, according to the US Food and Drug Administration, "(...) are copies of brand-name drugs and are the same as those brand name drugs in dosage form, safety, strength, route of administration, quality, performance characteristics and intended use".[1] Generics may enter the market if a patent-holder waives its rights or, more often, when the patents that protect a branded product expire. As imitators, generic producers do not incur significant research and development costs and are able to charge very competitive prices.

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[1] http://www.fda.gov/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely /UnderstandingGenericDrugs/default.htm

It has been observed that, sometimes, the producers of a branded pharmaceutical will sell a generic version of their own branded product, either directly or through license agreements. [2] These versions are often known in the literature as pseudo-generics.The rationale for selling pseudo-generics is not obvious: given its much lower price, selling a pseudo-generic seems to risk cannibalizing the sales of the, more profitable, branded product. Some type of strategic impact on other generic competitors seems necessary to justify their use, which sugests the possibility of anticompetitive effects.

The theoretical literature on the competitive implications of pseudo-generics is rather limited. Ferrándiz [3] presents a model in which firms A and B sell substitutable branded drugs under two alternative scenarios: in one of the scenarios, a third firm sells a generic version of A's drug; in the other scenario, the third firm doesn't exist but A itself sells a pseudo-generic. Unsurprisingly, this author concludes that consumers would be better off in the first scenario but A prefers the second one. Kamien and Zang [5] assume that, when patents for the branded pharmaceutical expire, there is free generic entry. They build scenarios with and without a pseudo-generic to study the conditions under which it would be sold and conclude that selling the pseudo-generic is a dominant strategy. But these authors assume that the type of interaction between the brand-name producer and its competitors depends on whether the former is selling a pseudo-generic: if she is not, all firms choose quantities simultaneously (Cournot) but if she is, then she has a first-mover advantage towards the competitors in choosing the quantities of both the branded drug and the pseudo-generic (Stackelberg). We find this crucial assumption unconvincing and feel it casts doubt on the generality of their conclusions. More recently, Kong and Seldon [6] have tried to rationalize pseudo-generics as an instrument to deter entry, in a model *a la* Dixit [2], but their results seem flawed [7].

This paper proposes a new theoretical rationale for the fact that the introduction of pseudo-generics may have anticompetitive effects. In our model, firms are price-setters in a market where both vertical and horizontal differentiation are present: branded pharmaceuticals are vertically differentiated towards generics (they are perceived as being strictly better), but generics are horizontally differentiated among themselves. In this setting, we show that the presence of pseudo-generics may result in higher prices for every variety of the product, to consumers detriment.

That branded pharmaceuticals, which have been in the market for a considerable period under patent, may be perceived by consumers as being better than newcomer non-branded generics, in spite of health authorities claims to the contrary, we regard as obvious. But a crucial assumption of our model, that requires justification, is that generics may be perceived as horizontally differentiated. Even if they are "therapeutically equivalent" to the branded product, and thus also among themselves, generics may differ along many easily observ-

[2] The frequency with which this happens varies considerably from country to country, possibiliy as a result of legal and institutional differences: Hollis [4] claims that they represent roughly one quarter of total generic sales in Canada and Australia, and also have strong positions in New Zeland, Germany, UK and Sweden.

able dimensions: ingredients other than the active substances may, and do, differ and characteristics such as flavour, shape, and color are usually different. Besides, packages and labels may vary significantly. Further, although they do not carry a product brand (the product will be described as "acetylsalicylic acid", not as "Aspirin", for example), they generally identify the producer (it will be acetylsalicylic acid by XYZpharma, for example): there is no *a priori* reason to assume that consumers, or whoever chooses the product for them, are less sensitive to the identity of the producer in this type of product than in any other. Thus, we regard the assumption of horizontal differentiation among generics as a reasonable one.

The rest of the paper is organized as follows. The next section introduces our model. For benchmark purposes, in section 3 we apply it in a monopoly situation. In the fourth section, we analyze oligopolistic competition under two alternative scenarios: with and without the pseudo-generic. Section 5, builds on previous results to determine the competitive impact of the pseudo-generic. We then discuss our results and conclude.

2 The model

In our model, there are two firms: an incumbent (I) and an entrant (E), indexed by $j = I, E$. These firms compete by simultaneously setting the prices of the products they sell. The incumbent sells a certain pharmaceutical product under a specific brand. She can also, if she chooses to, sell a generic, non-branded, variety of the product. The entrant, on the other hand, can only sell a generic variety. Let b (brand) refer to the branded variety of the product, g (generic) to the non-branded variety produced by the entrant, and pg (pseudo-generic) to the non-branded variety produced by the incumbent. Capitalized forms B, PG, and G refer to quantities or demand functions of these product varieties.

Branded and generic varieties of the product are fundamentally identical but consumers perceive them as being vertically differentiated. Moreover, and as explained above, consumers perceive generic varieties produced by different firms as horizontally differentiated. This being the case, this model assumes that consumers vary in their preferences over the differentiated generic pharmaceutical product. The market is then composed of a uniform mass of consumers distributed over a unidimensional space of product characteristics, defined by the interval $[0, 1]$. The disutility of consuming a generic product variety other than one's ideal variety is assumed to be linear in the distance along this Hotelling interval, with slope $t > 0$.

Let c_i denote consumer i's type, where c_i measures the distance between consumer i's location and the left endpoint of the unit interval. To reflect the existence of vertical differentiation between the branded good and the generic alternatives, we assume that a consumer's reservation price regarding the branded variety (β) is higher than her reservation price corresponding to a generic product (γ). More formally, $\beta > \gamma > 0$. In addition, and a consequence of horizontal differentiation, if the consumer decides to buy a generic variety, her surplus depends negatively on the distance between her location and the location of the seller in the generics product space she is buying from, where we denote by f_j firm j's location.

Consumers purchase either one unit or none. Each consumer opts for the product that provides her the most surplus, as long as this surplus is positive. Denoting by (p_b, p_g, p_{pg}) the vector of prices, consumer c_i's individual surplus is given by:

$$CS_i = \begin{cases} \beta - p_b & \text{if she buys } b \\ \gamma - p_k - t \times |f_j - c_i|\,, k = g, pg & \text{if she buys } g \text{ or } pg \\ 0 & \text{otherwise} \end{cases}. \quad (1)$$

Two additional remarks are in order at this point. First, as they are not fundamental for the purpose of this article, which is to illustrate a mechanism through which pseudo-generics can have anti-competitive effects, we normalize production costs to zero. Second, since, without loss of generality, we normalized the total number of consumers to be equal to 1, quantities may also be interpreted as market shares.

The following two sections compare firms' profits and consumers' surplus in alternative situations.

3 The monopolist's benchmark case

Consider first the case in which the incumbent is a monopolist, possibly because she is protected by patents. This being the case, she may either sell only the branded variety of the product or both the branded and the (pseudo-)generic varieties. However, in this perfect information setting, as the reservation price for generic varieties is lower than the reservation price for the branded variety (i.e., $\beta > \gamma$) and their respective production costs are identical (and equal to zero), it never pays to sell a generic variety along with the branded product. The incumbent then sets a price $p_b^1 = \beta$ for the branded variety. As a consequence, every consumer buys this branded product, getting zero surplus, and the incumbent's profit equals $\Pi_I^1 = \beta$.

4 Oligopolistic competition

Consider now the case of oligopolistic competition, say because the patents that protected the incumbent have expired and, as a result, she starts facing competition by an entrant.

In what follows, we assume that the entrant's (generic) variety of the product is located at the left endpoint of the generics' product space ($f_E = 0$) - the unit interval - and that, if it is available, the pseudo-generic is located at point f_I along the $(0, 1]$ segment. There are two different scenarios of interest, depending on whether the incumbent is present in the market with only one variety (the branded good) or with two varieties (the branded good and the pseudo-generic), which we discuss in turn.

4.1 The incumbent does not sell a pseudo-generic

Assume the incumbent sells only the branded variety and the entrant sells the generic variety. When this is the case, Figure 1 illustrates the determination of the demand for each product variety, for given location and prices. This Figure implicitly assumes that the generic variety is sufficiently cheaper than the branded product so as to have positive demand. Specifically, it assumes $p_b - p_g > \beta - \gamma$. The location of the "marginal consumer" $c_{b.g}$, who is indifferent between varieties b and g, follows from solving $\gamma - p_g - t \times c_{b.g} = \beta - p_b$:

$$c_{b.g} = \frac{(p_b - p_g) - (\beta - \gamma)}{t}. \tag{2}$$

With the total number of consumers equal to 1, the demand functions for each variety of the product are simply:

$$B(p_b, p_g) = 1 - c_{b.g} = 1 - \frac{(p_b - p_g) - (\beta - \gamma)}{t}, \tag{3a}$$

$$G(p_b, p_g) = c_{b.g} = \frac{(p_b - p_g) - (\beta - \gamma)}{t}. \tag{3b}$$

With no production costs, profit functions are $\Pi_B(p_b, p_g) = B(p_b, p_g)\, p_b$ and $\Pi_E(p_b, p_g) = G(p_b, p_g)\, p_g$. Maximizing these with respect to p_b and p_g, one obtains the best-response functions:

$$p_b = \frac{t + (\beta - \gamma) + p_g}{2} \tag{4a}$$

$$p_g = \frac{p_b - (\beta - \gamma)}{2} \tag{4b}$$

Solving the system of best-response functions, we find the equilibrium prices:

$$p_b^2 = \frac{2}{3}t + \frac{1}{3}(\beta - \gamma) \tag{5a}$$

$$p_g^2 = \frac{1}{3}t - \frac{1}{3}(\beta - \gamma) \tag{5b}$$

From these, through the demand functions, equilibrium quantities follow:

$$B^2 = \frac{1}{3}\frac{2t + (\beta - \gamma)}{t} \tag{6a}$$

$$G^2 = \frac{1}{3}\frac{t - (\beta - \gamma)}{t} \tag{6b}$$

Equilibrium profits are then:

$$\Pi_I^2 = \frac{1}{9}\frac{[2t + (\beta - \gamma)]^2}{t} \tag{7a}$$

$$\Pi_E^2 = \frac{1}{9}\frac{[t - (\beta - \gamma)]^2}{t} \tag{7b}$$

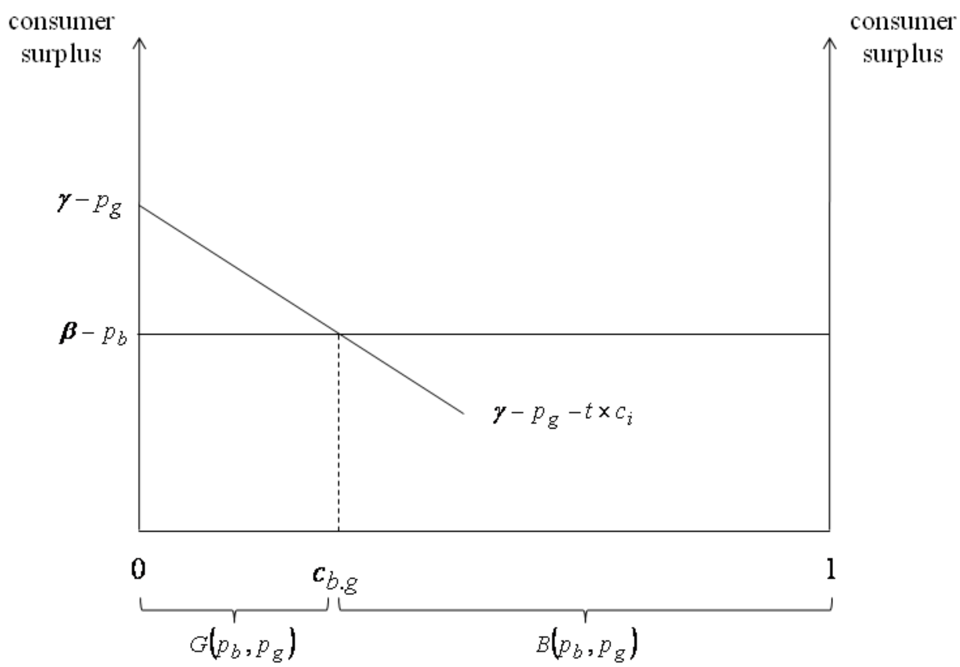

Figure 1: Determination of demand functions, when the incumbent sells a branded variety of the product and the entrant sells a generic variety, assuming the entrant is located at the left end of the market

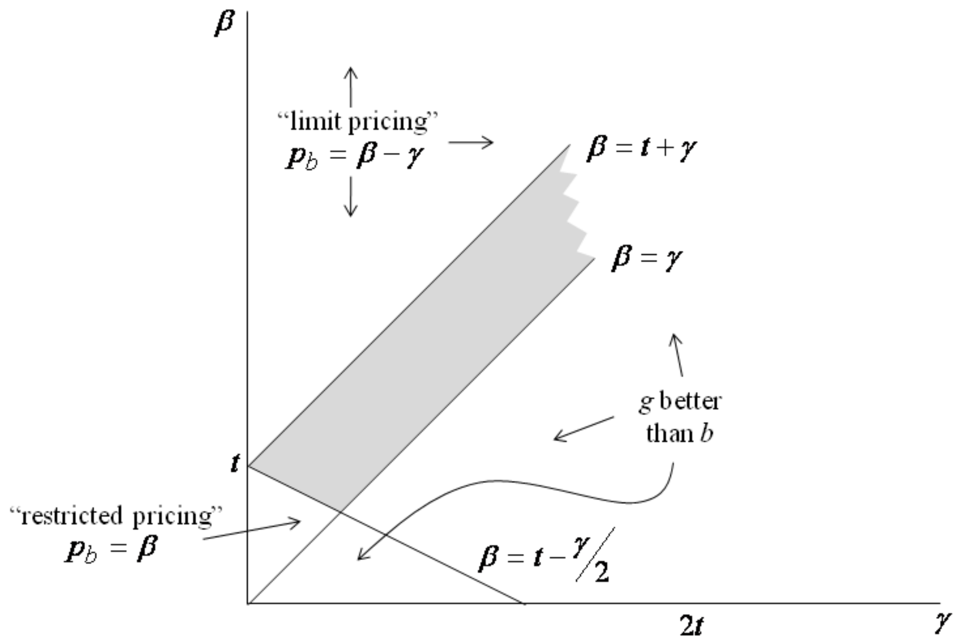

Figure 2: Restrictions on parameter values, when the incumbent sells the branded variety and the entrant sells a generic variety: results in section 4.1 hold for parameter values in the shaded area

Restrictions on parameter values For these results to hold, some restrictions must be imposed on parameter values. Basically, these assure that the branded variety is perceived as better than the generic, but not so much better that no one would buy the latter, and that the product is sufficiently valuable for everyone to be willing to buy it (market is fully covered under competition). Under these conditions, both varieties will be simultaneously sold at a profit. Figure 2 illustrates the necessary restrictions on β and γ, as a function of t.

In equilibrium, the indifferent consumer must be located in the $[0, 1]$ segment, i.e., $0 < c_{b.g} < 1$, as assumed. Simple algebra shows that the right-hand side condition $c_{b.g} < 1$ always holds since $t > 0$ and $\beta > \gamma$. As for $c_{b.g} > 0$,it must be that

$$\beta < t + \gamma. \tag{8}$$

If β exceeds the threshold value $t + \gamma$, then incumbent can raise its price above p_b^2 without inducing the entrant to sell the generic. Specifically, the incumbent can set a limit price of $p_b = \beta - \gamma$ and sell to the entire market, with a profit of $\Pi_b = \beta - \gamma$.

Notice, however, that the previous conditions are not enough for our previous results to be valid: even if located in the $[0,1]$ segment, the indifferent consumer could get negative surplus from both varieties. In order for this not to happen, let $\beta \geq p_b$. In equilibrium, this is equivalent to

$$\beta \geq t - \frac{\gamma}{2} \tag{9}$$

If this condition doesn't hold, then the incumbent will be restricted to $p_b = \beta$ and the entrant will respond with $p_g = \frac{\gamma}{2}$. This in turn implies that profits will be $\Pi_I = \beta(1 - \gamma/2t)$ and $\Pi_E = \gamma^2/4t$.

Summing up, the results in this section apply if conditions 8 and 9 hold.[3] Hence, the relevant region of parameter values is the one illustrated with the shaded area in Figure 2.

4.2 The incumbent sells a pseudo-generic

Consider now the case in which the incumbent, faced with generic competition by an entrant, sells also a non-branded version of her own product, which we call a pseudo-generic.

Assume the pseudo-generic is located sufficiently close to the entrant's generic product for some consumer to be indifferent between them: otherwise, there would be no strategic interaction between the two products and, therefore, no reason for the incumbent to sell the pseudo-generic. Denote by $c_{g.pg}$ the location of this consumer and by f_I the location of the pseudo generic variety in the generics product space. Assuming the pseudo-generic does not cannibalize the incumbent's whole market, there will also be some consumer $c^r_{b.pg}$ that is indifferent between the pseudo-generic and the branded variety of the product. Here, the superscript r indicates that this consumer is located to the right of f_I. We will later use the notation $c^l_{b.pg}$ for the consumer that is indifferent between these varieties to the left of f_I. The determination of the demand functions for the three varieties of the product is illustrated in Figure 3.

Solving $\gamma - p_g - t \times c_{g.pg} = \gamma - p_{pg} - t \times (f_I - c_{g.pg})$, the location of the consumer indifferent between the two generic varieties of the product is

$$c_{g.pg} = \frac{f_I}{2} + \frac{p_{pg} - p_g}{2t}. \tag{10}$$

Similarly, solving $\gamma - p_{pg} - t \times \left(c^r_{b.pg} - f_I\right) = \beta - p_b$, the location of the consumer indifferent between the two varieties sold by the incumbent is:

$$c^r_{b.pg} = f_I - \frac{\beta - \gamma}{t} + \frac{p_b - p_{pg}}{t}. \tag{11}$$

The demand functions are

[3] Recall also that $t > 0$ and $\beta > \gamma$.

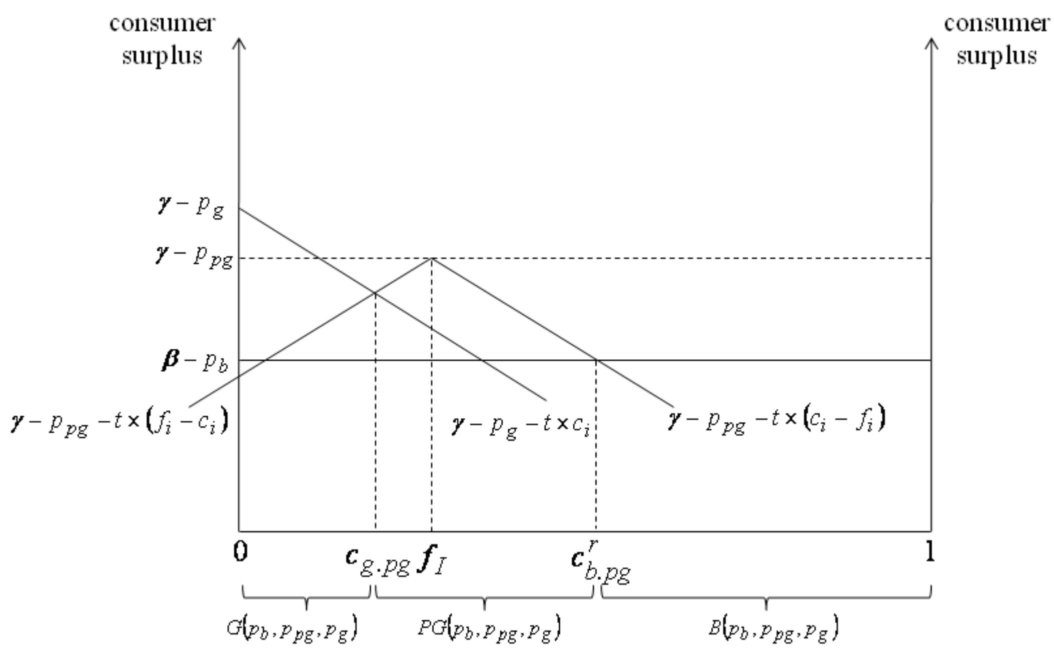

Figure 3: Determination of demand functions, when the incumbent sells both a branded and a generic variety of the product and the entrant sells a generic version, assuming the entrant is located at the left end of the market and the incumbent at f_I

$$\begin{aligned}
B\left(p_b, p_{pg}, p_g\right) &= 1 - c^r_{b.pg} = 1 - f_I + \frac{(\beta-\gamma) - (p_b - p_{pg})}{t} && (12a)\\
PG\left(p_b, p_{pg}, p_g\right) &= c^r_{b.pg} - c_{g.pg} \\
&= \frac{f_I}{2} - \frac{\beta-\gamma}{t} + \frac{p_b - p_{pg}}{t} - \frac{p_{pg} - p_g}{2t} && (12b)\\
G\left(p_b, p_{pg}, p_g\right) &= c_{g.pg} = \frac{f_I}{2} + \frac{p_{pg} - p_g}{2t} && (12c)
\end{aligned}$$

Profit functions are then:

$$\Pi_I\left(p_b, p_{pg}, p_g\right) = B\left(p_b, p_{pg}, p_g\right) \times p_b + PG\left(p_b, p_{pg}, p_g\right) \times p_{pg}$$

and

$$\Pi_E\left(p_b, p_{pg}, p_g\right) = G\left(p_b, p_{pg}, p_g\right) \times p_g.$$

Maximizing these profit functions, one obtains the best-response functions:

$$\begin{aligned}
p_b &= \frac{1}{2}(\beta-\gamma) + \frac{(1-f_I)\,t}{2} + p_{pg} && (13a)\\
p_{pg} &= \frac{tf_I}{6} - \frac{1}{3}(\beta-\gamma) + \frac{2}{3}p_b + \frac{1}{6}p_g && (13b)\\
p_g &= \frac{tf_I}{2} + \frac{1}{2}p_{pg} && (13c)
\end{aligned}$$

Solving the system composed of the previous three equations, one obtains the equilibrium price for each of the three varieties present in the market:

$$\begin{aligned}
p^3_b &= (11 - 5f_I)\,\frac{t}{6} + \frac{1}{2}(\beta-\gamma) && (14a)\\
p^3_{pg} &= (4 - f_I)\,\frac{t}{3} && (14b)\\
p^3_g &= (2 + f_I)\,\frac{t}{3} && (14c)
\end{aligned}$$

Resulting in the following quantities:

$$\begin{aligned}
B^3 &= \frac{1-f_I}{2} + \frac{\beta-\gamma}{2t} && (15a)\\
PG^3 &= \frac{1+2f_I}{6} - \frac{\beta-\gamma}{2t} && (15b)\\
G^3 &= \frac{1}{3} + \frac{f_I}{6} && (15c)
\end{aligned}$$

Equilibrium profits are:

$$\Pi_I^3 = \frac{t\left(41 - f_I\left(34 - 11f_I\right)\right)}{36} + \frac{\left(1 - f_I\right)}{2}\left(\beta - \gamma\right) + \frac{\left(\beta - \gamma\right)^2}{4t} \tag{16a}$$

$$\Pi_E^3 = \frac{1}{18}t\left(2 + f_I\right)^2 \tag{16b}$$

Restrictions on parameter values Again, for these results to be valid, some restrictions must be imposed on the parameters, which we discuss in what follows.

First, as in the previous subsection, we require that some but not all consumers prefer the entrant's generic to the incumbent's branded variety. More formally, we require that that $0 \leq c_{b.g} \leq 1$. The first inequality is equivalent to

$$\beta \leq \gamma + t\left(\frac{7}{3} - f_I\right) \tag{17}$$

The second inequality implies that

$$\beta \geq \gamma + t\left(\frac{1}{3} - f_I\right) \tag{18}$$

Second, to guarantee that some but not all consumers prefer the pseudo-generic to the entrant's variety, we require that: *(i)* $c_{b.pg}^r > c_{b.g}$; and *(ii)* $\gamma - p_{pg} - tf_I < \gamma - p_g$. In equilibrium, both conditions are equivalent to require that

$$f_I > \frac{2}{5} \tag{19}$$

If this holds, any $\beta > \gamma$ will satisfy 18.

Third, we also require that some but not all consumers prefer the branded variety of the product to the pseudo-generic, i.e., $f_I < c_{b.pg}^r < 1$. The second inequality is trivially satisfied for any $t > 0$, $\beta > \gamma$ and $0 < f_I < 1$. The first inequality, on the other hand, is equivalent to require that:

$$\beta < \gamma + t\left(1 - f_I\right) \tag{20}$$

Fourth, our solution assumes also that the consumer who is indifferent between the two generic varieties does not prefer the branded variety. Otherwise, the incumbent would not sell the pseudo-generic. Thus, we require also that $c_{b.g} \geq c_{b.pg}^l$, which implies that:

$$\beta \leq \gamma + t\left(\frac{5}{6} - f_I\right) \tag{21}$$

It should be noted that condition 21 is more restrictive than either 17 and 20.

Finally, we assume that the branded variety, and, therefore, every other variety, provides non-negative surplus, i.e., $\beta \geq p_b$. This is equivalent to:

$$\beta \geq t\frac{11 - 5f_I}{3} - \gamma \tag{22}$$

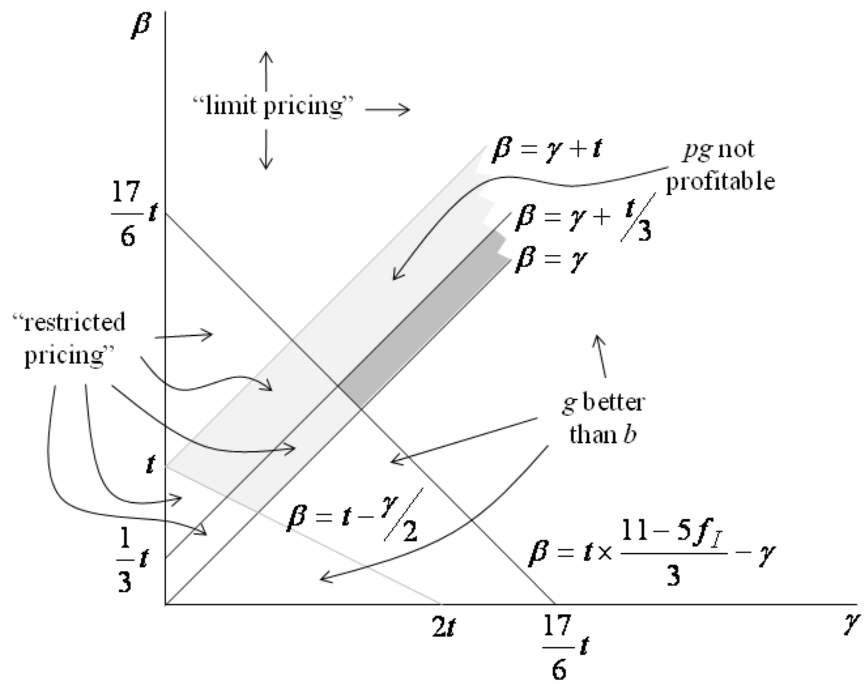

Figure 4: Restrictions on parameter values when the incumbent sells both branded and pseudo-generic varieties of the product and the entrant sells a generic: results in section 4.2. hold for parameter values in the dark shaded area, assuming $f_I = 0.5$; results in section 4.1. hold for both the dark and the light shaded areas

Summing up, the active restrictions are, thus, 19, 21, and 22. Figure 4 summarizes the restrictions that apply to the demand parameters β and γ, for $f_I = 0.5$ and a specific value of t.

5 Price and profit impact of the pseudo-generic

We now turn to the main results in the paper, where we determine the competitive impact due to the pseudo-generic introduction in an oligopolistic setting.

Proposition 1 *For parameter values satisfying conditions 19, 21, and 22, the introduction of a pseudo-generic raises the price of both the branded and the true-generic varieties of the product.*

Proof. $p_b^3 > p_b^2 \Leftrightarrow f_I > -1 - \frac{\beta-\gamma}{t}$ and $p_g^3 > p_g^2 \Leftrightarrow f_I < \frac{7}{5} + \frac{1}{5}\frac{\beta-\gamma}{t}$. With $\beta > \gamma$ and $t > 0$, both conditions hold for any $f_I \in [0, 1]$. ■

The overall impact of the pseudo-generic on consumers does not depend on these two prices alone, though, as some of them will replace the pseudo-generic for the other varieties of the product. But that will be of no avail.

Proposition 2 *For parameter values satisfying conditions 19, 21, and 22, the pseudo-generic is more expensive than either the branded product or the true generic would be in its absence.*

Proof. $p_{pg}^3 > p_b^2 \Leftrightarrow f_I < 2 - \frac{\beta-\gamma}{t}$ and $p_{pg}^3 > p_g^2 \Leftrightarrow f_I < 3 - \frac{\beta-\gamma}{t}$. These are less restrictive than condition 21, above, and so always true for the relevant range of parameter values. ■

As every price rises with the introduction of the pseudo-generic, we finally claim that

Corollary 3 *For the range of parameter values defined by conditions 19, 21, and 22, the introduction of a pseudo-generic reduces consumers' surplus.*

Thus, for certain parameter values, if the incumbent sells a pseudo-generic, consumers will be hurt. But we have yet to prove that the incumbent will want to sell the pseudo-generic. The following proposition establishes the conditions in which that will happen.

Proposition 4 *For parameter values satisfying conditions 19, 21, and 22, selling the pseudo-generic increases the incumbent's profit if the pseudo-generic is perceived as a sufficiently good substitute for the true-generic (f_I is sufficiently low) and, if that does not happen, also if either consumers are sensitive to horizontal differentiation (t is not low) or the perceived quality differential between branded and generic products is significant ($\beta - \gamma$ is not low).*

Proof. Let $\Delta\Pi = \Pi_I^3 - \Pi_I^2$. First, note that $\frac{\partial \Delta\Pi}{\partial f_I} < 0$, for any $0 \leq f_I \leq 1$, and $\frac{\partial^2 \Delta\Pi}{\partial f_I^2} > 0$: for the relevant range of parameter values, the profitability of selling the pseudo-generic is decreasing in f_I. As condition 19 requires that $f_I > \frac{2}{5}$, note also that $\Delta\Pi\left(f_I = \frac{2}{5}\right) > 0$. Thus, if f_I is sufficiently close to $\frac{2}{5}$, selling the pseudo-generic is profitable, for any values of the other parameters in the relevant range. If $\Delta\Pi = 0$ had no solutions for $f_I \in [0, 1]$, this would be true for any relevant value of f_I. The solutions to this equation are $f_I = \frac{1}{11t}\left(17t + 9\theta + \sqrt{2}\sqrt{142t\theta + 13\theta^2 + 7t^2}\right)$ and $f_I = \frac{1}{11t}\left(17t + 9\theta - \sqrt{2}\sqrt{142t\theta + 13\theta^2 + 7t^2}\right)$. The first solution always exceeds 1 and thus places no additional restrictions on parameter values. The second, however, may lie in the $[0, 1]$ interval. Although we do not have an analytical solution, visual inspection of this function shows this only happens if t and $\beta - \gamma$ simultaneously take low values; in that case, sufficiently high values of f_I imply that selling the pseudo-generic is not profitable. Again, visual inspection shows that the critical value of f_I, above which selling the pseudo-generic is not profitable, is always larger than 0.7. ■

The following numerical example ilustrates these results. Assume $t = 0.5$, $\gamma = 1$ and $\beta = \frac{7}{6}$. Using the formulas above, it is immediate to find that, if the incumbent does not sell the pseudo-generic, equilibrium is characterized by

	price	quantity	profit
branded product	0.388	0.777	0.302
generic	0.111	0.222	0.025

Assume, alternatively, that the incumbent sells a pseudo-generic located at $f_I = 0.5$. Equilibrium values will then be:

	price	quantity	profit
branded product	0.792	0.417	0.330
pseudo-generic	0.583	0.167	0.097
generic	0.417	0.417	0.174

Thus, every price rises, increasing both firms' profits at consumers' expenses.

The intuition for these results can be understood by thinking of the impact that a price reduction by the incumbent will have on her market share. If she is not selling the pseudo-generic, the incumbent's branded product competes directly against the entrant's generic, as illustrated in Figure 1: in this situation, a unitary price reduction by the incumbent steals $\frac{1}{t}$ market share from the entrant ($\frac{\partial G(p_b,p_g)}{\partial p_b}$, along 3b). But if incumbent sells the pseudo-generic, this product interposes between the branded product and the "true"-generic, as seen in Figure 3: a reduction of the price of the branded product would steal consumers from its own pseudo-generic (i.e., it would move $c^r_{b.pg}$ to the left) but would have no impact on the entrant's market share ($c_{g.pg}$ would remain the same and $\frac{\partial G(p_b,p_g)}{\partial p_b} = 0$, along 12c). To steal market share from the entrant, the incumbent would now need to resort to the pseudo-generic price. But a unitary reduction of the price of the pseudo-generic steals just half as much market share from the entrant ($\frac{\partial G(p_b,p_{pg},p_g)}{\partial p_{pg}} = \frac{1}{2t}$, along 12c) as a reduction of the price of the branded product would if the pseudo-generic was not available. This is because the two generics are horizontally differentiated and consumers trade off the reduced price against the higher "transportation costs". Thus, the incentive to reduce prices is weaker if the pseudo-generic is being sold.

This is aggravated by two other factors. First, reducing the price of the pseudo-generic will not only capture consumers that would otherwise buy the true-generic but also others that would buy the incumbent's, more profitable, branded product (reducing the price of the pseudo-generic moves $c^r_{b.pg}$ to the right).[4] Besides, in this model, as usual, prices are strategic complements: anticipating higher prices by the pseudo-generic selling incumbent, the entrant herself sets higher prices, further decreasing the incumbent's incentive to reduce prices. Thus, the presence of the pseudo-generic softens competition between the two firms.

[4] Put it another way, in case the incumbent is a multiproduct firm, decreasing the price of the the pseudo-generic has a canibalization effect since part of the demand captured with the price decrease refers to consumers previously buying the other variety sold by the incumbent - the branded product.

6 Discussion and further research

This paper illustrates a new theoretical rationale for the fact that the introduction of pseudo-generics can lead to higher prices of all (branded and non-branded) varieties in the market and reduce consumer surplus. The key feature of the proposed model is the coexistence of both vertical and horizontal differentiation which we think is a good description of the way pharmaceutical products market work in reality.

There are other contexts where this coexistence of two types of differentiation is at work and in which our model may prove insightful. A good example is the case in which branded products are sold in retail stores along with private labeled products (sometimes produced by the same firm which sells as well the main brand available in the market). The empirical literature shows that entry by store brands is often accompanied by price increases (Ward *et al.* [8], Bronfrer and Chintagunta [1]).

In concluding, it should be pointed out that an important limitation to the previous analysis is the fact that the location of the generic varieties in the product space are assumed to be exogenously given. Clearly, the assumption of exogenous "locations" restricts the applicability of the proposed model, since real life industries product positioning and repositioning is another important dimension through which firms strategically interact. So, it seems important to extend the analysis in order to consider cases in which locations are endogenously determined. This will be done in future research. Hopefully, the above model can be seen as a stepping stone in the direction of a more complete analysis.

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