ADVERTISING AND COMPETITION IN THE ETHICAL PHARMACEUTICAL INDUSTRY: THE CASE OF ANTIHYPERTENSIVE DRUGS*

JOHN A. RIZZO
Yale University

ABSTRACT

This paper uses data on the majority of name-brand antihypertensive drugs marketed in the United States during 1988–93 to test the hypothesis that advertising decreases the price elasticity of demand in the pharmaceutical industry. This is the first study to directly estimate the effects of drug product promotion on the price elasticity of demand in this industry. We find strong evidence of an advertising effect. In particular, detailing efforts (the salient means for product promotion in this industry) systematically lower price sensitivity. Given the inverse relationship between elasticity of demand and price, it is likely that consumers pay higher prices as a result of the advertising that occurs in this industry. Our findings are thus consistent with Hurwitz and Caves, who find evidence that advertising inhibits entry into this market but in contrast to earlier research that found no anticompetitive effect.

THE competitive effect of advertising is a classic and controversial topic in applied industrial organization. Whether product promotion lowers price elasticity of demand and increases price has important implications for legislative restrictions on advertising, antitrust litigation, and other legal procedures. Although the issue remains unresolved, a growing body of evidence suggests that the effects of advertising hinge on the nature of advertising and information conditions in the market. At one extreme, price advertising in markets where consumers can easily observe quality is likely to promote competition. In such cases, the consumer need only choose the cheapest product for a desired quality level. Empirical evidence generally supports the hypothesis that price advertising promotes competition even in markets where consumers are somewhat uncertain about quality.[1] In contrast, non-

* Department of Epidemiology and Public Health, Yale University School of Medicine. I thank Dennis Carlton and an anonymous reviewer for helpful comments and suggestions and Tom Abbott for his extensive input on earlier versions of this paper. Thanks are also due to Moshe Adler, Richard Caves, William Comanor, Pat Danzon, Roger Feldman, Robert Helms, Mary Olsen, Mark Pauly, Bill Taylor, Emilio Venezian, and Richard Zeckhauser for their helpful comments. The author is responsible for any remaining errors.

[1] John A. Rizzo & Richard J. Zeckhauser, Advertising and the Price, Quantity, and Quality of Primary Care Physician Services, 27 J. Hum. Resources 381 (1992).

[*Journal of Law and Economics*, vol. XLII (April 1999)]
 0022-2186/99/4201-0004$01.50

dvertising may limit competition by differentiating products and in- brand loyalty.[2]

paper investigates how advertising affects competition in the market rmaceuticals. Pharmaceutical products are heavily promoted. Promo- xpenditures often amount to 20–30 percent of sales.[3] Available evi- n the competitive effects of pharmaceutical advertising is limited onclusive, however. Existing studies have tested for competitive ef- studying the relationship between advertising and entry in the phar- cal industry, pooling data across different pharmaceutical markets. nd Salkever[4] point out that no study has estimated the effects of ad- g on the price elasticity of demand for pharmaceuticals, noting that n important direction for further research.

resent study seeks to bridge this gap in the literature and contribute dvertising/competition debate as it pertains to the pharmaceutical . Using a market-specific data set that includes a cross section and ies of most branded antihypertensive drugs in the United States, we the effects of pharmaceutical promotional efforts on the price elas- demand. The antihypertensive drug market is dominated by brand- oducts, the vast majority of which continue to enjoy patent protec- nce, in studying this large drug market, it is natural to focus on the tive effects of product promotion on brand-name pharmaceuticals. examine the direct effects of promotional efforts on the demand ypertensive drug products.

rtension afflicts some 61 million Americans,[5] a disproportionate whom are elderly, African American, or poor.[6] Estimates indicate costs associated with hypertension amounted to $14.8 billion in which $3.0 billion were costs incurred for antihypertensive drug [7]

d.; and John A. Rizzo & Richard J. Zeckhauser, Advertising and Entry: The Case ian Services, 98 J. Pol. Econ. 476 (1990).

A. Hurwitz & Richard E. Caves, Persuasion or Information? Promotion and the Brand Name and Generic Pharmaceuticals, 31 J. Law & Econ. 299 (1988).

rd G. Frank & David S. Salkever, Pricing, Patent Loss and the Market for Pharma- 59 S. Econ. J. 165 (1992).

et P. Dustan *et al.*, Report of the Task Force on the Availability of Cardiovascular the Medically Indigent, 85 Circulation 849 (1992).

d.; and National Institutes of Health, The Fifth Report of the Joint National Com- Detection, Evaluation, and Treatment of High Blood Pressure (1992).

ital and nursing home services accounted for $4.4 billion, physician and nursing or $5.1 billion, and lost productivity due to disability for $2.3 billion (see Dustan *ra* note 5, for further details). Even with these large expenditures, a majority of ve patients in the United States are not being adequately managed with diet, exer- pharmaceutical treatment. Currently, less than 50 percent of hypertensive patients

Understanding the competitive effects of drug product promotion has important implications for legislation governing the marketing practices of drug companies. Consumers typically have less generous insurance coverage for prescribed medicines than for other forms of health care.[8] If advertising lowers price sensitivity and raises price in this industry, a substantial share of the nation's population may suffer adverse consequences.

Evidence of an anticompetitive effect would lend support to arguments by some members of the medical profession who call for stricter legal restrictions on drug-marketing practices.[9] On the other hand, if advertising increases physician and patient awareness and compliance with treatment regimens, consumers may benefit. Whether product promotion increases or decreases consumer welfare remains an empirical issue and a focus of this study.

The conventional wisdom holds that drug purchasers are rather price insensitive. However, it remains unclear whether this pattern reflects an inherent price insensitivity of the key decision makers in drug selection—physicians—or product promotion efforts on the part of pharmaceutical manufacturers. There is good reason to believe that physicians are insensitive to price. For example, Scherer states, "[P]hysicians tend to be risk averse, insensitive to cost, and creatures of habit, prescribing drugs by brand name even when much less expensive generic substitutes exist."[10] Temin[11] echoes these sentiments, noting that physicians often lack good information on the comparative risks and benefits of alternative treatments. As a result, the choice is on the basis of customary prescribing behavior in the community, a practice that may also serve to limit malpractice exposure.

While these arguments are quite plausible, only a direct test of the determinants of own price elasticity of demand can discern the extent to which price insensitivity reflects exogenous physician decisions or the influence of pharmaceutical firms' promotional efforts. Our findings support the latter interpretation. In the absence of product promotion, we estimate that de-

---

are adequately controlled. See Norman M. Kaplan, Treatment of Hypertension: Drug Therapy, in Clinical Hypertension (Norman M. Kaplan ed. 1990).

[8] Evidence from the National Medical Expenditure Survey indicates that less than half of outpatient prescribed medicines were covered by third-party payers. This coverage is substantially below that for expenses related to hospital or physician services. See Beth Hahn & Doris Lefkowitz, Annual Expenses and Sources of Payment for Health Care Services (AHCPR Pub. No. 93-0007, National Medical Expenditure Survey Research Findings 14, 1992).

[9] J. Frederick Brodsky, Letter to the Editor, 327 New Eng. J. Med. 1687 (1992).

[10] F. Michael Scherer, Pricing, Profits, and Technological Progress in the Pharmaceutical Industry, 7 J. Econ. Persp. 97 (1993).

[11] Peter Temin, Taking Your Medicine: Drug Regulation in the United States (1980).

sponds quite elastically to changes in price. Product promotion low- responsiveness significantly, however. These results are consistent se of Hurwitz and Caves,[12] who find an anticompetitive effect of ng on entry but in contrast to other work, which reports either in- ve results or a procompetitive effect.

emainder of this paper is divided into five sections. Section I briefly izes existing evidence from economic and medical research on the tive effects of pharmaceutical product promotion. The conceptual ork and empirical specification are described in Section II. Data and variables are discussed in Section III, and the results presented on IV. Section V summarizes the findings and their policy implica-

I. Previous Work

oted earlier, existing work on the competitive effects of pharmaceu- vertising is limited. However, information is available from two First, microeconomic studies have examined advertising effects us- rmaceutical industry data. Second, medical researchers have investi- hysician responses to promotional efforts by pharmaceutical compa-

A. *Microeconomic Studies*

omic research on the competitive effects of pharmaceutical advertis- focused on the relationship between advertising promotions and one ar form of competition, namely, new product introductions. A nega- ationship between advertising and new product introductions has terpreted as evidence that advertising inhibits competition. The re- these studies have yielded conflicting evidence. Vernon[13] found no ally significant relationship between advertising and new product while Telser et al.[14] report a positive effect of advertising on entry. [15] also finds a positive relationship between advertising and new t entry. In contrast, more recent work reports an anticompetitive ad- g effect. Thus, using a sample of 56 observations from 29 different

Hurwitz & Caves, *supra* note 3.

n M. Vernon, Concentration, Promotion, and Market Share Stability in the Pharma- Industry, 19 J. Indus. Econ. 246 (1971).

ter G. Telser *et al.*, The Theory of Supply with Applications to the Ethical Pharma- Industry, 18 J. Law & Econ. 449 (1975).

ith B. Leffler, Persuasion or Information? The Economics of Prescription Drug Ad- , 24 J. Law & Econ. 45 (1980).

drug markets, Hurwitz and Caves[16] found that sales-promotion outlays helped preserve incumbents' market shares vis-à-vis entrants, suggesting that advertising limits competition.

B. *Medical Research*

At least since the 1961 Senate hearings on anticompetitive behavior in the pharmaceutical industry, pharmaceutical promotions have been suspected of influencing the prescribing behavior of physicians. A Senate report issued at that time charged that such efforts induced physicians to prescribe wasteful and even dangerous drugs.[17] Subsequent research on physician prescribing behavior supports the notion that pharmaceutical advertising affects prescribing patterns. For example, Avorn, Chen, and Hartley[18] report that physician beliefs about specific drugs more closely resemble advertising claims than actual measures of the drug's performance. Several studies on the basis of self-reported data from physicians also suggest that physician prescribing behavior is affected by drug promotional efforts.[19]

More recently, Chren and Landefeld[20] studied the effects of physician contact with drug companies on actual prescribing behavior. Their study was conducted in a university hospital setting. It examined whether physician interactions with drug companies affected the likelihood that the physician would request that a drug be added to the hospital's formulary. The study found that several measures of physician involvement with drug companies affected physician requests that drugs be added to the hospital formulary. Rather disturbingly, more than one-half of the new drugs requested

[16] See Hurwitz & Caves, *supra* note 3. See also William S. Comanor, The Political Economy of the Pharmaceutical Industry, 24 J. Econ. Literature 1178 (1986), for a review of the literature on the competitive effects of advertising in the pharmaceutical industry.

[17] Senate Subcomm. on Antitrust and Monopoly, 87th Cong., 1st Sess., Report of the Study of Administered Prices in the Drug Industry (1961).

[18] Jerry Avorn, Milton Chen, & Robert Hartley, Scientific vs. Commercial Sources of Influence on the Prescribing Behaviors of Physicians, 73 Am. J. Med. 4 (1982).

[19] See Nicole Lurie *et al.*, Pharmaceutical Sales Representatives in Academic Medical Centers: Interaction with Faculty and House Staff, 5 J. Gen. Internal Med. 240 (1990); W. Paul McKinney *et al.*, Attitudes of Internal Medicine Faculty and Residents toward Professional Interaction with Pharmaceutical Sales Representatives, 264 JAMA 1693 (1990); Marjorie A. Bowman, The Impact of Drug Company Funding on the Content of Continuing Medical Education, 6 Mobius 66 (1986); Marjorie A. Bowman & David L. Pearle, Changes in Drug Prescribing Patterns Related to Commercial Company Funding of Continuing Medical Education, 8 J. Continuing Educ. Health Prof. 13 (1988); and James P. Orlowski & Leon Wateska, The Effects of Pharmaceutical Firm Enticements on Physician Prescribing Patterns, 102 Chest 270 (1992).

[20] Mary-Margaret Chren & C. Seth Landefeld, Physicians' Behavior and Their Interactions with Drug Companies, 271 JAMA 684 (1994).

le or no therapeutic advantage over comparable drugs already on ary.[21]

C. *Summary*

onomic studies yield conflicting evidence on the competitive ef- ıg product promotion. And as noted earlier, no economic study y examined the effect of drug product promotion on the price f demand. Although evidence from the medical literature sug- rug product promotion does influence prescribing behavior, most ıdies have been descriptive in nature and/or confined to a single health care organization. Hence, further microeconomic testing petitive effects of drug product promotion appears warranted.

II. Conceptual Framework

A. *The Theoretical Model*

ysis considers the effects of advertising and promotion on the antihypertensive drug products. We view the antihypertensive aving differentiated products. Within the group of drugs used ertension, there are several major classes including angiotensin- enzyme (ACE) inhibitors, calcium channel blockers, beta block- cs, other antihypertensive products (composed of adrenergic drenergic stimulants, and alpha/beta adrenergic blockers), and nbination therapies. Although each of these drugs has been ctive in controlling blood pressure, there are important sub- whom certain of these drugs are contraindicated. For example, rs are contraindicated in populations suffering from asthma or while ACE inhibitors are contraindicated for pregnant women. ome groups appear to respond better to certain types of drugs ers. As Kaplan notes, "An elderly, obese, black woman will nd better to a diuretic than to a beta blocker or an ACEI (ACE younger, physically active, white man would likely respond well to an alpha-blocker or an ACEI. In general, black patients th a diuretic (but) less well with a beta blocker or an ACEI. . . . han the demographic features, the presence of one or more con- ease features can provide a rational reason to choose or avoid her drug."[22] Thus, the broad classes of antihypertensive drugs

l Landefeld, in *id.*, employed therapeutic ratings from the Food and Drug Ad- reaching these conclusions.

n, *supra* note 7, at 248–49.

should be considered differentiated competitors within the same overall market.

Within each class of drugs, the individual products are also differentiated (although they are clearly more substitutable than across major classes). That is, although the individual products may be quite similar in either chemical composition or pharmacokinetic action, there are nonetheless differences across them that may make one more suitable than another in any particular situation or that might lead a physician to prefer one product over another.[23]

The demand for antihypertensive drug i in period t, q_{it}, is a function of its price, p_{it}, the detailing efforts by the drug company, D_{it}, and other factors summarized by the vector X_{it} that include competitor prices and detailing efforts, the length of time the drug has been on the market, and other product-specific factors. Thus, we write demand as

$$q_{it} = q_{it}(p_{it}, D_{it}, X_{it}), \tag{1}$$

where

$$\partial q_{it}/\partial p_{it} < 0$$

and

$$\partial q_{it}/\partial D_{it} > 0.$$

In the empirical analysis, we test the hypothesis that

$$\partial^2 q_{it}/\partial p_{it}/\partial D_{it} > 0;$$

that is, we test whether detailing lowers the responsiveness of sales to price.

We further posit that the accumulated stock of past detailing efforts follows a perpetual inventory process. Thus, we define the detailing stock at the beginning of the year as follows:

$$D_{it}^{B} = \rho D_{i,t-1}^{B} + d_{i,t-1}, \tag{2}$$

[23] The literature on generic product introductions clearly demonstrates that even when faced with a new product that the FDA has deemed to be bioequivalent, many physicians continue to prescribe the original name-brand product. See, for example, Hurwitz & Caves, *supra* note 3; and Frank & Salkever, *supra* note 4. See also Zvi Griliches & Iain Cockburn, Generics and New Goods in Pharmaceutical Price Indexes, 84 Am. Econ. Rev. 1213 (1994). For the brand-name drugs examined in our study, the FDA and U.S. Patents Office in fact have deemed that most of them are distinct products, even within classes (for example, within the class of calcium channel blockers), arguing that they have sufficiently different chemical compositions to avoid the existing patents of their rivals. Further evidence that these drugs are viewed as differentiated products is that the FDA requires each brand-named drug to undergo a complete battery of clinical trial studies of safety and efficacy prior to approval.

$\rho < 1$ reflects the real depreciation of the accumulated stock
d $d_{i,t-1}$ is the flow of detailing expenditures during the preced-
eflated by the Consumer Price Index.

that sales depend on the stock of advertising goes back to the
k of Nerlove and Arrow.[24] In the context of the pharmaceutical
re are several reasons to believe that the effects of detailing
over time. First, consumers must obtain a prescription from a
fore purchasing the product. Because of the many drugs on the
the uncertainty surrounding the precise side effects of each, it
e for any one physician to be informed fully about the relative
and disadvantages of all products. As a result, physicians de-
cribing patterns,'' whereby as they become more familiar with
action and side effects of a particular drug, they tend to pre-
re often. Thus, promotional activities taken in one period that
icians to gain experience with a particular drug are likely to
sting effects. Second, the products we examine are used to treat
ndition. After a patient starts taking a product and the dosage
keep his blood pressure under control, he is unlikely to switch
ess significant side effects emerge. As a result, if promotional
encourage patients to start using a product in one period, sales
xtend into the future.

e time span of the data (1988–93), in many instances the prod-
mine had already been on the market for several years prior to
ervation in our data set. In these cases, it is necessary to con-
iling stock for the beginning of 1988. One would, of course,
ick and collect additional data on the annual flows of detailing
the first introduction of the drug, but this was not possible. As
e, we construct the initial stock under the assumption that the
f detailing expenditures were constant (in real terms) over the
fe of the drug. Thus, knowing that the drug has been on the
years prior to 1988, we define the beginning-of-period stock

$$D^{\beta}_{i,88} = \sum \rho^{t} d_{i,88}, \quad t = 0 \text{ to } T - 1. \tag{3}$$

a drug that has already been on the market since 1983, we
ate the beginning period detailing stock in 1988 as

$$D^{\beta}_{i,88} = (1 + \rho + \rho^2 + \rho^3 + \rho^4) d_{i,88}. \tag{4}$$

ove & Kenneth J. Arrow, Optimal Advertising Policy under Dynamic Condi-
mica 129 (1962).

Empirically, we found that the model was not particularly sensitive to the value chosen for ρ. In part this is due to the short time period examined and the way the initial detailing stock was constructed.[25]

Preliminary analysis also indicated significant differences between the effects of current detailing flows and the detailing stocks—with the former having a much stronger effect on the elasticity of demand. Thus, rather than force a common effect through the model, we enter the current flow and beginning-of-period stocks separately into the model.

B. *Empirical Specification*

Although the underlying theory of demand helps determine which variables should be included in the model, it provides little guidance in selecting the appropriate functional form. In the process of conducting this study, several alternative functional forms were examined. Specifically, we examined constant elasticity, Trans-log, and log-linear functional forms. In addition, we estimated a Box-Cox functional form, allowing the form parameter to vary from zero to one. Overall, the qualitative results were robust to these alternative specifications, and the regression fits did not appreciably change. Some forms did, however, exhibit multicollinearity problems.

On the basis of this preliminary analysis of the data, we settled on a functional form that is log-linear in prices, quantities, and detailing stocks and flows

$$\begin{aligned} \ln q_i = \alpha_0 + (\alpha_1 + \alpha_2 \ln d_i + \alpha_3 \ln D_i) \ln p_i + \alpha_4 \ln d_i \\ + \alpha_5 \ln d_i^2 + \alpha_6 \ln D_i + \alpha_7 \ln D_i^2 + \beta X_i + \epsilon_i, \end{aligned} \tag{5}$$

where ln( ) indicates a natural logarithm and time subscripts have been suppressed for notational convenience. If $\alpha_2 > 0$, detailing flows lower the price elasticity of demand. If $\alpha_3 > 0$, then the detailing stock lowers the price elasticity of demand. These are the salient hypotheses tested in Section IV. This focus on the own price elasticity of demand is predicated on the well-known first-order profit-maximizing condition for firms facing a downward sloping demand curve, in which the price-cost margin is inversely proportional to the absolute value of the price elasticity of demand.

In addition to allowing detailing to affect the price elasticity of demand (and hence product price), we also allow it to have a direct effect on the quantity demanded through the parameters α_4–α_7. The competitive implications of these parameters are more difficult to interpret, since increased product usage could arguably be appropriate or inappropriate, depending on

[25] I selected a value for ρ of 0.70, which yielded the best-fitting model. However, the results were not sensitive to alternative values.

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.