



## Competition in the pharmaceutical industry: How do quality differences shape advertising strategies?☆

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### ARTICLE INFO

#### Article history:

Received 11 October 2010

Received in revised form 28 June 2012

Accepted 25 July 2012

Available online 7 September 2012

#### JEL classification:

I11

L11

L13

L65 and M37

#### Keywords:

Product differentiation

Market segmentation

Advertising

Pharmaceutical industry

### ABSTRACT

We present a Hotelling model of price and advertising competition between prescription drugs that differ in quality/side effects. Promotional effort results in the endogenous formation of two consumer groups: brand loyal and non-brand loyal ones. We show that advertising intensities are strategic substitutes, with the better quality drugs being the ones that are most advertised. This positive association stems from the higher rents that firms can extract from consumers whose brand loyalty is endogenously determined by promotional effort. The model's main results on advertising and pricing strategies are taken to the data. The latter consists of product level data on prices and quantities, product level advertising data, as well as the qualitative information on drug quality contained in the Orange Book compiled by the Food and Drug Administration (FDA). The empirical results provide strong support to the model's predictions.

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### 1. Introduction

A particular feature of the market for prescription drugs is that patients usually do not establish their own diagnosis nor are they fully aware of the effectiveness or side effects associated with the different drugs. As a consequence, the choice of drug to administer is generally made by a physician. It may however also be the case that a patient expresses a preference for a drug over another,

in particular if she has been exposed to some form of advertising.<sup>3</sup> Accordingly, a consumer is best represented by a physician–patient pair whose choice to address a given pathology is determined by the intrinsic characteristics of the available drugs, their prices, and promotional effort. In the US, the latter takes three forms. The bulk consists in “detailing” i.e., salespeople personally visiting doctors to promote a set of drugs, often leaving free samples in the process. The second type emerged in late 1996 when the US Food and Drug Administration (FDA) allowed “plain vanilla” advertising for prescription drugs, for instance via television ads.<sup>4</sup> Since then, spending on direct-to-consumer advertising (DTCA, from now on) has increased more than any other marketing activity

☆ This paper was written before Siotis joined the European Commission and the views expressed are those of the author and do not necessarily reflect those of the European Commission. We would like to thank Nikos Vettas, Patrick Rey, Gerard Llobet and Natalia Fabra for helpful suggestions, and Marisa de Frutos whose pharmacological expertise greatly helped us navigate through the idiosyncracies of the industry. Valuable comments were also received from seminar participants at University of Edinburgh, University of Southampton, and at the CRETE2010 conference. Financial support from Project SEJ 2007-04339-001 is kindly acknowledged by de Frutos. Siotis gratefully acknowledges support from projects SEJ2007-66268, ECO2010-20504 and I3 2006/04050/011.

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<sup>3</sup> For cholesterol reducing drugs, *Wosinska (2002)* finds that direct to consumer advertising (DTCA) may affect the demand for an individual brand positively provided that brand is on the third party's payer formulary. This is also indirect evidence that, in the US, “price matters”, albeit indirectly (via the presence on the formulary).

<sup>4</sup> The FDA introduced changes in August 1996. Prior to that date, rules stipulated that advertising had to provide detailed information on the drug, thus implying that TV ads were prohibitively expensive (because of their time length) in most cases. In the European Union (EU), direct to consumer advertising for prescription drugs remains prohibited.

(Iizuka, 2004)). The last category is made-up of adverts appearing in specialised medical publications.<sup>5</sup>

Differences across consumers' responsiveness to price and advertising are, in pharma, at least as strong as in other industries. The combination of differences in insurance coverage across patients logically leads to heterogeneous responses to price. Doctors prescribing drugs to patients that benefit from a generous employer or State financed health coverage are unlikely to be very price sensitive (without however ignoring it altogether in their decisions), whereas physicians in hospitals and/or physicians attending uninsured patients are often well aware of the budgetary costs of their prescription decisions. In the same line, some doctor/patients are almost oblivious to promotional effort (in all its forms), whereas others tend to be more influenced by face-to-face meeting with sales representatives and TV ads, prescribing/consuming what they are most familiar with.<sup>6</sup> Promotional effort affects the proportion of doctor/patient pairs falling in each category, which we will respectively coin as "non-loyal" and "loyal".<sup>7</sup> In the absence of promotional effort, doctor/patient choices would solely be driven by price and intrinsic drug characteristics. If promotional effort were to tend to infinity, even the most reluctant patient/doctor pairs would end-up being influenced by it.

Pharmaceutical products are chemicals that improve the health of some humans but can cause serious side-effects in others. Consider, for instance, blood pressure control, the largest market in value terms, with worldwide sales exceeding 30 billion. Drugs to treat hypertension act via different parts of the body: central nervous system, heart (beta blockers), kidney (diuretics, saluretics), and vessels (alpha blockers, ACE inhibitors, AT1 and calcium antagonists). The efficacy of these drugs in terms of bringing blood pressure in the desired range differs across patients. In addition, they differ in terms of (numerous) side effects whose incidence vary substantially across the population. For some patients, a single molecule is a perfect cure: blood pressure is lowered within the desired range with no side effects. For other patients, the efficacy may be more limited (blood pressure lowered but above the optimal range) and side effects may be pervasive.<sup>8</sup> In short, one of the characteristics of pharmaceutical products is the existence of side-effects and/or contraindications that result in mismatch costs whenever consumers' ideal treatment is not available.

To capture the features of the pharma industry described above, we present a Hotelling model of competition among prescription drugs potentially characterised by different quality/side effects. Producers of these drugs compete both in prices and advertising. The latter gives rise to the endogenous formation of two consumer groups: brand loyal and non-brand loyal ones. We show that promotional effort and prices are strategic complements so that equilibrium prices are higher the more advertising firms do. Moreover, advertising efforts are strategic substitutes as they neutralise one another. This occurs because higher advertising by one firm results in a lower advertising by its rival.<sup>9</sup> By reducing its

promotional effort, the firm enlarges the mass of non-loyal consumers on which it can focus while keeping prices at a relatively high level. In other words, it takes advantage of the fact that its rival price high as it has a large base of loyal consumers. In equilibrium, the firm that invests more in advertising is the one with a better quality drug. Thus, in our model, heterogeneity in firms' advertising behavior is driven by quality differentials. We perform comparative statics with respect to changes in the mismatch (transport) cost, in quality asymmetries and in the level of co-payment. We show that they all affect advertising levels and hence equilibrium prices. Larger co-payments or lower side effects both result in lower aggregate advertising expenditures and in lower prices.

Our results indicate that, for a given quality differential, the better quality drugs are also the ones that are most advertised. This positive association stems from the higher rents that firms can extract from consumers that endogenously exhibit brand loyalty as a consequence of promotional effort. It is however not possible to conclude that the link between quality and profit maximising advertising spend provides incentives to the development of superior drugs. On the one hand, while advertising increases profits of all firms, a firm with a lower quality product benefits relatively more from it. Potentially, this can have negative effects on the incentives to target path-breaking R&D. On the other hand, in the presence of large sunk costs, the prospect of large (absolute) profits may be necessary to induce firms to undertake risky research projects.

The model provides a number of testable hypotheses on pricing and advertising strategies that are taken to the data. The latter has been gathered by the market intelligence firm IMS-Health and consists of product level data that allows us to retrieve prices and quantities. It encompasses the entire universe of prescription drugs sold in the US during the period 1994–2003. IMS sales data is complemented with product level DTCA data gathered by TNS Media and Intelligence/Competitive Media Reporting and detailing expenditure (promotion to office-based and hospital-based physicians) by IMS-Health. Last, proxies for drugs' quality are obtained from the Orange Book published by the Food and Drug Administration (FDA). In line with the prediction of the model, our results suggest that (i) better products are advertised more intensively, (ii) advertising has a positive impact on prices, and, (iii) prices are higher in those markets where payers enjoy lower co-payment obligations.

Since the seminal work by Grossman and Shapiro (1984), several papers have investigated the role of advertising in markets with product differentiation. From a theoretical perspective our model shares some features with those of Brekke and Kuhn (2006) and Konigbauer (2007). The former paper examines pricing and advertising decisions in a duopoly market where pharmaceutical firms use DTCA and detailing in sales promotion. Contrary to us, they focus on informative advertising and on drugs for which the loyal (monopolistic) segment of the market is not fully covered. As in our paper, Konigbauer (2007) analyzes the impact of persuasive advertising on prescription decisions, but it focuses on the competition between a branded firm and a generic competitor.

Several empirical studies have analyzed the competitive effect of advertising on prescription drugs' sales. The recent article by Dave and Saffer (2010) provides an exhaustive overview of the results of these studies. Two papers have studied the effect of advertising on price elasticity: Rizzo (1999) (for antihypertensive drugs), and Mayerhoefer and Zuvekas (2008) (for antidepressants). Both papers establish that advertising has a positive direct effect on sales (i.e., shifts demand outward). However, while the former

<sup>5</sup> See Azoulay (2002) for evidence that advertising and scientific information stemming from clinical trials can affect physicians' prescription choices.

<sup>6</sup> Iizuka and Jin (2007) find that directed-to-physician advertising (i.e., detailing and medical journal advertising) has positive, significant, and long-lasting effects on the prescription choice of allergy drugs.

<sup>7</sup> This characterization is akin to that found in Bala and Bhardwaj (2010) who distinguish between "strong preference" patients whose choices are influenced by DTCA, and "other patients" who are not.

<sup>8</sup> Heart rhythm disorders, hypotension, impotence, mediastinal and gastrointestinal disorders, abdominal pain, eye disorders, or subcutaneous tissue disorders are some of the side effects.

<sup>9</sup> The result is not driven by free-riding as we assume that market size is given and hence it is independent of firms' promotional efforts. In contrast, Linnosmaa (2008)

assumes that the number of patients visiting a physician is determined by aggregate DTCA expenditures, thus attributing "public good" characteristics to DTCA.

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