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DIRECT-TO-CONSUMER ADVERTISING AND THE DEMAND FOR CHOLESTEROL-REDUCING DRUGS*

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ABSTRACT

In August 1997, the Food and Drug Administration (FDA) reinterpreted its advertising regulations to ease limits on the use of broadcast media when advertising prescription drugs directly to consumers. We estimate the effect of direct-to-consumer advertising on demand, using 1995–2000 data from the market for the statin class of cholesterol-reducing drugs. We find no statistically significant effect from any form of advertising and promotion on new statin prescriptions or renewals and no evidence of adverse market effects from advertising or the FDA policy change. We did find evidence, however, that television advertising increased the proportion of cholesterol patients who had been successfully treated, which suggests that advertising reinforces compliance with drug therapy.

I. INTRODUCTION

THE subject of advertising is marked by diverse and conflicting perspectives. Popular writers and social critics, for example, often portray advertising as wasteful and manipulative, while some academic economists argue that advertising can provide useful information for consumers and lower prices.¹

* The authors gratefully acknowledge IMS Health and Scott-Levin for providing the data described in this paper.

¹ A publication by the Media Foundation, *Adbusters*, seeks to identify the manipulative aspects of advertising. Studies by economists that found that restrictions on advertising raised prices include Lee Benham, *The Effect of Advertising on the Price of Eyeglasses*, 15 *J. Law & Econ.* 337 (1972); and John E. Kwoka, Jr., *Advertising and Price and Quality of Optometric Services*, 74 *Am. Econ. Rev.* 211 (1984). Pauline M. Ippolito & Alan D. Mathios, *Information, Advertising and Health Choices: A Study of the Cereal Market*, 21 *Rand J. Econ.* 459 (1990), and Pauline M. Ippolito & Alan D. Mathios, *Information, Policy, and the Sources of Fat and Cholesterol in the U.S. Diet*, 13 *J. Pub. Pol'y & Marketing* 200 (1994), found that the consumption of high-fiber cereals increased and the consumption of fat and saturated fat decreased when manufacturers were allowed to advertise the health content of their products. An overview of the academic and popular debate over advertising is contained in John E. Calfee & James K. Glassman, *Fear of Persuasion: A New Perspective on Advertising and Regulation* (1997).

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As the nation's health care costs continue to rise, it is not surprising that the pharmaceutical industry's multibillion-dollar direct-to-consumer (DTC) advertising expenditures are attracting their share of critics and defenders.

Some physicians, such as Matthew Holland, complain that DTC advertising encourages patients to ask physicians to write inappropriate prescriptions.² Health care providers, such as managed care organizations, and health care payers, such as employers, charge that advertising is increasing health care costs. In fact, according to Reuters, several state legislatures are considering curbs on DTC advertising.³

The nation's guardian against false or deceptive advertising, the Federal Trade Commission, has taken issue with the critics, arguing in 1996 and 2002 comments to the FDA that DTC advertising can be valuable for consumers. In 2002, the National Health Council, an organization of health associations (including the American Medical Association) and businesses, issued a consensus statement that concluded that "DTC advertising is an effective tool for educating consumers and patients about health conditions and possible treatments."⁴

Recent changes in federal policy toward prescription drug advertising have intensified the debate. In 1997, the Food and Drug Administration (FDA) sharply reduced restrictions on drug advertising originally imposed in 1985. The original DTC advertising regulations required print ads to include a detailed "brief summary" of risk and other information and required broadcast ads to include a "major statement" of risks, while also making "adequate provision" for viewers to obtain full FDA-approved prescribing information. Although it was not feasible for broadcast ads to meet these requirements, the FDA allowed ads of two kinds. The first could discuss an illness or condition, suggesting that consumers see a physician for treatment without mentioning a brand. The second could emphasize a pharmaceutical brand without stating what condition the drug could treat.

For some years, FDA staff and others had expressed dissatisfaction with the disclosure requirements, partly because their research had strongly suggested that the requirements were of little benefit to patients.⁵ The FDA had also accelerated the pace of switching prescription drugs to over-the-counter (OTC) status, recognizing the greater role that consumers were taking in

² Matthew F. Hollan, *Direct-to-Consumer Marketing of Prescription Drugs: Creating Consumer Demand*, 281 *JAMA* 382 (1999).

³ Karen Pallarito, *States Target Direct-to-Consumer Drug Ads*, *Reuters Health*, June 28, 2001.

⁴ National Health Council, *Direct-to-Consumer Prescription Drug Advertising* (January 2002) (<http://www.nationalhealthcouncil.org/advocacy/dtc.htm>, accessed September 29, 2002); and National Health Council, *Direct-to-Consumer Prescription Drug Advertising: Overview and Recommendations* (January 2002) (http://www.nationalhealthcouncil.org/advocacy/DTC_paper.pdf, accessed June 30, 2002).

⁵ Louis A. Morris & Lloyd G. Millstein, *Drug Advertising to Consumers: Effects of Formats for Magazine and Television Advertisements*, 39 *Food Drug & Cosmetic L. J.* 497 (1984).

their health care decisions.⁶ In August 1997, 6 months after the departure of FDA Commissioner David Kessler, an opponent of DTC advertising, the FDA greatly eased the burden for broadcast ads, allowing them to achieve “adequate balance” by including a concise summary of risks and related information (often via voiceover), specifying sources for more complete information (for example, a toll-free number, an Internet Web site address, and either concurrent print ads or specified locations such as pharmacies), and stating that information is available from all physicians and pharmacists.⁷ According to studies by Wayne Pines and Chris Adams, DTC advertising, especially on television, accelerated rapidly from \$579 million in 1996 to \$2.6 billion in 2000.⁸

The FDA’s 1997 action that eased limits on the most powerful form of consumer advertising might be expected to increase the effect of DTC advertising (and more generally promotion) on prescription drug demand, all else equal. We investigate this fundamental hypothesis as a step toward assessing the welfare effects of DTC advertising. We use market data to assess the effect of industry promotional activity, including DTC advertising, on the demand for an important class of drugs, the so-called statin drugs for reducing serum cholesterol. Surprisingly, we are unable to find any evidence that advertising has affected demand in the short run. Consumer behavior in this market appears to be influenced primarily by patients’ interactions with their doctors, the sequence of visits that must be made before a prescription is filled, and the growing dissemination of objective evidence that prescription drugs are effective in reducing cholesterol and preventing heart attacks. We do provide preliminary evidence that advertising reinforces these factors, while strengthening patient compliance with statin drug therapy. It is also possible that advertising may affect demand in the long run, but we have not been able to capture that phenomenon.

II. THE STATIN CLASS OF CHOLESTEROL-REDUCING DRUGS

Epidemiological evidence, such as data from the Framingham Heart Study, led researchers in the 1950s to hypothesize that higher levels of serum cholesterol increased the risk of coronary heart disease. Influential segments of the public health community, including the U.S. Department of Agriculture and some agencies of the U.S. Department of Health and Human Services,

⁶ Food and Drug Administration, Center for Drug Evaluation and Research: From Test Tube to Patient: Improving Health through Human Drugs (1999).

⁷ In August 1999, the FDA issued a final guidance for DTC advertising (Food and Drug Administration, Center for Drug Evaluation and Research, Guidance for Industry: Consumer-Directed Broadcast Advertisements (August 1999), 64 Fed. Reg. 43197 (1999), leaving requirements essentially unchanged from the August 1997 version.

⁸ Wayne Pines, A History and Perspective on Direct-to-Consumer Promotion, 54 Food & Drug L. J. 495 (1999); and Chris Adams, FDA Plans to Review Policy Allowing Direct-to-Consumer Drug Ads for TV, Wall St. J., March 28, 2001, at B1.

reached a consensus during the 1970s that reducing cholesterol, primarily through dietary changes, could substantially reduce the risk of heart disease. This limited consensus formed the basis for a number of federal policies, culminating in the 1985 National Cholesterol Education Program that urged physicians to counsel their patients to reduce dietary cholesterol or use cholesterol-reducing drugs to reduce the risk of heart disease.⁹

As with many public health claims, the hypothesized link between cholesterol and heart disease had its detractors. Many observers such as Gary Taubes noted the lack of evidence from controlled clinical trials that dietary changes could substantially affect serum cholesterol or that changes in serum cholesterol would change the risk of heart attacks or death from coronary heart disease.¹⁰ And although several drugs were available by the 1970s to reduce serum cholesterol, all had serious side effects, and none had an established ability to reduce the risk of heart disease.¹¹

With the introduction of Mevacor in 1987, a new statin class of cholesterol drugs that were largely free of serious side-effects transformed the treatment of high cholesterol.¹² Competing brands began to appear in 1991. By 1997, five manufacturers were producing six brands of statin drugs. Substantial clinical testing, required of all new drugs to win FDA approval but often continued thereafter, has found that statin drugs typically reduce the incidence of fatal and nonfatal heart attacks by 20–30 percent.¹³ Research continues on these drugs, on new statin drugs still under development, and on heart disease and its treatment.

⁹ James Cleeman & Claude Lenfant, The National Cholesterol Education Program: Progress and Prospects, 280 JAMA 2099 (1998); and Gary Taubes, The Soft Science of Dietary Fat, 291 Science 2536 (2001).

¹⁰ Taubes, *supra* note 9.

¹¹ Martijn Katan, Review of D. John Betteridge, ed., *Lipids: Current Perspectives*, 336 New Eng. J. Med. 1394 (1997).

¹² Technically, the statin drugs are 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase inhibitors (*id.*). Cholesterol-reducing drugs are often referred to as lipid-lowering drugs. The most important side-effects are liver abnormalities and muscle disease. Elevated liver enzymes occur in approximately 1–2 percent of patients but return to normal following discontinuation of therapy (Richard S. Safeer & Cynthia L. LaCivita, *Choosing Drug Therapy for Patients with Hyperlipidemia*, 61 Am. Fam. Physician 3371 (2000)). Myopathy occurs in approximately .01 percent of patients (William C. Roberts, *Twenty Questions on Atherosclerosis*, 13 Baylor U. Med. Ctr. Proc. 139 (2000)). In August 2001, Baycol (introduced in 1997) was withdrawn because of an abnormal number of deaths from rhabdomyolysis, a rare muscle disease that is sometimes fatal.

¹³ Susan D. Ross *et al.*, *Clinical Outcomes in Statin Treatment Trials*, 159 Archives Internal Med. 11793 (1999). Statin drugs have also been found effective in treating heart attacks (Gergo C. Fonarow *et al.*, *Use of Lipid-Lowering Medications at Discharge in Patients with Acute Myocardial Infarction: Data from the National Registry of Myocardial Infarction*, 103 Circulation 38 (2001)). In addition, a small but growing body of research has found that cholesterol reduction lowers the risk of strokes (Harvey D. White *et al.*, *2000 Pravastatin Therapy and the Risk of Stroke*, 343 New Eng. J. Med. 317 (2000)) and, possibly, the risk of neurological diseases such as Alzheimer's (Susan J. Landers, *Beyond Cholesterol: New Uses for Statins*, Am. Med. News, June 18, 2001).

That research has yielded three findings that are particularly relevant here. First, the relationship between reducing cholesterol and preventing heart attacks has finally become firmly established and widely accepted by the medical community.¹⁴ Second, an expert panel's findings reported in the *Journal of the American Medical Association* showed that the criteria for using cholesterol-reducing drugs have steadily expanded beyond treatment to the prevention of cardiovascular disease and, in the process, demonstrated that larger proportions of adults can benefit from statin drugs.¹⁵ Finally, the expert panel also showed that a large share of people who would benefit from cholesterol reduction, by drug therapy or other means, have failed to get appropriate diagnosis or treatment.¹⁶ The role for statin drug therapy has also expanded because it has proved difficult to reduce cholesterol substantially by traditional means such as dietary changes.¹⁷

III. STATIN DRUG COMPETITION AND MARKETING

Developing drugs that reduce cholesterol and the risk of heart disease was a major medical breakthrough. But drug companies still had to compete for consumer demand. One way is to reduce side-effects. Another is to showcase results from clinical trials. Lipitor, for instance, is marketed as achieving the most rapid reductions in cholesterol levels (and increases in high-density lipoproteins (HDL), the "good" cholesterol); Zocor's marketing focuses on reduced mortality from heart disease; Pravachol is touted as being shown to prevent first and second heart attacks.

Price competition may also be important, but it is difficult to identify. Three of the four dominant brands (Lipitor, Zocor, and Pravachol) had comparable average retail prices, while Baycol's price was substantially lower.¹⁸ Retail prices for the entire statin drug market have been very stable, increasing only 7 percent in real terms between 1995 and 2000.¹⁹ Because these data do not reflect private discounts and rebates from manufacturers to pharmaceutical benefit managers or managed care organizations, prices are probably falling despite the surge of interest in these drugs. Stable statin drug prices

¹⁴ D. Monkman, Treating Dyslipidaemia in Primary Care: The Gap between Policy and Reality Is Large in the U.K., 321 *Brit. Med. J.* 1299 (2000).

¹⁵ Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), 285 *JAMA* 2486 (2001).

¹⁶ *Id.*

¹⁷ J. L. Tang *et al.*, Systematic Review of Dietary Intervention Trials to Lower Blood Total Cholesterol in Free-living Subjects, 316 *Brit. Med. J.* 1213 (1998); and Taubes, *supra* note 9.

¹⁸ Baycol has been withdrawn from the market, but this did not occur until after the period covered by our analysis.

¹⁹ Data are from IMS Health. See <http://www.imshealth.com>.

may actually be disguising a quality-adjusted decline in price because ongoing research is revealing new and improved uses for these drugs.

Product promotion, or marketing, is the most transparent and potentially most effective way for pharmaceutical firms to compete. In one prominent marketing strategy, called physician detailing, pharmaceutical representatives visit physicians, managed care organizations, health insurance companies, or affiliated organizations such as pharmaceutical benefit management firms to stress how their drugs can reduce health care or labor costs. Since the 1997 FDA policy change, media advertising directed toward consumers through television, newspapers, and magazines has become especially important.

Institutional features of the statin drug market appear to influence advertising's content and potential effects. The Food and Drug Administration rules require patients to get a physician's prescription to obtain a statin drug.²⁰ Given the large population of potential users who have no regular doctor and are unable to use reliable home tests or self-diagnoses to determine their cholesterol levels, DTC advertising could provide a strong stimulus for people to see a physician about the benefits from drug treatment.²¹ On the other hand, pharmaceutical firms have limited experience in using broadcast advertising of prescription drug brands to motivate consumers to see their physicians about possible medical conditions. In any case, because roughly 75 percent of prescription drug costs are covered by insurance and other third parties, DTC advertising invariably focuses on therapeutic benefits instead of price.²²

IV. SOME EMPIRICS OF MARKET CONDITIONS

Market data from 1995 through 2000 reveal the salient characteristics of the statin drug market and motivate systematic analyses of possible causal relations. As expected in a market for an effective new drug, demand has been growing steadily (Figure 1).²³ Although statin use has increased greatly

²⁰ Merck and Bristol-Myers-Squibb have asked the FDA to permit OTC sales of Mevacor and Pravachol, respectively. The Association of Black Cardiologists supported their petition, which the FDA declined to grant (Victoria Stagg Elliott, FDA Advisory Committee Vetoes OTC status for Low-Dose Anti-cholesterol Drugs, *Am. Med. News*, August 7, 2000). Should the manufacturers succeed in obtaining OTC status, the role of marketing in the statin drug market could change substantially.

²¹ Home cholesterol measurement devices measure only total cholesterol, not high-density lipoprotein (HDL) and low-density lipoprotein (LDL) cholesterol, which are clinically important.

²² IMS Health data, cited in Pharmaceutical Research and Manufacturers of America, *Pharmaceutical Industry Profile* (1999).

²³ *Id.* Sales data are collected by IMS Health on a weekly reporting basis; data were initially supplied for this study time aggregated such that the first two 4-week periods in a given quarter were reported as "months," followed by a 5-week period reported as a third "month." Observations were adjusted by the authors such that a given observation represents the extrapolation of estimated daily sales over $30\frac{1}{3}$ days.

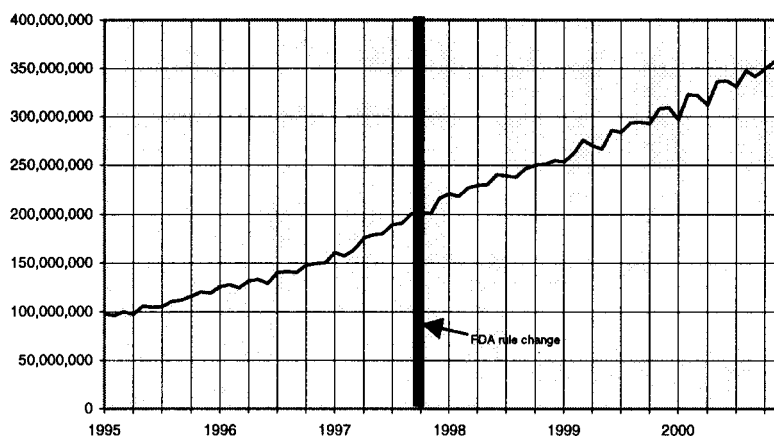


FIGURE 1.—Total pills dispensed, statin. Data are from IMS Health.

since the first quarter of 1995, it appears to have increased slightly less since the FDA rule change on DTC advertising. The growth in prescriptions decomposed into new and renewals (with brand switches recorded as new prescriptions) was very similar to the growth in total pills dispensed.²⁴

Although the trend in demand has been steadily upward, the trend in the promotion of statin drugs has been irregular. Total promotional spending has fluctuated considerably but has not increased much since the FDA rule change except for two brief periods including the end of 2000 (Figure 2). The mix of promotional expenditures, however, has changed dramatically. Figure 3 decomposes these into broadcasting (mainly television), popular print, medical journals, and physician detailing and shows that television advertising has become far more important since the rule change, while popular print advertising appears somewhat less important. The variation in the data is consistent with “pulse advertising”—a series of brief periods of intensive advertising followed by a sharp slowdown or cessation—but it is not apparent how this variation has contributed to the growth in consumer demand.

To explore this issue, we estimated a monthly time-series regression of total statin drug prescriptions on advertising expenditures and other potentially important influences including a price index supplied by IMS Health (deflated by the Consumer Price Index for Urban Consumers) and a variable to control for potentially persuasive medical research findings about the ben-

²⁴ As noted previously, real statin drug prices have remained constant; thus, the trend for statin drug expenditures is very similar to the trend exhibited by pills and prescriptions.

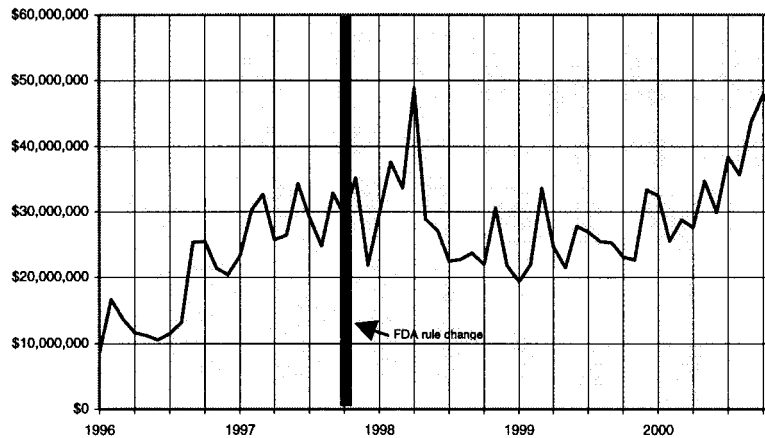


FIGURE 2.—Total statin promotional dollars. Data are from IMS Health.

efits of using statin drugs.²⁵ Specifically, we included a dummy variable to represent the 1998 presentation of preliminary results of a clinical trial that attracted considerable attention because it demonstrated that for many heart disease patients, statin drug therapy was at least as effective as angioplasty.²⁶ We also used several alternative information variables based on the number of substantive news stories about cholesterol in the *New York Times*, *Los Angeles Times*, *Washington Post*, and *USA Today*.

Because a Dickey-Fuller test revealed that the dependent variable was nonstationary, these models were estimated using first differences (in logs). Advertising expenditures were specified in several ways including simple lags, 3-month and 6-month stocks to capture the notion of pulse advertising, and as total expenditures, total DTC advertising, and individual components (television, print, journal, and detailing). (We also tried instrumenting advertising expenditures for statin drugs using advertising expenditures for all drug prescriptions as an instrument.)

Our consistent finding was that advertising expenditures had a statistically insignificant effect on prescription demand. Using a dummy variable to indicate the effect of promotions before and after the 1997 FDA rule change and employing a simple version of a switching regression did not change this finding. We also estimated models using alternative measures of demand

²⁵ Pierre Azoulay, Do Pharmaceutical Sales Respond to Scientific Evidence? Evidence from Anti-ulcer Drugs, 11 *J. Econ. Mgmt. Strategy* 551 (2002), found that both medical research findings and promotion increased the sales of anti-ulcer drugs.

²⁶ The study was Atorvastatin versus Revascularization Treatments (AVERT); preliminary results were presented at the November 1998 American Heart Association meeting. The results were published in Bertram Pitt *et al.*, Aggressive Lipid-Lowering Therapy Compared with Angioplasty in Stable Coronary Artery Disease, 341 *New Eng. J. Med.* 70 (1999).

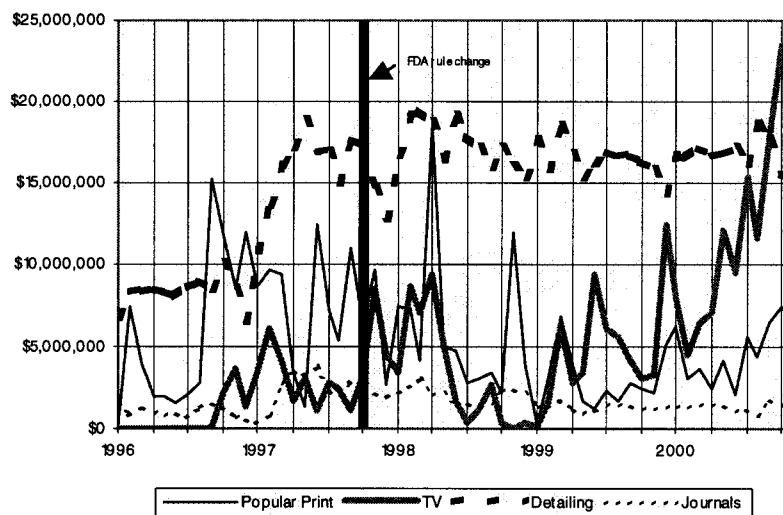


FIGURE 3.—Monthly statin promotional dollars by type. Data are from IMS Health.

such as number of pills and revenues. Because prescriptions and pills prescribed may not necessarily correspond to consumption patterns (consumers can time shift by purchasing a larger prescription), we also constructed another demand measure by calculating the mix of 30-day and 90-day prescriptions and treating the 90-day prescription as the equivalent of one 30-day prescription for each of the subsequent 3 months (we termed this variable PATIENTS as a measure of the number of people undergoing statin treatment in a given month). None of these regressions yielded significant coefficients for any of the advertising variables. Finally, we examined the impact of advertising on pharmaceutical firms' market shares and, again, found no statistically significant effect from advertising despite dramatic shifts in these shares during the sample period.²⁷

It is important to stress that several steps may occur between the time an advertisement motivates a consumer to explore drug therapy for cholesterol and when the drug is purchased, which makes it difficult to rule out the possibility that DTC advertising does influence demand. These steps typically include a visit to a doctor, a second visit to review cholesterol test results, perhaps advice to try dietary changes and exercise, perhaps another chole-

²⁷ Mevacor's share of total prescriptions went from 37 percent in December 1995 to 2 percent in December 2000; Lipitor's market share went from 14 percent in December 1997 to over 50 percent in December 2000. Marta Wosinska, *Effects of Direct-to-Consumer Drug Advertising on Prescription Choice* (Working paper, Univ. California, Berkeley 2001), found that DTC advertising had a small but statistically significant effect on brand shares, conditioned on a physician deciding to prescribe a statin drug.

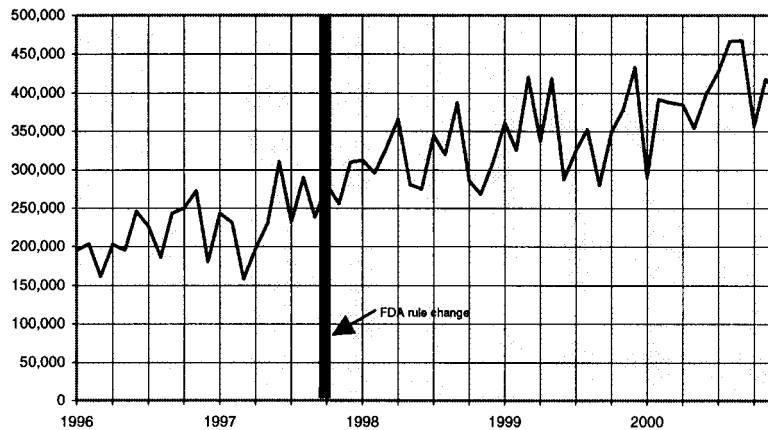


FIGURE 4.—New high-cholesterol diagnoses. Data are from Scott-Levin, Physician Drug and Diagnosis Audit.

terol test, and, finally, the first prescription. This may take a few weeks to 6 months or more, with considerable variance among patients and perhaps among physicians. Thus it may be possible to detect the effect of DTC advertising on consumer demand only with disaggregated data that link a patient's cholesterol treatment history with the timing of DTC advertising expenditures.²⁸

V. INVESTIGATING OTHER POSSIBLE EFFECTS OF DIRECT-TO-CONSUMER ADVERTISING

Because consumers may not respond to advertising in a way that is easy to detect empirically, we explored alternative ways in which advertising could affect this market. For example, advertising could affect demand by influencing consumers to visit their doctors, get checkups and diagnoses, and ultimately use a cholesterol-reducing prescription drug. Indeed, Figure 4 documents a steady rise in physician office visits involving a new diagnosis of elevated cholesterol, on the basis of monthly data from Scott-Levin's ongoing panel of physicians. New diagnoses can signal a treatable condition and lead to additional office visits. Figure 5 shows that total office visits for patients under treatment for high cholesterol have risen from roughly 1 million in 1996 to more than 2.5 million in 2000. And a large fraction of these

²⁸ Meredith B. Rosenthal *et al.*, Demand Effects of Recent Changes in Prescription Drug Promotion (Working paper, Nat'l Bur. Econ. Res., June 28, 2002), aggregated five therapeutic drug classes to estimate the effects of drug advertising. However, they are likely to have overstated these effects because it appears that they did not detrend their sales and advertising data.

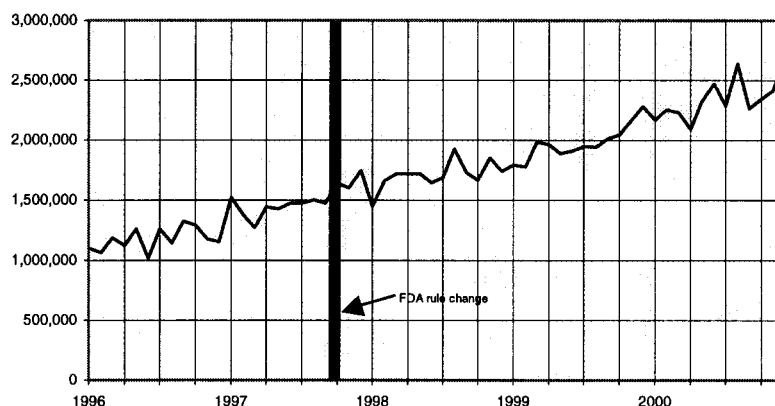


FIGURE 5.—Doctor visits, patients currently under treatment for high cholesterol. Data are from Scott-Levin, Physician Drug and Diagnosis Audit.

people are being treated with statin drugs. Data from Scott-Levin indicate that the proportion of elevated cholesterol diagnoses resulting in a statin drug prescription increased from 75 to 95 percent during 1996–2000.²⁹

It is therefore possible to characterize a process that has been growing during the past 4 years in which consumers visit the doctor, get a diagnosis, and, when diagnosed with high cholesterol, usually get a statin prescription. Advertising may therefore have an indirect effect on statin drug demand by influencing people to visit their doctor for a checkup and diagnosis. (This potential relationship is not contemporaneous in our (Scott-Levin) data because office visits are not coded as cholesterol related until the patient is diagnosed, which usually does not happen until a new patient visits the doctor a second time to review the results of a serum cholesterol test.)

We explored this possible effect of advertising by estimating monthly time-series regressions of office visits for all reasons, visits related to cholesterol, and so on, as a function of advertising expenditures plus alternative information variables. A Dickey-Fuller test revealed that the visits variables were nonstationary, so we estimated models using first differences (in logs). We specified advertising expenditures in several alternative ways including simple lags and 3-month and 6-month stocks. The consistent finding was that advertising expenditures had a statistically insignificant effect on office visits. In addition, if advertising were having a strong effect on office visits, one might expect that patients would be initiating requests for statin drugs. But the Scott-Levin physicians' panel data indicate that the share of patients with

²⁹ Scott-Levin, Physician Drug and Diagnosis Audit (http://verispan.com/products/data_sheet.asp?c=2&p=16).

elevated cholesterol who requested a statin drug prescription has been only 2–5 percent since 1997.

In the face of growing cholesterol-related patient visits and statin drug demand, it would strengthen our findings that advertising has had a statistically insignificant effect on this growth if we could point to what has caused it. We can only conjecture at this point. One relevant fact is that actual and potential patients can obtain objective evidence on the efficacy of statin drugs in reducing serum cholesterol. Could such emerging evidence affect demand? Using the Scott-Levin data, we constructed the variable SUCCESS as the percentage of existing patients with a high-cholesterol diagnosis whose total cholesterol fell below 200 and then regressed PATIENTS (as defined previously) on lagged values of SUCCESS. The motivation is that information about successful treatment may influence demand; for example, people who are dramatically lowering their cholesterol may increase demand by spreading the word about the effectiveness of statin drugs and thus making patients more receptive to physicians' recommendations for statin drug therapy. Estimation results excluding a statistically insignificant information variable are as follows (*t*-statistics are in parentheses):

$$\begin{aligned} \% \Delta \text{PATIENTS}_t = & .016 + .077\% \Delta \text{SUCCESS}_{t-1} + .031 \Delta \text{SUCCESS}_{t-2} - .254 \text{MA}(1); \\ & (8.6) \quad (3.0) \quad (1.1) \quad (-2.1) \end{aligned}$$

$N = 57, \quad R^2 = .21.$

The variable SUCCESS has a statistically significant effect with one lag; the coefficient falls by about half for a 2-month lag but still exceeds its standard error. This finding is consistent with the idea that information is playing a role in the growth of the statin drug market. That information is presumably not from advertising, but instead from successful treatments that we speculate are being discussed among friends, coworkers, and the public at large as well as among physicians.³⁰ Given that the Scott-Levin data indicate that the average total cholesterol levels of existing cholesterol patients declined from about 240 to about 215 between 1996 and the end of 2000, it would not be surprising if patients were sharing their positive experiences with statin drug therapy.

It seems likely that the doctor, acting as a gatekeeper with both professional advice and the power to prescribe, has, in combination with objective evidence from the effects of cholesterol-reducing drugs, “crowded out” advertising from playing a significant short-run role in the growth of the cholesterol drug market. But advertising may be having a subtle effect by reinforcing

³⁰ Fred Mannering & Clifford Winston, *Automobile Air Bags in the 1990s: Market Failure or Market Efficiency?* 38 *J. Law & Econ.* 265 (1995), found that consumers' adoption of airbags was spurred by information disseminated among friends, family members, and the media about actual experiences with airbags.

doctors' recommendations to try a statin drug and continue using it. To explore this possibility, we estimated the effect of television advertising expenditures on SUCCESS (the number of existing patients with a high-cholesterol diagnosis whose total cholesterol fell below 200) and found that advertising had a positive and statistically significant effect, which suggests that advertising may be reinforcing the resolve of cholesterol patients to continue their therapy and achieve successful results.³¹ This finding is consistent with survey evidence indicating that patients pay attention to advertising for drugs they are using, which reminds them to refill prescriptions and stick with their regimens, thereby improving compliance.³² (Advertising could also reinforce word-of-mouth information.)

We explored whether we could detect this effect using our data on prescription refills as a dependent variable, but we found that advertising had a statistically insignificant effect. As before, this may reflect the difficulty of correlating the sequence of consumers' behavior with advertising. That is, our data could not distinguish between the initial refill (when the doctor's role is still large) and subsequent refills (when the physician's role may be attenuated and such refills are spread across several months).

Could advertising be having adverse effects? For instance, it has been alleged that drug advertising is attracting people into the market who do not need the drug. Robert Dubois and others find that although considerably more patients received lipid-lowering therapy from 1997 to 1999, the distribution of statin use by risk profile has remained stable.³³ According to the Scott-Levin data, average cholesterol levels for newly diagnosed patients have remained essentially constant since 1996. Given the aging of the population, this suggests, and is consistent with findings in the medical literature, that statin drugs are underused rather than overused. As noted, average statin prices have probably declined and certainly have not been inflated by promotional expenditures, which have been running at only 6 percent of statin revenues. Finally, advertising could be wasting resources if it merely shifted brand shares without providing information to consumers or reinforcing re-

³¹ The estimation results were (*t*-statistics are in parentheses)

$$\Delta \text{SUCCESS}_t = .0047 + \frac{1.16E}{(22.6)} - \frac{.9\Delta \text{TV}_t}{(2.9)} - \frac{.924\text{MA}(1)}{(-37.5)};$$

$$N = 58, R^2 = .40.$$

³² John E. Calfee, Public Policy Issues in Direct-to-Consumer Advertising of Prescription Drugs, 19 *J. Pub. Pol'y & Marketing* 174 (2002). This function of advertising was noted by Victoria Stagg Elliott, Questions Swirl around Drug Ads for Patients, *Am. Med. News*, July 9/16, 2001; and in the 2002 statement by the National Health Council.

³³ Robert Dubois *et al.*, Growth in Use of Lipid Lowering Therapies; Bad News? Good News? Or the Wrong Question? (unpublished manuscript, Protocare Sciences, Inc., Santa Monica, Cal. 2001).

search incentives. We found previously, however, that advertising did not have a statistically significant effect on brand shares.

Given that physicians play a dominant role in statin drug use and that many patients who could benefit from these drugs are not using them, it is possible that the prescription requirement is having adverse effects. This issue is beyond the scope of our paper, but as previously noted, some physicians support OTC status for at least some statin drugs. In all likelihood, DTC advertising would become a potent tool for reducing undertreatment and noncompliance.

VI. QUALIFICATIONS AND CONCLUSIONS

Branded DTC advertising has been a new and expensive competitive tool for prescription drug manufacturers. We found, in the case of statin drugs, that it has not directly increased total market demand or firms' market shares in the short run but that it may be strengthening patient compliance (or reinforcing information disseminated by word of mouth), which suggests that advertising may have an effect on demand in the long run.

This does not completely resolve the questions of why pharmaceutical companies have quadrupled advertising spending since the 1997 FDA rule change and why statin drug demand has sharply increased. We speculate that the large gyrations in DTC advertising spending indicate that firms are experimenting with their new promotional tools, such as pulse advertising. Firms may need more experience before their promotions directly affect demand, or they may learn that advertising is not nearly as effective as they thought it would be and decide to curtail it. To be sure, we also found that the time-tested tool of detailing had no direct effect; inexperience may not be a factor in this case.

We have also pointed out that advertising's effectiveness is proverbially difficult to assess given the process at work in the statin drug market—a positively received advertising message followed by several visits to a doctor and possibly a prescription for and then the use of a cholesterol-reducing drug. Future work could capture this process by using disaggregate patient data to identify the lags between advertising and drug purchases or renewals.

The substantial increase in the demand for statin drugs is undoubtedly related to the growing recognition by physicians and patients that the drugs are effective—in that respect, television advertising appears to be playing an important role by increasing drug therapy compliance. We have found no evidence that advertising is having the pernicious effects claimed by its critics, which suggests that the FDA's decision to permit it in the cholesterol drug market has not hurt consumers. Given the many undiagnosed cases of treatable elevated cholesterol and the difficulties of detecting by econometric methods the relationship between advertising and prescription sales, it is entirely possible that advertising could yet generate large direct benefits in

the long run. Additional assessments will be illuminating as this market evolves.

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