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Direct-to-Consumer Advertising in Pharmaceutical Markets*

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Abstract

We study effects of direct-to-consumer advertising (DTCA) in a market with two pharmaceutical firms providing horizontally differentiated (branded) drugs. Patients varying in their susceptability to medication are *a priori* uninformed of available medication. Physicians making the prescription choice perfectly identify a patient's most suitable drug. Firms promote drugs to physicians (detailing) to influence prescription decisions and, if allowed, to consumers (DTCA) to increase the awareness of the drug. The main findings are: Firstly, firms benefit from DTCA only if prices are regulated. On the one hand, DTCA reduces the physicians' market power and thus detailing expenses, while, on the other, it triggers price competition as a larger share of patients are aware of the alternatives. Secondly, under price regulation DTCA is welfare improving as long as the regulated price is not too high. Under price competition, DTCA is harmful to welfare unless detailing is wasteful and the drugs are poor substitutes.

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1 Introduction

The pharmaceutical industry is one of the most advertising-intensive industries (see e.g. Scherer and Ross, 1990). Promotional expenditures often amount to 20-30 percent of sales, sometimes even exceeding expenditures on R&D.[1] However, contrary to most other industries the vast amount of promotional spendings are not targeted at the consumers, but rather at the physicians making the prescriptions. While this can be explained by the important role of the physician as the patient's agent, another important reason lies with the regulatory restrictions on direct-to-consumer advertising (DTCA) of prescription drugs that are present in most countries.

Recently, however, there has been a trend towards a more liberal legislation on DTCA. In the US, the Food and Drug Administration issued new guidelines in 1997 for broadcast advertising of prescription drugs directly to consumers, facilitating the use of television for DTCA. A similar liberalisation is carried through in New Zealand. In the European Union a 5-year pilot project of allowing DTCA for three long-term and chronic diseases - diabetes, AIDS and asthma - has recently been proposed.

The role of DTCA has generated a controversial debate (see e.g. Wilkes *et al.*, 2000). Opponents claim that DTCA causes physicians to waste valuable time during encounters with patients and encourages the use of expensive and sometimes unnecessary medications. Proponents argue that DTCA increases the consumers' awareness and knowledge about available medical treatments, and this may enable them to detect a possible disease at an earlier stage and more actively take part in the decision of which drug to prescribe.

The debate on DTCA seems to ignore that pharmaceutical companies already spend tremendous amounts of money on promotion aimed at influencing the physicians' prescription choices in ways favourable to the companies.[2] In this paper, we therefore seek to contribute to the debate by investigating the interaction between advertising directed at consumers (DTCA), on the one hand, and promotional activities targeted at physicians (detailing), on the other. In particular, the following three questions will be addressed: (i) How does availability of DTCA affect the pharmaceutical firms' incentives to spend resources on detailing, and, eventually, the physician's prescription choices? (ii) Does DTCA have a pro-competitive or an anti-competitive effect on drug prices and

[1] According to Schweitzer (1997) the marketing expenses for three of the largest US pharmaceutical companies - Merck, Pfizer, and Eli Lilly - ranged from 21 to 40% of annual sales, while the R&D expenses varied between 11 and 15%. Similar figures are reported from Novartis and Aventis, the largest pharmaceutical companies in Europe. See also Hurwitz and Caves (1988) for US data or Zweifel and Breyer (1997) for figures in Germany and Switzerland.

[2] Rosenthal *et al.* (2002) report spendings on promotion to professionals in the US to 13,241 millions of dollars in 2000.

profits in the industry? (iii) Is DTCA beneficial or detrimental from a welfare point of view?

We will apply the following theoretical framework. We consider a market for prescription drugs, in which a Health Authority (e.g. the FDA) decides on whether or not to allow DTCA. We consider both a regime of price regulation and the case where prices are set by the pharmaceutical firms. This enables us to compare the effects of DTCA across health care systems in which firms compete on price (e.g. in the US or Germany) and systems in which prices are regulated (e.g. in the UK or the Scandinavian countries).[3]

There are two pharmaceutical firms in the market providing horizontally differentiated drugs. Applying the familiar Hotelling model, this is captured by assuming the firms (or drugs) to be located at either end of the unit interval. This means that we focus on *branded vs. branded* competition in the prescription drug market, and not on branded vs. generic competition. Thus, we have in mind competition between medications based on different chemical entities treating a particular disease. There is evidence that most illnesses can be treated by a variety of medications, and that many drugs meet competition from chemically differentiated substitutes even under patent protection.[4]

We assume that patients differ in their susceptibility towards the different drugs, as represented by their location on the Hotelling-line. This means that some patients are better off with, say, drug 1, while others are better off with the alternative drug. Thus, there is no strict hierarchy in which one drug is universally better than another, implying that optimal treatment depends on the individual case and is a matter of *matching*. As the patients are initially unaware of the relevant medication available, they visit a physician who has the appropriate skills and knowledge to identify the optimal match for each patient.[5]

The pharmaceutical companies attempt to bias prescription choices toward their own brand by promoting it to the physician. The marketing activities are personal and targeted as they mainly involve pharmaceutical sales agents providing information on a particular drug in a face-to-face meeting with the physician. These agents also invite physicians to sponsored conference trips, provide

[3]Most European countries exercise some form of price regulation on prescription drugs. See e.g. Mossialos (1998) for an overview of the different ways drug prices are regulated in Europe.

[4]Scherer (2000) reports that the number of drugs per symptom group ranged from 1 to 50, with a median of 5 drugs and mean of 6.04. Lu and Comanor (1998) find that all but 13 of 148 new branded chemical entities introduced in the US between 1978-87 had at least one fairly close substitute; the average number of substitutes being 1.86.

[5]Note that the issue of over-utilisation of prescription drugs is not addressed in the paper. Although, this could be included, for instance, by assuming a fraction of the patients not in need for any of the available drugs, the model is most suitable to analyse the matching problem.

free product samples, etc. We therefore consider it reasonable to assume that detailing gives rise to an agency problem as the physician may be more inclined to prescribe the most heavily promoted drug to a patient rather than a more suitable alternative that experiences less promotion.[6] Consequently, some patients may face a utility loss in receiving a suboptimal prescription.

An important feature of detailing activities is that they are not a direct reward to the physician for the prescription. Instead this is effort that is irreversibly spent (sunk) by the pharmaceutical companies at the time the physician makes the decision about which drug to prescribe. For instance, a physician that has received a sponsored trip to a conference may, but need not, prescribe this company's product. However, detailing may still influence the physician's inclination to prescribe the company's drug, otherwise these spendings would not take place. This makes it reasonable to describe detailing competition as a marketing contest, where the firm spending more resources on detailing faces a higher probability that the physician will prescribe its own rather than the competing brand.[7]

Firms may also advertise their drugs directly to consumers, if this is permitted by the Health Authority. Contrary to promotion to physicians, DTCA is mainly impersonal and provided through mass media (e.g. television or print medias). As patients are *a priori* uninformed about the available medication, the firms must convey some information about their drugs to the patients via their advertising campaigns.[8] To capture these features, we employ the advertising model of Grossman and Shapiro (1984), in the duopoly variant, where advertising increases the fraction of patients aware of a particular product. We find it reasonable that patients' information about available medication limits the physician's ability or inclination to prescribe a less suitable ("wrong") drug. There may be several reasons for this, like the risk of being subject to liability suits or loosing reputation. Professional ethics may also restrain the physician from actively recommending a less suitable drug to a patient aware of the alternatives.

[6] In the context of branded vs. branded competition, Rizzo (1999) provides evidence that detailing effort makes demand less elastic to prices, indicating a persuasive nature of such activities. Hurwitz and Caves (1988) provide similar evidence in the context of branded vs. generic competition. See also Hellerstein (1998).

[7] In the context of promotional competition, Schmalensee (1976, 1992) uses a similar approach to determine firms' market shares as a function of advertising. In a related paper, Konrad (2002) also models promotion aimed at physicians as a marketing contest.

[8] There are also regulatory restrictions on the content of DTCA of prescription drugs. In general, advertisements should include information relating to side effects, contraindications, and effectiveness as reported on the packages. Concerning broadcasting advertising of prescription drugs, the FDA in the US issued guidelines in 1997 stating that these requirements could be satisfied by referring the patient to further sources of information: their doctor, a web-site, a charge-free phone number, and a print advertisemement (see e.g. Wilkes *et al.*, 2000).

Within this framework, the paper provides the following answers to the three questions raised previously. Firstly, we find that the two different marketing strategies, DTCA and detailing, are substitutes, rather than complements, for the firms in achieving higher profits. Firms' incentive to advertise directly to consumers is to reduce the physicians' market power and by this to *soften* detailing competition. Thus, firms respond to a relaxation of the restrictions on DTCA by lowering their detailing effort.[9]

Secondly, emphasising the different nature of DTCA and detailing, we find that the two marketing strategies have a distinctly different effect on competition between the pharmaceutical firms. Consistent with the empirical literature in the context of branded vs. branded competition (e.g. Rizzo, 1999, King, 2000), detailing tends to reduce the price elasticity of demand, implying an anticompetitive effect. However, there is a direct loss involved with detailing as the firms have to transfer resources to the physician. DTCA reduces the physician's influence over demand and, thereby, allows firms to contain their total promotional outlays. However, by increasing the price elasticity of demand, DTCA also triggers price competition, similar to Grossman and Shapiro (1984). Overall, we find the pro-competitive effect to be dominant so that the availability of DTCA curbs profits when prices are not regulated. When prices are set by the Health Authority, the price effect vanishes and firms now benefit from a removal of a ban on DTCA.

Thirdly, we find that DTCA improves welfare under price regulation as long as the regulated price is not too high. Here, the costs of DTCA are more than offset by the benefits due to improved matching of drugs to patients and lower spendings on detailing. However, when the regulated price is high, e.g. for the purpose of stimulating R&D, firms tend to provide excessive levels of DTCA, making a ban on DTCA desirable. Under price competition, over-provision of DTCA arises if the social cost of detailing is not too high and when drugs are poor substitutes. This is because product prices are high when the brands are poor substitutes, and intense promotional competition arises. Despite the presence of over-provision, the high mismatch cost in the case of poor substitutability usually does not justify a ban on DTCA in this case.

Although the (empirical) literature on marketing in the pharmaceutical industry is quite extensive (see e.g. Scherer, 2000, for a review), most of the literature has considered how promotion of branded drugs (to physicians) may deter entry of generic drugs (e.g. Frank and Salkever, 1997, and Scott Morton, 2000). There are some studies considering competition between branded drugs,

[9] Rosenthal *et al.* (2002) present figures from the US market showing that both DTCA and promotion to professionals have increased in absolute numbers for the periode 1996-2000. However, in percentage of sales, total promotional efforts have been constant and the figures indicate a substitution effect from detailing towards DTCA, though DTCA still constitutes a relatively small share of total sales (2.2%) and total promotional spendings (16%).

providing evidence that detailing effort tends to make demand less elastic to prices and thus may have an anticompetitive effect (e.g. Rizzo, 1999, and King, 2000), but the effect of DTCA is not addressed.

The two papers closest to ours are Rubin and Schrag (1999) and Konrad (2002). The former considers the effect of DTCA on the provision of drugs by HMOs' to their patients. As payments are prospective and patients are uninformed about available medication, the HMOs' have an incentive to provide cheaper and, perhaps, less effective drugs. Assuming a more effective drug being supplied by a monopolist and a less effective drug supplied by a competitive market, Rubin and Schrag (1999) show that the monopolist can mitigate this agency problem by using DTCA to inform patients about its product. Despite the similarities, they do not consider competition in terms of advertising and prices, and they are not concerned about the role of detailing effort on physician's prescription choice, which are the main issues of our paper.

Similar to us, Konrad (2002) is concerned about how promotional effort targeted at a physician may distort the prescription choice and potentially impose a utility loss on patients due to mismatching. Although Konrad (2002) also models detailing competition as a marketing contest, the framework is different in that he is concerned about asymmetry between firms and different types of promotion to physician (detailing effort and "pseudo" research studies), but does not deal with the interaction between detailing and DTCA.

The rest of the paper is organised as follows. In section 2, the basic analytical framework is described. In section 3 and 4, we derive the equilibrium outcomes for a price regulation regime and a price competition regime, respectively. Section 5 is devoted to analyse the welfare implications of DTCA. Section 6 concludes.

2 Model

Assume the market for prescription drugs consists of a continuum of patients distributed uniformly on the line segment $[0,1]$ with mass 1. In the market there are two pharmaceutical firms, indexed by $i = 0, 1$, located at either end of the unit interval. Firm i sells the branded drug i at a uniform price p_i. Each patient is in need of one unit of drug 0 or 1. The surplus (utility) derived by a patient located at $x \in [0,1]$ from getting a unit of drug i is

$$U_{x,i} = v - t\,|x - i| - p_i, \tag{1}$$

where $v > 0$ and $t > 0$. We assume that the gross utility, v, is always large enough for the whole market to be covered. Patients are heterogeneous with respect to their susceptibility to treatment with the two branded drugs. The parameter t captures the utility loss ("transportation cost") per unit distance between the product in question and a patient's ideal or most suitable drug. The first two terms in (1) can be interpreted as a measure of the effectiveness

of drug i for a patient located at x, where the term $t\,|x-i|$ can be thought of as potential side-effects depending on the degree of mismatch between patient x and drug i.

Note that in (1) patients cover the full price of the drugs purchased. In practice, patients often bear some fixed proportion of the price of prescription drugs due to insurance. However, the model and the subsequent analysis will not change qualitatively by introducing a copayment on the prices.[10] Furthermore, in the price regulation regime (cf. section 3) prices do not affect the allocation of drugs to patients, capturing the case of patients being insensitive to relative prices.

Patients are *a priori* uninformed of their diagnosis and relevant medication, and seek medical advice by a physician. The physician has the skills to perfectly observe a patient's disease and to identify the most suitable medical treatment. Based on (1) a physician would prescribe drug 0 to a patient located at x if[11]

$$v - tx - p_0 \geq v - t\,(1-x) - p_1. \tag{2}$$

Let $\widehat{x}$ define the patient who is equally well off by consuming either drug. From (2), the location of the marginal patient is given by

$$\widehat{x} = \frac{p_1 - p_0 + t}{2t}. \tag{3}$$

If a physician bases her choice of prescription drug solely on patient characteristics, she would prescribe drug 0 to every patient located to the left of $\widehat{x}$, i.e. in the interval $[0, \widehat{x}]$, and drug 1 to the residual share of patients.

However, pharmaceutical firms spend substantial efforts in promoting drugs to physicians aiming at affecting their prescription choices in favour of the firm. In the following we will refer to these marketing activities as *detailing*.[12] Importantly, detailing is not a direct (monetary) reward for the prescription. The promotional effort is already sunk when the physician makes the decision about which drug to prescribe. Instead, detailing is typically an in-kind transfer from a drug producer that increases the likelihood that the physician will prescribe

[10] Let τ denote the copayment rate. Then the function in (3) can be written as $\widehat{x} = \frac{\tau(p_1-p_0)+t}{2t}$. Rearranging this yields $\widehat{x} = \frac{p_1-p_0+\widetilde{t}}{2\widetilde{t}}$, where $\widetilde{t} = t/\tau$, which implies just a reinterpretation of t.

[11] One could question the role of the prices in the physician's prescription choice. However, there is empirical evidence that physicians do care about patients' expenditures when deciding which drug to prescribe (Lundin, 2000). Moreover, Rizzo (1999) estimates that in absence of detailing effort demand responds quite elastically to changes in prices. In any instance, section 3 will capture the case where prices do not matter for the prescription choice.

[12] We acknowledge that in many instances detailing may also play an important informative role. In our model, we focus on the persuasive aspect of promotion.

this producer's drug rather than a competing brand.[13] In line with this, we assume that firm i chooses the amount of detailing, φ_i, which is irreversibly spent before the physician makes her decision about which drug to prescribe. Applying the standard Tullock model of rent seeking, we let the probability that firm i convinces the physician to prescribe its product be given by the following contest success function[14]

$$\mu_i = \frac{\varphi_i}{\varphi_i + \varphi_j}. \tag{4}$$

We see that the probability that the physician prescribe the branded drug i is increasing in firm i's detailing effort but decreasing in firm j's detailing effort. Thus, the firm that is able to commit to a higher level of detailing faces a higher probability that a physician will prescribe its product. Note that Schmalensee (1976, 1992) uses the parametric form given by (4) to determine firms' market shares as a function of advertising in the context of promotional competition.[15]

If allowed by the Health Authority, firms may also spend resources on direct-to-consumer advertising (DTCA). Since patients are initially uninformed about available medication of their disease, we find it reasonable that this type of advertising must convey some (product-specific) information to the patients, at least the product's existence. Employing the informative advertising model of Grossman and Shapiro (1984), though in the duopoly variant, we let Φ_i denote the fraction of patients receiving an ad from firm i. The firms cannot target advertising at each individual patient, implying that every patient has an equal chance of receiving a given ad. This is consistent with DTCA typically being provided by mass media, like television, newspapers, etc.

We let firm i's cost of reaching a fraction Φ_i of the patients be given by $A(\Phi_i)$, where $A' > 0$ and $A'' > 0$. For analytical purposes, we will in the following assume that $A(\Phi_i) = a\Phi_i^2/2$, with a maximum advertising expenditure of $a/2$.[16] Thus, it becomes increasingly costly for the firms to reach a greater

[13] We do not distinguish between whether a physician deliberately or unconsciously alters her prescription choice when being exposed to detailing. The former case refers to a selfish physician who consciously prescribes the promoted drug for the reason of receiving future benefits from the drug producer. The latter case refers to a physician who prescribes the promoted drug for reasons such as guilt or emotional attachment built up with a relationship to sales agents, sponsored conference trips, etc.; or simply out of idleness.

[14] This contest success function has been suggested by Tullock (1980). It is a special case of a more general contest success function, but has gained support by an axiomatization in Skaperdas (1996).

[15] Konrad (2002) also applies a contest approach to model how promotional competition may affect physician's prescription choice.

[16] Building on Butters (1977), Grossman and Shapiro (1984) let $A_i(\Phi_i) = c' \ln\left(\frac{1}{1-\Phi_i}\right)$. The quadratic variant used in our paper has the same properties, but we have to impose a lower bound on the parameter a to secure that $\Phi_i \leq 1$. For more details about the advertising technology, see the mentioned literature.

fraction of the population by DTCA.

The availability of DTCA divides the market into four possible segments: (i) A fraction $\Phi_0\Phi_1$ of patients who are aware of both drugs, (ii) a fraction $\Phi_0(1-\Phi_1)$ of patients who are aware of only drug 0, (iii) a fraction $\Phi_1(1-\Phi_0)$ of patients who are aware only of drug 1, and, finally, (iv) a fraction $(1-\Phi_0)(1-\Phi_1)$ of patients who have not received any ads and therefore remain uninformed about available medication even after firms' advertising campaigns. We assume that a health shock induces individuals to visit a physician irrespective of their knowledge of the relevant medical treatments, and that every patient receives medical treatment. At this point our model diverges from Grossman and Shapiro (1984) in that also the uninformed fraction of patients, i.e. $(1-\Phi_0)(1-\Phi_1)$, eventually demands one of the products.

We find it reasonable that patients' knowledge about relevant medication affects physicians' prescription choice.[17] Specifically, we assume that the physician's scope to prescribe a promoted, but less suitable ("wrong"), drug is constrained by the patient's information about the alternatives. In particular, faced with a patient aware of his most suitable drug, we assume that a physician prescribes this particular drug. Otherwise, she will have to falsely claim that the patient would be better off with the other ("wrong") drug. We find it plausible that physicians will refrain from such actions. There may be several reasons for this, for instance, the risk of facing litigation, professional ethics, or a concern for loosing patients in the future.

To formalise the physicians' prescription behaviour, let m denote the fraction of patients informed about their most suitable drug, where m is given by

$$m = \Phi_0\widehat{x} + \Phi_1(1-\widehat{x}). \tag{5}$$

For this group of patients, physicians base their prescription choices on patient characteristics, as described by (2) and (3). For the residual group of patients,

$$1-m = (1-\Phi_0)\widehat{x} + (1-\Phi_1)(1-\widehat{x}),$$

physicians' choice of prescription is assumed to be governed by firms' detailing effort, as described in (4).

Finally, it seems reasonable that not every physician is receptive to detailing in the sense that such activities distorts the prescription choice. Let $q \in (0,1)$ denote the share of physicians receptive to detailing effort. Firms are assumed to know the share q, but not an individual physician's type. Normalising the number of physicians in the population to one, the (expected) demand for drug 0 can be written as

$$D_0 = q\left[\Phi_0\widehat{x} + \mu_0(1-m)\right] + (1-q)\widehat{x}. \tag{6}$$

[17] For instance, Lipsky and Taylor (1997) found that 71 percent of family physicians believe that DTCA induces the physician to prescribe drugs that they would not ordinarily prescribe.

An analogous expression describes the demand for drug 1. From (6) we see that by spending resources on DTCA, firm 0 lowers the fraction of patients for which it must contest by spending resources on detailing in order to convince the physician to prescribe its product.

The pharmaceutical firms face identical and constant marginal production costs, which we normalise to zero. The R&D costs are considered sunk at the time marketing and price decisions are taking place, and play no role in the analysis. Assuming firms to be risk neutral, firm i's (expected) payoff amounts to

$$\pi_i = p_i D_i - a\Phi_i^2/2 - \varphi_i. \tag{7}$$

The following sequence of moves is considered:

- Stage 1: The Health Authority decides on whether or not to allow DTCA.
- Stage 2: The pharmaceutical firms determine spendings on detailing, and, if allowed, they set prices and the level of DTCA.
- Stage 3: The physician prescribes either drug 0 or 1 to the patients.

As usual, the game is solved by backward induction.[18]

3 Marketing competition and regulated prices

Let us first examine firms' marketing strategies when price competition is absent. This corresponds to the situation present in most European countries, where prices of prescription drugs are not unilaterally set by the pharmaceutical companies but rather subject to some sort of governmental regulation.[19] At the marketing stage (stage 2) firms take these prices as given. Firm i then maximises (7) with respect to φ_i and Φ_i, taking into account the physicians' prescription choice as described by (6). Restricting attention to the symmetric equilibrium, this is defined by the following equations[20]

$$\Phi^r = p\frac{q}{4a}, \tag{8}$$

$$\varphi^r = p\frac{q}{4}\left(1 - \Phi^r\right) = p\frac{q}{4}\left(1 - p\frac{q}{4a}\right), \tag{9}$$

[18] One could argue that marketing is more of a long-term decision than price setting, and should therefore be determined at a stage previous of the price game. As this only complicates the analysis without providing any qualitatively different results, we have decided to follow Grossman and Shapiro (1984) by assuming marketing and price decisions to take place at the same stage of the game.

[19] See e.g. Mossialos (1998) for an overview of the different ways prescription drug prices are regulated in Europe.

[20] The equilibrium is defined for $a > p\frac{q}{4}$.

where the superscript r denotes that we consider the price regulation regime. Under a ban on DTCA (i.e. $\Phi^r = 0$), we see from (9) that firms' detailing effort depends only on the regulated price (p) and the fraction of physicians receptive to detailing (q). Obviously, both a higher p and a higher q induce the firms to spend more effort on detailing.

However, the availability of DTCA may change the situation. As by (8), the level of DTCA increases in the regulated price and falls in the cost of advertising. More interestingly, DTCA increases in q and has a negative impact on detailing. The intuition is that by increasing patients awareness of their product firms constrain the physicians' market power related to the prescription decision. To this extent, DTCA serves as a means to *soften* detailing competition.

Inserting (8) and (9) into (7), we obtain equilibrium profit

$$\pi^r = \frac{p}{2} - \frac{a}{2}\left(\Phi^r\right)^2 - \varphi^r = \frac{p}{4}\left(2 - q\right) + \frac{p^2 q^2}{32a}. \tag{10}$$

We see that firms' profits increase in the regulated price, but decrease in the cost of advertising (a). A higher price triggers marketing competition in terms of DTCA and possibly detailing, but the direct positive effect on profits is not offset by the increase in marketing expenditures. It can be shown that profits decrease in the fraction of physicians receptive to detailing.[21] However, this is not very surprising as a higher q increases spending on both detailing and DTCA, as explained above.

Although DTCA lowers spendings on detailing, this is costly in itself. Therefore, it is not clear whether DTCA contributes to higher or lower profits to the pharmaceutical firms. A comparison of the equilibrium outcomes yields the following result.

Proposition 1 *If prices are regulated, the availability of DTCA lowers detailing effort and increases profits to the pharmaceutical firms.*

Proof. >From (9) a ban on DTCA, i.e. $\Phi^r = 0$, implies $\varphi^r \mid_{\Phi^r=0} = p\frac{q}{4}$. Comparison with (9) immediately shows $\varphi^r \mid_{\Phi^r=0} \geq \varphi^r$. Inserting $\varphi^r \mid_{\Phi^r=0}$ into (7) yields $\pi^r \mid_{\Phi^r=0} = \frac{p}{4}\left(2 - q\right)$. Comparing this to (10), gives

$$\pi^r - \pi^r \mid_{\Phi^r=0} = \frac{p^2 q^2}{32a} > 0,$$

which completes the proof. ■

The availability of another marketing strategy, i.e. DTCA, does not lead the firms to engage in ruinous competition. As the proposition demonstrates,

[21] $\frac{\partial \pi^r}{\partial q} = -\frac{p}{4} + \frac{pq}{16a} < 0$ for any $a > p\frac{q}{4}$ (see footnote 20).

firms actually benefit from the availability of DTCA when prices are regulated. This means that the expenditure on DTCA is more than offset by the reduction in detailing costs.

To fully understand the result, consider a ban on DTCA. In this case, competition between the firms is a pure marketing contest. Firms spend effort on detailing in order to convince the physician to prescribe their product, with the prize $p \cdot q$ attached to it, which each firm receives with probability 1/2. The residual profit, i.e. $\frac{p}{2} \cdot (1-q)$, is related to the fraction of physicians not receptive to detailing and thus not subject to competition. A substantial share (half) of the firms' profit is dissipated in the marketing contest. This is a standard result in the contest literature (see e.g. Hillman and Samet, 1987).

DTCA enables the firms to reduce the profits subject to detailing competition by way of reducing the scope for physicians to prescribe promoted rather than most suitable drugs to patients. From (7), we see that the (expected) profit related to detailing is reduced to $\frac{p}{2} \cdot q\,(1-\Phi)$, while the profit not subject to detailing competition increases with $\frac{p}{2} \cdot (1-q\,(1-\Phi))$. This explains why detailing effort decreases and profit increases when firms have DTCA to their avail under price regulation.

4 Marketing and price competition

Let us now consider the case where the Health Authority allows the pharmaceutical firms to set the prices of their products. This situation is relevant for some markets, such as the US and the German market. When prices are not subject to regulation, the nature of the market game changes, and this makes it intersting to examine the impact of price competition on firms' marketing strategies.

At stage two of the game, firm i now maximises (7) with respect to p_i, Φ_i and φ_i, taking into account the physicians' prescription behaviour as described by (6). The symmetric equilibrium is (implicitly) determined by the following set of equations

$$p^c = \frac{t}{1-q\,(1-\Phi^c)}, \tag{11}$$

$$\varphi^c = p^c \cdot \frac{q}{4}\,(1-\Phi^c)\,, \tag{12}$$

$$\Phi^c = p^c \cdot \frac{q}{4a}, \tag{13}$$

where the superscript (c) denotes that we consider the price competition regime. Inspection of (11)-(13) reveal that DTCA not only affects detailing but also prices. In fact, we see from (11) that DTCA contributes to lower prices of prescription drugs. In the extreme case, where every patient is aware of the two drugs available, i.e. $\Phi^c \to 1$, the equilibrium price approaches the price under full information, i.e. $p^c \to t$. The price is also affected by the fraction

of physicians receptive to detailing (q). Again, we see that as this fraction becomes very low, i.e. $q \to 0$, the price approaches the full information price.

The pro-competitive effect on prices of advertising that conveys information to the consumers is pointed out in a more general framework by Grossman and Shapiro (1984). In our model, though, advertising has an additional effect, and that is to *soften* detailing competition. As explained above, DTCA enables firms to curb the physicians' market power by increasing the patients' information about available medication.

The symmetric equilibrium is obtained by solving the set of equations (11)-(13), and is given by[22]

$$p^c = \frac{2t}{1-q+\Omega}, \tag{14}$$

$$\varphi^c = \frac{t}{4}\left(\frac{1+q-\Omega}{1-q+\Omega}\right), \tag{15}$$

$$\Phi^c = \frac{\Omega+q-1}{2q}, \tag{16}$$

where

$$\Omega = \sqrt{q^2\frac{t}{a} + (1-q)^2}.$$

Inserting (14)-(16) into (7), equilibrium profit is given by

$$\begin{aligned}\pi^c &= \frac{p^c}{2} - \frac{a}{2}\left(\Phi^c\right)^2 - \varphi^c \\ &= \frac{t}{4}\left(\frac{3-q+\Omega}{1-q+\Omega}\right) - \frac{a}{2}\left(\frac{\Omega+q-1}{2q}\right)^2\end{aligned} \tag{17}$$

We can now establish the following result.

Proposition 2 *If prices are not regulated, the availability of DTCA lowers prices, detailing effort and profits to the pharmaceutical firms.*

Proof. The equilibrium under a ban on DTCA is obtained by setting $\Phi^c = 0$ in (11) and (12), yielding $p^c\left|_{\Phi^c=0}\right. = \frac{t}{1-q}$ and $\varphi^c\left|_{\Phi^c=0}\right. = \frac{t}{4}\left(\frac{q}{1-q}\right)$. Comparison with (11) and (12) immediately shows $p^c\left|_{\Phi^c=0}\right. \geq p^c$ and $\varphi^c\left|_{\Phi^c=0}\right. \geq p^c$. Inserting $\varphi^c\left|_{\Phi^c=0}\right.$ and $p^c\left|_{\Phi^c=0}\right.$ into (7), we obtain $\pi^c\left|_{\Phi^c=0}\right. = \frac{t}{4}\left(\frac{2-q}{1-q}\right)$. Comparing this with (17) yields

$$\pi^c\left|_{\Phi=0}\right. - \pi^c = \frac{t}{4}\left(\frac{\Omega-1+q}{(1-q)(1-q+\Omega)}\right) + \frac{a}{2}\left(\frac{\Omega+q-1}{2q}\right)^2 > 0,$$

[22] Equilibrium is defined for $1-q < \Omega < 1+q$, which is true for any $a > q\frac{t}{4}$.

which is true since by assumption $a > q\frac{t}{4}$, implying that $1 - q < \Omega < 1 + q$ (see footnote 22). ■

Thus, contrary to the price regulation regime, the opportunity of DTCA now tends to reduce the pharmaceutical firms' profits. Although, DTCA lowers detailing effort, as in the previouse case, it also has an effect on prices when these are set by the firms rather than a Health Authority. As DTCA tends to lower prices, both the price reduction and the increase in expenditures due to DTCA more than offsets the gain in detailing outlays.

The result is consistent with Grossman and Shapiro (1984) who proves this to hold for a broad class of advertising technologies. In our model, though, advertising provides a benefit in that it *softens* detailing competition by limiting the physician's inclination or ability to prescribe promoted drugs. However, as in Grossman and Shapiro (1984), advertising proves to be a two-edged sword. By spending more resources on DTCA, price competition is triggered. As the price effect more than offsets savings due to lower detailing effort, profits fall in the amount of DTCA, which explains why firms are better off with a ban on DTCA. This result provides an example of a situation where it may be in the interest of oligopolists to raise their own costs, here the advertising costs.[23]

5 Welfare implications

Let us now turn to stage one of the game and explore the following two questions: (i) Does the market provide an optimal level of DTCA? (ii) Is DTCA welfare improving and should it therefore be allowed by the Health Authority?

Before proceeding, we should stress that we carry out a second-best analysis by taking the presence of detailing as given. As detailing is the very source of drug mismatch, one could argue that the mismatch problem, and by the same token, the social role for DTCA would be eliminated if the Health Authority could somehow ban the promotional role of detailing. For a variety of reasons, this is not observed in practice and will, therefore, not be the focus of our analysis.[24]

The welfare standard used here is the conventional one of consumer surplus plus profits, or alternatively the patients' health benefit less (marketing) costs.

[23] There is some empirical evidence that firms actually may benefit from a ban on advertising. For example, Eckard (1991) shows that cigarette manufacturers have benefitted from their exclusion from television advertising.

[24] One reason is that enforcing a ban on promotional spendings targeted at physicians is likely to be excessively costly. As such promotional activities take various forms, firms can easily neutralise a ban on any one activity by shifting to another. Moreover, it is difficult to differentiate between pure persuasion and the provision of information to the physician. This clearly leads to a problem of verifiability and, thus, to an enforcement problem.

Social welfare can be written as[25]

$$W = v - T - a\Phi^2 - c \cdot 2\varphi \tag{18}$$

where $c \in [0, 1]$. The first term is the patients' gross benefit of receiving medical treatment. Since the number of patients is normalised to 1 and every patient is prescribed one of the drugs, the total gross benefit is equal to v. The second term represents the aggregate mismatching costs. These costs refer to imperfect matching of prescription drugs to patients. The two last terms are the industry's outlays on DTCA and on detailing.

The parameter c measures the social cost associated with detailing. The extreme case of $c = 1$ refers to a situation where detailing is considered as pure social waste, which is a common approach in the rent seeking or contest literature (see e.g. Tullock, 1980). On the other hand, if $c = 0$, detailing is considered a welfare-neutral transfer from the pharmaceutical companies to the physicians. In this case, one dollar at the physicians' or the pharmaceutical firms' hand has an equal value from a welfare point of view.

To calculate the total mismatching cost T, we partition the patients into groups depending on their knowledge about available medication and on whether or not they have visited a physician receptive to detailing effort. We can write the total mismatch costs as follows

$$T = (1 - q)\frac{t}{4} + q\left[m\frac{t}{4} + (1 - m)\frac{t}{2}\right] = \frac{t}{4}\left(1 + q\left(1 - \Phi\right)\right). \tag{19}$$

The first term is the fraction of patients that have visited a physician whose prescription choice is not influence by detailing (i.e. $1 - q$). As this group is prescribed their most suitable drug they face an average mismatch cost of $t/4$. For the residual fraction (i.e. q), mismatch costs depend on the patients' information. Facing patients aware of their most suitable drug, i.e. m (cf. (5)), the average mismatch cost is $t/4$ as physicians refrain from actively recommending a less suitable ("wrong") drug in this case. Finally, for the group of patients uninformed about their most suitable drug, i.e. $1 - m$, the physicians' choice of prescription drugs is governed by detailing efforts, implying an average mismatch cost of $t/2$. Thus, T varies between $t/4$, which occurs when $q \to 0$ or $\Phi \to 1$, and $t/2$, which occurs when $q \to 1$ or $\Phi \to 0$. We can now address the questions posed at the beginning of the section, considering in turn the regimes of price regulation and price competition.

5.1 Price regulation

We firstly consider the question of whether or not firms provide an efficient level of DTCA. Recognising from (9) that detailing can be implicitly defined

[25] Since the market always is assumed to be covered, prices are just monetary transfers involving no efficiency loss. This is due to the assumptions of unit demand and non-binding reservation price v, which make total demand inelastic to prices.

as a function of DTCA, total differentiation of (18) yields

$$\frac{dW}{d\Phi} = -\frac{\partial T}{\partial \Phi} - 2c\frac{\partial \varphi}{\partial \Phi} - 2a\Phi, \tag{20}$$

The first term represents the marginal gain of improved matching of drugs to patients due to DTCA. The second term refers to impact of DTCA on detailing, which we have shown is negative, with c measuring the magnitude of this benefit. Finally, the last term reflects the marginal social loss due to higher expenditure on DTCA. The following can then be stated.

Lemma 1 *Under price regulation, pharmaceutical firms provide a socially optimal level of DTCA only if* $p = \frac{t}{2(1-c)}$. *If* $p < (>) \frac{t}{2(1-c)}$ *a sub-optimal (an excessive) level of DTCA occurs.*

Proof. Using (9) and (8) in (18), we obtain from (20)

$$\frac{dW}{d\Phi}\mid_{\Phi=\Phi^r} = q\frac{t}{4} + 2c\left(p\frac{q}{4}\right) - 2a\left(p\frac{q}{4a}\right) = \frac{q}{4}\left[t - 2p\left(1-c\right)\right].$$

Then it is easily verified that $\frac{dW}{d\Phi}\mid_{\Phi=\Phi^r} \geq 0 \Leftrightarrow p \leq \frac{t}{2(1-c)}$. ■

The provision of DTCA by pharmaceutical firms may be excessive or sub-optimal depending on the level of the regualted price. A more generous price tends to increase the firms' spending on DTCA. From a social point of view, this is beneficial in that mismatch is reduced and the social waste of detailing tends to be reduced through DTCA, but these benefits are offset by an increase in the cost of DTCA.[26] For any given price, over-investment in DTCA is then the more likely the lower the degree of mismatch (t) and the lower the social cost of detailing c.

While it could be argued that by setting the price appropriately, the regulator could stimulate an optimal level of DTCA, this is likely to be impractical when the regulator has to use the price in order to provide incentives to develop the drug. The high R&D costs in the pharmaceutical industry may then imply levels of the price for which DTCA advertising is excessive. Therefore, we may consider whether or not the lifting of a ban on DTCA improves welfare. Here, welfare under a ban of DTCA is given by

$$W\mid_{\Phi=0} = v - T\mid_{\Phi=0} - c\cdot 2\varphi\mid_{\Phi=0}. \tag{21}$$

An obvious benefit from prohibiting DTCA is the saving in firms' expenditures on this activity. This gain has to be balanced against the increase in mismatching costs and in spending on detailing. As there is scope for over-provision of

[26] Whether or not detailing is reduced depends on whether or not the direct and positive effect of price on detailing outweighs the negative impact of greater DTCA.

DTCA, the question concerning a ban is then whether or not over-provision is so strong as to lead to a drop in welfare below the status quo once DTCA is allowed.

Proposition 3 *Under price regulation, the availability of DTCA is socially beneficial (harmful) if and only if* $c > (<) \frac{p-t}{2p}$.

Proof. Under a ban on DTCA, welfare is obtained by inserting $\varphi^r \mid_{\Phi=0} = p\frac{q}{4}$ into (21), yielding

$$W^r \mid_{\Phi=0} = v - \frac{t}{4}(1+q) - 2c\left(p\frac{q}{4}\right). \tag{22}$$

When DTCA is allowed, welfare is obtained by inserting (8) and (9) into (18), yielding

$$W^r = v - \frac{t}{4}\left(1 + q\left(1 - p\frac{q}{4a}\right)\right) - 2c\left(p\frac{q}{4}\left(1 - p\frac{q}{4a}\right)\right) - a\left(p\frac{q}{4a}\right)^2. \tag{23}$$

Comparing (22) and (23), gives

$$W^r - W^r \mid_{\Phi=0} = q^2 p\frac{t - p(1-2c)}{16a}.$$

Then it is easily verified that $W^r \geq (<) W^r \mid_{\Phi=0} \Leftrightarrow c \geq (<) \frac{p-t}{2p}$. ■

Note that a ban of DTCA is justified only if $c < \frac{1}{2}$. Otherwise, the social gain from reduced detailing justifies the lifting of a ban alone even if the drugs are perfect substitutes, i.e. even if $t = 0$. Further, this finding holds irrespective of the level of price. Hence, if detailing is considered to be socially wasteful, then it is always in the social interest to lift a ban on DTCA. Consider now $c < \frac{1}{2}$, resembling a situation in which some social value is attached to detailing. Here, the desirability of DTCA also depends on the regulated price and on the substitutability between the two drugs. If price regulation is sufficiently tight, it is beneficial to allow DTCA. Specifically, this is the case for all prices below t, the price that would emerge under price competition when patients are completely informed ($\Phi = 1$) or physicians are completely unreceptive to detailing ($q = 0$). If, however, if R&D incentives compel the regulator to grant a high price to the firms, then the over-investment in DTCA is so strong as to justify a ban. Such a situation is the more likely the better substitutes the drugs are.

5.2 Price competition

Again, we start out with considering whether or not firms provide an efficient level of DTCA. As in the previous case, equilibrium detailing can implicitly be defined as a function of DTCA, implying that we can address the first question by evaluating (20) in equilibrium. To establish the result, define

$$\widehat{c}(a,t,q) := \frac{1}{8}(1-q+\Omega)(3+q-\Omega),$$

where $0 < \widehat{c}(a,t,q) \leq \frac{1}{2}$ for all $q \in [0,1]$ and $a \geq \frac{qt}{4}$ is easily verified. Then the following holds.

Lemma 2 *Under price competition, pharmaceutical firms provide excessive levels of DTCA if and only if* $c < \widehat{c}(a,t,q)$. *Given* $c < \frac{1}{2}$, *this is satisfied if* t *is sufficiently high and/or* a *is sufficiently low.*

Proof. In the price competition regime, detailing can be expressed as a function of Φ by inserting (11) into (12), yielding

$$\varphi^c = \frac{qt(1-\Phi^c)}{4[1-q(1-\Phi^c)]}. \tag{24}$$

Using this in (18), we obtain from (20)

$$\frac{dW}{d\Phi}|_{\Phi=\Phi^c} = \frac{qt}{4} + \frac{2cqt}{4[1-q(1-\Phi^c)]^2} - 2a\Phi^c.$$

Substituting into this expression $1-q(1-\Phi^c) = \frac{1}{2}(1-q+\Omega)$, as follows under use of (16), and $2a\Phi^c = \frac{p^c q}{2} = \frac{qt}{(1-q+\Omega)}$, as follows under use of (13) and (14), gives

$$\frac{dW}{d\Phi}|_{\Phi=\Phi^c} = \frac{qt}{4} + \frac{2cqt}{(1-q+\Omega)^2} - \frac{qt}{(1-q+\Omega)}$$

such that

$$\frac{dW}{d\Phi}|_{\Phi=\Phi^c} \geq 0 \Leftrightarrow c \geq \frac{1}{8}(1-q+\Omega)(3+q-\Omega) =: \widehat{c}(a,t,q).$$

It is easily verified that $\frac{\partial \widehat{c}}{\partial a} < 0$ and $\frac{\partial \widehat{c}}{\partial t} > 0$. Noting that $a = \frac{qt}{4} \Leftrightarrow \Omega = 1+q$, it follows that $\widehat{c}\left(\frac{qt}{4},t,q\right) = \widehat{c}\left(a,\frac{4a}{q},q\right) = \frac{1}{2}$. ■

When firms are allowed to set prices both under- and over-provision of DTCA can arise. As one may expect, over-investment arises if (and only if) the social cost of detailing c is sufficiently low. More surprisingly, given c over-investment arises if the products are poor substitutes, i.e. if t is high, and

if the cost of advertising is low, i.e. if a is low. This finding is particularly striking with respect to the substitutability. Poor substitutability implies a high mismatch cost and, thus, significant social gains to DTCA advertising. However, at the same time firms can set high prices when products are poor substitutes. This boosts promotional activity to such extent that the cost of DTCA outweighs its social gains. More generally, the divergence between private and social benefits from DTCA can be explained by three externalities. A firm's DTCA involves (i) a positive externality upon consumers through lower mismatch, implying a tendency towards underinvestment, (ii) a negative business stealing externality on its rivals, (iii) a negative social externality in that one dollar saved on detailing, as valued by the firm corresponds to a social benefit of only c dollars. As it turns out, the negative externalities of DTCA tend to dominate for low values of c. With regard to t, the business stealing externality tends to dominate the mismatching externality.

We would like to point out that this finding is consistent with the received literature. While Shapiro (1980) shows that a monopolist would always underprovide informative advertising, extending the model to n firms Grossman and Shapiro (1984) demonstrate that in most cases competition tends to induce firms to over-provide informative advertising. The reason is that the wasteful consumer-stealing effect of DTCA tends to dominate the beneficial matching effect as the number of competitors increase. This indicates that increased competition should make over-provision more likely.

Let us now turn to the second question of whether DCTA is beneficial from a welfare point of view and should therefore be allowed, or whether a ban is desirable. As before, the benchmark is the level of welfare under a ban on DTCA, as given by (21). To establish the result, define now

$$\widehat{\widehat{c}}(a,t,q) := \frac{1}{4}(1-q)(1+q-\Omega),$$

where $0 \leq \widehat{\widehat{c}}(a,t,q) \leq \frac{(1-q)q}{2} < \widehat{c}(a,t,q)$ is readily checked. Then the following can be stated.

Proposition 4 *Under price competition, the availability of DTCA is socially harmful if and only if* $c < \widehat{\widehat{c}}(a,t,q)$. *Given* $c < \frac{(1-q)q}{2}$, *this is satisfied if* t *is sufficiently low and/or* a *is sufficiently high.*

Proof. Under a ban on DTCA, welfare is obtained by inserting $\varphi^c|_{\Phi=0} = \frac{tq}{4(1-q)}$ into (21), yielding

$$W^c|_{\Phi=0} = v - \frac{t}{4}(1+q) - 2c\left(\frac{t}{4}\frac{q}{1-q}\right). \tag{25}$$

When DTCA is allowed, welfare is found by inserting (24) into (18), yielding

$$W^c = v - \frac{t}{4}\left[1 + q\left(1 - \Phi^c\right)\right] - 2c\left(\frac{qt\left(1 - \Phi^c\right)}{4\left[1 - q\left(1 - \Phi^c\right)\right]}\right) - a\left(\Phi^c\right)^2. \qquad (26)$$

Comparing (26) and (25), gives

$$W^c - W^c\left|_{\Phi=0}\right. = \frac{qt\Phi^c}{4} + \frac{ctq\Phi^c}{2\left(1-q\right)\left[1 - q\left(1 - \Phi^c\right)\right]} - a\left(\Phi^c\right)^2.$$

Substituting into this expression $1 - q\left(1 - \Phi^c\right) = \frac{1}{2}\left(1 - q + \Omega\right)$, as follows under use of (16), and $a\Phi^c = \frac{p^c q}{4} = \frac{qt}{2(1-q+\Omega)}$, as follows under use of (13) and (14), gives

$$\frac{dW}{d\Phi}\left|_{\Phi=\Phi^c}\right. = \Phi^c qt\left[\frac{1}{4} + \frac{c}{\left(1-q\right)\left(1-q+\Omega\right)} - \frac{1}{2\left(1-q+\Omega\right)}\right]$$

such that

$$\frac{dW}{d\Phi}\left|_{\Phi=\Phi^c}\right. \geq 0 \Leftrightarrow c \geq \frac{\left(1-q\right)\left(1+q-\Omega\right)}{4} =: \widehat{\widehat{c}}\left(a,t,q\right).$$

It is easily verified that $\frac{\partial\widehat{\widehat{c}}}{\partial a} > 0$ and $\frac{\partial\widehat{\widehat{c}}}{\partial t} < 0$. Noting that $\frac{t}{a} = 0 \Longleftrightarrow \Omega = 1 - q$, it follows that $\widehat{\widehat{c}}\left(\infty,t,q\right) = \widehat{\widehat{c}}\left(a,0,q\right) = \frac{(1-q)q}{2}$. ■

The desirability of DTCA depends on the social cost of detailing c. A ban of DTCA is warranted if c is sufficiently low. DTCA is more likely to be socially harmful if the products are good substitutes, i.e. if t is low, and/or if the cost of DTCA is high, i.e. if a is high. This is interesting in that in Lemma 2, we have concluded that under those same circumstances (low t, high a) over-investment is less likely. Note that $\widehat{\widehat{c}}\left(a,t,q\right) < \widehat{c}\left(a,t,q\right)$ implies that DTCA is only banned if it actually leads to over-investment.

The seeming contradiction can then be explained with reference to a discrepancy in the marginal and absolute effects of a and t. Over-investment arises if the marginal cost of DTCA exceeds its marginal social value. As shown in Lemma 2, this is the more likely the higher t and the lower a. But a higher t and a lower a also imply that the absolute benefit of DTCA is more likely to outweigh its cost. Hence, poor (good) substitutability of drugs indicates that while over-investment is likely (unlikely), its occurence does not justify (justifies) a ban.

6 Concluding remarks

This study has examined the effects on competition and welfare of relaxing the restrictions on DTCA of prescription drugs which are currently in place

in many countries. Observing that pharmaceutical firms spend substantial amounts of money on promoting drugs to physicians, we have focused our analysis on the interaction between DTCA and detailing, where these marketing strategies affect prescription choices. Although the model is stylised, we believe the analysis provides some new insights into the debate on DTCA. Our main findings are as follows: Firstly, firms respond to the opportunity of DTCA by lowering their spendings on detailing. The reason is that DTCA reduces the physician's scope to prescribe promoted drugs at will, and, thereby, softens detailing competition.

Secondly, whether or not DTCA is beneficial to the firms' depends crucially on the regulatory regime. If prices are set by a Health Authority, the availability of DTCA allows firms to curb the physician's market power, and, thereby, achieve savings in detailing outlays such that total promotional cost falls. Firms, therefore, suffer from a ban on DTCA. If, in contrast, firms are price setters, DTCA stiffens price competition and leads to a lower mark-up. This is because DTCA increases the share of informed consumers and, thereby, the price elasticity of demand. As it turns out, the reduction in mark-up leads to lower profits in the presence of DTCA although firms are able to reduce total promotional cost. In this regard, firms benefit from a ban on DTCA if price competition matters.

Finally, the social gains from DTCA amount to a better allocation (matching) of pharmaceuticals across consumers and to a reduction in the social cost of detailing. These gains are offset by the industry cost of DTCA. Generally, the welfare impact of DTCA is ambiguous. In both regimes instances of over- and under-provision can arise depending on whether or not detailing is considered to be socially wasteful. Over-investment is particularly likely in instances in which prices are high. Under price regulation this may be due to concerns about R&D incentives; under price competition high prices are set if the drugs are poor substitutes. While a ban may then be justified in the first case, it is usually not in the latter because poor substitutability of drugs is also associated with high mismatch costs.

In conclusion, we should point at some of the more limiting assumptions we have made. Firstly, in focusing on the matching issue rather than the problem related to over-prescription of drugs, we have assumed that total demand is not affected by the promotional spending, which only shifts market shares. In practice, promotional competition is also likely to increase the volume of prescriptions. In this case, allowing firms to engage in DTCA is likely to increase market coverage. The analysis by Grossman and Shapiro (1984) suggests that this would not change a potential stiffening of price competition and the resulting fall in profit. The welfare effect of DTCA would now also depend on whether or not the expected health gain of an additional prescription exceeds its total unit cost.

Secondly, we have assumed a positive role of DTCA in that consumers who have received the relevant ads always receive the appropriate drug. One concern about DTCA is that it is persuasive rather than informative and may, thus, become itself a source of mismatch. When DTCA is only partially informative some consumers relying on their own expertise in interpreting DTCA may pick the wrong drug. The implications of this for the effects of DTCA on price competition and welfare remain to be explored.

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