

**DOES DTC ADVERTISING RAISE PRICE? THE IMPACT OF  
PHARMACEUTICAL ADVERTISING ON CONSUMERS' PRICE SENSITIVITY**

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## **Does DTC Advertising Raise Price? The Impact of Pharmaceutical Advertising on Consumers' Price Sensitivity**

### **Abstract**

The impact of DTC advertising on consumers has become the focus of considerable debate. One question of interest, given rising health care costs, is whether DTC advertising increases the price of prescription drugs. This study uses data on name brand drugs in five major therapy classes marketed in the U.S. during 2001-2005 to test the effect of DTC advertising, as well as other promotional variables, on the price elasticity of demand. The predictions of two competing theories on the economic effects of advertising are used as a basis for forming the hypotheses. The data indicate that there is not a significant relationship between DTC advertising and price sensitivity in these five categories. Given the inverse relationship between elasticity of demand and price, the evidence suggests that, at least after the introductory stage of the life cycle, consumers do not pay higher prices as a result of DTC advertising that occurs in the pharmaceutical industry.

## **Does DTC Advertising Raise Price? The Impact of Pharmaceutical Advertising on Consumers' Price Sensitivity**

The impact of direct to consumer (DTC) prescription drug advertising on consumers has been controversial since its U.S. inception in the early 1980's, because prescription drugs are a product category that has a profound impact on public health and consumer welfare. Specifically, one controversy concerns whether DTC advertising contributes to rising health care costs in the US, which, on a per capita basis, are the highest in the world. Although DTC advertising is currently legal in only two OECD countries, the U.S. and New Zealand, several others are considering it, including Australia, Canada, the U.K., and some European Union members (Auton 2004). Unquestionably, prescription drugs are a product category that has a profound impact on public health and consumer welfare. Therefore, it is particularly important to examine the economic and societal effects of prescription drug advertising.

In particular, the debate over pharmaceutical pricing has captured the attention of the U.S. Congress. Specifically, when Democrats took control of Congress following the elections in November, 2006, Nancy Pelosi, the incoming Speaker of the House, put controlling drug prices at the top of the Democratic agenda. Soon after, the House passed a bill that would amend the Medicare prescription-drug benefit, to allow the government to negotiate prices with the pharmaceutical industry (Anand 2007). In addition, Senator Edward Kennedy recently co-sponsored legislation that would impose a two-year moratorium on advertising a drug after its approval (Teinowitz 2006).

Although prescription drugs themselves move in a relatively straightforward path from manufacturers to wholesalers to retail pharmacies or non-retail providers (such as

hospitals and clinics) to the final consumers, the flow of payments that occurs is more complicated. The prices consumers pay depend upon the degree of competition in a marketplace and on purchasers' bargaining power. In the pharmaceutical marketplace, competition depends on whether a brand-name drug has patent protection or whether both brand name and generic versions of the drug are available. Even brand-name drugs under patent protection can face competition from other brand-name drugs that are considered to be therapeutic substitutes. A purchaser's bargaining power depends on both the volume purchased and the purchaser's ability to choose which drug to purchase from a set of competing drugs. A health plan can negotiate lower prices from the manufacturer (in the form of rebates) by buying a large volume of the brand-name drugs. In contrast, for generic drugs, the chain pharmacy, rather than the health plan, has greater negotiating power because of stocking several different comparable generic drugs. Therefore, manufacturers have no incentive to negotiate price terms with a health plan for generic drugs even if the health plan buys a large volume of them (Congressional Budget Office 2007).

Because of the unique nature of the product, pharmaceutical drug manufacturers employ a variety of promotional techniques. For example, journal advertising (JRL) reflects advertising expenditures for prescription products appearing in medical journals aimed at physicians. In addition, office/hospital promotional contact (CON) includes costs associated with the personal selling activities of pharmaceutical representatives that are directed to office-based physicians, hospital-based physicians, and directors of pharmacies. This type of interaction is often referred to as detailing because the sales representative details the unique attributes associated with a particular drug. In many

cases, sales representatives will “detail” more than one drug during a single appointment with a physician. Closely related, the retail value of product sampling (RVOS) reflects the sampling activities of pharmaceutical representatives that are directed to office-based physicians. For instance, during a routine contact or detailing of a physician, sales representatives typically leave the physicians complementary samples to distribute to patients when prescribing a drug for the first time. This not only defrays some of the initial cost of the drug, it allows doctors and patients an opportunity to determine the safety and efficacy of the treatment in a clinical setting. Finally, cost of DTC advertising aimed at patients includes expenditures for pharmaceutical prescription products in the following media types: television, radio, newspaper, magazine, and outdoor billboards.

Prior studies across industries on the overall effect of advertising on consumer pricing have found seemingly conflicting results. As detailed in the review by Kaul and Wittink (1995), some research suggests that an increase in advertising leads to an increase in prices paid by consumers because of product differentiation, while other studies suggest an increase in advertising leads to a decrease in prices paid by providing information to consumers and enhancing competition. This classical debate over the impact of advertising will be discussed in greater detail later.

Although promotional expenditures often account for 20-30 percent of sales in the pharmaceutical industry, evidence on the competitive effects of pharmaceutical advertising is limited and inconclusive (Rizzo 1999). While there have been numerous studies examining DTC advertising, almost no research has been conducted regarding its effect on the price sensitivity of patients. This is unfortunate, given the policy related implications related to the marketing practices of the pharmaceutical industry. Indeed, as

Manchanda and colleagues (2005) suggest in their review of the literature, understanding the relationship between drug prices and sales probably offers one of the best research opportunities for academicians.

Understanding the competitive effects of pharmaceutical promotion, particularly advertising, has important implications for legislation governing the marketing practices of pharmaceutical companies. Moreover, if greater advertising reduces (increases) price sensitivity, it enables firms to increase (reduce) prices (Narayanan et al. 2004). Because consumers typically have less generous insurance coverage for prescribed medicines than for other forms of health care, if advertising reduces price sensitivity and increases price in the market for pharmaceuticals, a substantial share of the nation's population may suffer adverse consequences (Rizzo 1999). Fortunately, some recent empirical studies have begun to examine the impact of DTC advertising on prices.

### **Literature Review**

Historically, a number of studies have examined the effect of competition on drug pricing. For instance, Comanor (1964) examines the effect of new products on existing pharmaceutical prices and concludes that the introduction of new branded products and patent-protected products can increase product differentiation in the marketplace and potentially increase prices. In addition, Peltzman (1973) argues that even though new pharmaceutical products may be introduced at higher prices than older drugs already on the market, the new drugs may nevertheless induce competitive effects that reduce overall drug prices. Finally, Perloff, Suslow, and Seguin (1995) develop a theoretical model of new drug interactions that considers drug firm pricing decisions in a setting where drugs are spatially differentiated. When a new drug enters, whether the price of the

existing product rises or falls depends on how closely substitutable the new drug is for the existing one.

Much of the more recent drug pricing literature focuses on the introduction of generic alternatives to branded drugs. For example, Grabowski and Vernon (1992) estimate that branded prices rise both before and after generic entry. Conversely, however, Caves, Whinston, and Hurwitz (1991) estimate that the price of a branded drug falls about 2 percent after its patent expires. Also, Frank and Salkever (1992) examine generic competition and conclude that the market for pharmaceuticals is segmented. These authors conclude that there is a highly price-elastic hospital segment that responds to price changes in either branded or generic drugs and a less elastic insured consumer segment that responds only to price changes in the branded drug. Before the entry of generics, the branded drug serves both segments, and the price elasticity it faces is a mixture of the price elasticities of both segments. Upon generic entry, the branded drug loses the price-elastic segment to the generic drugs, and this lowers the elasticity of the branded drug's demand curve, which leads to an increase in price.

In the context of branded pharmaceutical competition, Rizzo (1999) analyzed the demand for antihypertensive drugs in the U.S. from 1988-1993. This author found that interactions between price and drug product class are insignificant, although detailing (personal selling directly to doctors) efforts resulted in significantly higher prices for consumers.

Berndt and colleagues (2001) examine the role of information in facilitating and explaining growth of the overall antiulcer drug market, as well as in shaping the changing market shares of four patented products. They find that marketing information stocks

positively affect sales, that sales elasticity is largest for detailing, followed by journal pages of advertising, and is smallest for DTC advertising. They also find that order-of-entry effects are significant, as are quality attributes.

Other studies find that the impact of detailing and DTC advertising can be additive. For instance, Neslin (2001) examined monthly data for 391 branded products from various pharmaceutical categories and, for a “median” brand, estimates the impact of detailing and DTC advertising on the number of prescriptions written by physicians. He finds that the return on investment for \$1 of detailing is \$1.72, and the corresponding ROI for DTC is \$.19. Additionally, Witnick (2002) considers more data points and distinguishes between the size of the brands and their launch date in characterizing the average response to promotional investments. He finds a considerable difference between the ROIs of detailing and DTC. For brands that have at least \$500 million in annual revenues launched between 1998 and 2000, ROI for detailing is \$11.60 and \$1.30 for DTC.

In another study, Manning and Keith (2001) examined the National Institute for Health Care Management data from 2001 and find that a rank ordering of brands according to DTC expenditures shows no significant relationship with percentage increases in cost per prescription. Other more recent research exploring advertising expenditures for branded drugs and prescription costs also supports the assumption that there is little or no correlation between the level of DTC advertising and price (Masia 2003). For example, Narayanan, Desiraju, and Chintagunta (2004) do not find a significant interaction between DTC advertising and price, but do find that higher levels of detailing significantly increase price sensitivity. Furthermore, Donohue and Berndt

(2004) examine the impact of DTC and physician detailing on the choice of antidepressant medication. They find that detailing has a much greater effect on medication choice in the antidepressant market than does DTC advertising.

Two additional studies consider the impact of DTC on demand. Rosenthal and colleagues (2003) find that 9 percent to 22 percent of category growth can be attributed to DTC. Additionally, Wosinska (2002) use a large panel of insurance prescription claims for cholesterol-lowering drugs and reports two empirical observations. First, DTC affects only the market shares of drugs on the formulary, and that even for these drugs the marginal impact of DTC on demand is lower than the marginal impact of detailing. Second, the impact of DTC is lower than that of detailing.

Other research finds evidence of synergies between the marketing-mix elements. For instance, Swinyard and Ray (1977) find that advertising's effectiveness is enhanced when it follows a personal selling encounter. Conversely, Azoulay (2002) finds evidence of a negative interaction between detailing and DTC, an effect he refers to as "jamming."

Bhattacharya and Vogt (2003) propose a dynamic theory of pharmaceutical pricing and conduct an explanatory empirical analysis inspired by the theory. Their theory predicts a pattern of increasing prices and decreasing promotional activities over a drug's life cycle. Prices are kept low and advertising levels high early in the life cycle in order to build public knowledge about the drug. As knowledge grows, prices rise and advertising falls.

While conventional wisdom holds that pharmaceutical purchasers are rather price insensitive, it remains unclear whether this perceived pattern reflects product promotional efforts on the part of pharmaceutical manufacturers (Rizzo 1999). Therefore, a direct test

of the competitive effects of pharmaceutical firms' promotional efforts on brand-name pharmaceuticals and the resulting price premium, if any, can be used to ascertain how advertising affects the price sensitivity of consumers in the pharmaceutical market.

The empirical evidence collected to date appears to be conflicting with regard to the hypothesis that advertising hinders competition in the pharmaceutical industry. However, a limited number of studies have been conducted on this topic, and although no research explicitly supports the implication that DTC promotion leads to higher prices, more research is clearly needed, and that is the goal of this study. Specifically, the research question of interest is: do pharmaceutical promotional efforts reduce price sensitivity of consumers? To ascertain the impact that pharmaceutical promotion, particularly DTC advertising, has on consumer price sensitivity, five distinct therapy classes with extensive promotional activity are investigated. Because of the unique characteristics of demand for pharmaceuticals, and the resultant strategies adopted by competing brands in each therapeutic class, an explanation of each class is given, followed by the conceptual framework and hypotheses.

## **Therapeutic Class Descriptions**

### ***Sleep Disorder (Insomnia)***

Sleep disorders, which can be temporary or long-term problems, affect the quantity or quality of sleep. The National Institutes of Mental Health has identified three broad categories of insomnia. These include: transient, insomnia that lasts fewer than three days; short-term, which lasts three days to three weeks; and chronic, which lasts more than three weeks.

Insomnia is the most common sleep disorder in the United States. It is experienced at some time by approximately one-third of the adult population, 100 million in the United States, and is a persistent problem for approximately 10 percent, or 30 million cases (Bixler, Kales, Soldatos, Kales, and Healey 1979; Ford and Kamerow, 1989). More than \$1 billion dollars are spent annually in the U.S. on sleep medications.

Drugs used in the management of insomnia include unique agents called non-benzodiazepine sedative hypnotics. Examples include Ambien (zolpidem), Sonata (zaleplon), and Lunesta (eszopiclone). Drug classes also considered sedative hypnotics are barbiturates and sedating antihistamines. The non-benzodiazepines and barbiturates are controlled substances because they carry an addiction potential if used improperly. A new class of sedative hypnotics has recently come to market. Rozerem (ramelteon), the first in the class, is a melatonin receptor agonist which mimics the body's natural sleep promoting hormone, melatonin. The unique properties of this drug class are that it works with the body's natural circadian rhythm to promote sleep. The melatonin receptor agonists do not carry an addiction potential.

### ***Overactive Bladder***

Urinary incontinence is the involuntary leakage, or loss, of urine due to the inability to control urine release from the bladder (OAB). It results from an underlying cause that can be permanent (such as a stroke) or temporary (such as a urinary tract infection). Urinary incontinence can affect both men and women, at any age. Evidence has shown that overactive bladder incidence increases significantly with age (Rovner and Wein 2002). The incidence of urinary incontinence increases in individuals who are 65 years or older, occurring in one of every 10 elderly individuals. Additionally, it is more

predominant in patients who are in long-term care facilities, particularly women - whose first symptoms often appear at the start of menopause (Express Scripts 2006).

The National Overactive Bladder Evaluation (NOBLE), a telephone survey, provided data on the prevalence of wet and dry OAB in the U.S. The overall prevalence of OAB was 16.9 percent in women and 16.0 percent in men (Stewart et al. 2003). Applied to the U.S. population as a whole, this translates into approximately 33.3 million affected adults. A recent study estimated the total socioeconomic consequences of the overactive bladder syndrome in a large U.S. study to be \$12.6 billion (Palleschi and Tubaro 2005).

Effective treatment includes the combination of drug therapy with behavioral interventions. Drug therapy includes: oxybutynin (Ditropan, Aventis; Ditropan XL, ALZA Corporation; Oxytrol, Watson Pharma), tolterodine (Detrol, Pfizer; Detrol LA, Pfizer), and trospium (Sanctura, Odyssey Pharmaceuticals/Indevus Pharmaceuticals). More recently, Solifenacin (Vesicare, Yamanouchi/GlaxoSmithKline) and darifenacin (Enablex, Pfizer) were approved by the Food and Drug Administration (FDA) in the fourth quarter of 2004.

### ***Erectile Dysfunction***

Erectile dysfunction (ED), sometimes called "impotence", is the inability to achieve or maintain an erection for sexual intercourse. Erectile dysfunction can affect all age groups. It has been estimated that 18 to 30 million American men suffer from erectile dysfunction (Express Scripts 2006). This number has increased significantly as awareness of the disorder has heightened. Researchers and health care professionals now have a better understanding of what causes erectile dysfunction and the effective medications

used to treat the condition. The first step in the treatment of erectile dysfunction is a physical examination. This is done to rule out disorders such as diabetes, high blood pressure, high cholesterol, kidney disease, alcoholism, or multiple sclerosis, which can cause erectile dysfunction. It is estimated that physical diseases or conditions are the cause of erectile dysfunction approximately 70 percent of the time (Express Scripts 2006). Prescription medications like Viagra (sildenafil), Levitra (vardenafil), and Cialis (tadalafil) are frequently prescribed.

### *Cholesterol*

Treatment of high cholesterol is aimed at lowering the low-density lipoproteins (LDL) or "bad cholesterol," lowering triglyceride levels, and increasing the high-density lipoproteins (HDL) or "good cholesterol." Decreasing total cholesterol by 10 percent can result in a 30 percent reduction in coronary heart disease incidence. For every 1 percent decrease in LDL (bad cholesterol levels), heart disease rates drop 2 percent. On the other hand, for every 1 percent decrease in HDL, there is a 2-3 percent increase in the risk of heart disease (Express Scripts, Inc. 2006).

It is estimated that 100 million American adults have total blood cholesterol values of 200 mg/dL and higher--desirable total cholesterol levels are below 200mg/dL (Express Scripts 2006). This desired level may be lower for those who have already had a heart attack or for those at risk for heart disease because they smoke, have hypertension, or have diabetes. There are about 13.2 million Americans with known coronary heart disease and about 8.7 million adults without diagnosed coronary heart disease. Interestingly, about 10 percent of adolescents aged 12 through 19 have total blood cholesterol levels of greater than 200mg/dL. This may be resultant from the increasing

rates of obesity among children and adolescents. There is compelling evidence that the atherosclerotic process begins in childhood and progresses slowly into adulthood (Express Scripts 2006).

Several drug classes are used to treat high cholesterol including:

- antilipemic agents such as niacin (Niacor, Nicolar, Nicotinic Acid)
- bile acid resins including cholestyramine powder for suspension (Prevalite, Questran, Questran Light), colesevelam (Welchol), and colestipol (Colestid)
- cholesterol absorption inhibitors such as ezetimibe (Zetia)
- fibric acid derivatives such as fenofibrate (Micronized, Antara, Lofibra, Tricor, Triglide) and gemfibrozil (Lopid)
- HMG-CoA reductase inhibitors such as atorvastatin (Lipitor), fluvastatin (Lescol), fluvastatin Extended-Release (Lescol XL), lovastatin (Mevacor), lovastatin extended release (Altacor, Altoprev), pravastatin (Pravachol), rosuvastatin (Crestor), and simvastatin (Zocor).

### *Antidepressants*

Depression is an illness that can cause noticeable changes in moods, perceptions of oneself, and environment. There are several types of depression, each varying in the number, severity and length of symptoms. Approximately 16 percent of Americans, 48 million, will have depression during their lifetime. In any given year, more than 14 million Americans, or more than 6 percent of adults, experience depression (GlaxoSmithKline 2007).

While depression can affect anyone, its effect may vary depending on age and gender. Women are almost twice as likely to become depressed as men. The higher risk may be due partly to hormonal changes brought on by puberty, menstruation, menopause, and pregnancy. Although their risk for depression is lower, men are more likely to go undiagnosed and less likely to seek help. They may show the typical symptoms of depression, but are more likely to be angry and hostile or to mask their condition with

alcohol or drug abuse. Suicide is an especially serious risk for men with depression, who are four times more likely than women to kill themselves. Older people may lose loved ones and have to adjust to living alone. They may become physically ill and unable to be as active as they once were. These changes can all contribute to depression. Loved ones may attribute the signs of depression to the normal results of aging, and many older people are reluctant to talk about their symptoms. As a result, older people may not receive treatment for their depression (GlaxoSmithKline 2007).

There are many different kinds of antidepressants, including: selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants (tricyclics), and monoamine oxidase inhibitors (MAOIs). SSRIs are a group of antidepressants that includes drugs such as escitalopram (Lexapro), citalopram (Celexa), fluoxetine (Prozac), paroxetine (Paxil) and sertraline (Zoloft). Tricyclics include: amitriptyline (Elavil), desipramine (Norpramin), imipramine (Tofranil) and nortriptyline (Aventyl, Pamelor). Newer generation antidepressants are more prescribed, and include venlafaxine (Effexor), nefazadone (Serzone), bupropion (Wellbutrin), mirtazapine (Remeron), and trazodone (Desyrel). Less used are the monoamine oxidase inhibitors (MAOIs) including: phenelzine (Nardil) and tranylcypromine (Parnate).

### **Conceptual Framework and Hypotheses**

The economic effects of advertising have been a source of considerable debate for many years. In a classic article in *Journal of Marketing*, Farris and Albion (1980) summarized two competing theoretical perspectives on advertising's effects on consumers. They referred to these views as the "Advertising = Market Power" and

“Advertising = Information” schools of thought. Among other impacts on consumers, the two schools make very different predictions for the impact of advertising on prices.

In general, the “Advertising = Market Power” and “Advertising = Information” schools provide opposing perspectives on the role of advertising in society (Mitra and Lynch 1995). The Market Power school focuses on advertising’s impact on firm profitability to the possible detriment of consumers, while the latter suggests that advertising plays a largely positive role by informing consumers. A detailed summary of each school’s view is provided below.

### ***Advertising = Market Power***

As summarized by Stanley Ornstein (1977, p.2), the “Advertising = Market Power” school states:

In short, advertising increases industrial concentration, raises barriers to entry, and, therefore, leads to collusion and market power. The result is restricted output, raised prices, inefficient allocation of resources, long-run excess profits of monopolists, and distortion in distribution of wealth.

Adherents to the Market Power view (e.g., Kaldor 1950; Bain 1956; Comanor and Wilson 1974; Schmalensee 1972) generally argue that advertising is so powerful that it shifts consumer preferences and tastes. By changing consumer preferences through advertising, the Market Power view argues that large advertising expenditures build competitive advantage by allowing for (artificial) product differentiation that is used to induce brand loyalty (Kaul and Wittink 1995). The increased brand loyalty helps to make consumers less price sensitive, and allows firms to charge high prices and make excessive profits at the expense of consumers (Farris and Albion 1980; Kanetkar, Weinberg and

Weiss 1992). The Market Power view asserts that advertising is used to build a barrier to entry and will increase industry concentration ratios (Taylor, Zou and Ozsomer 1995).

### ***Advertising = Information School***

The “Advertising = Information” school also has some noted adherents, including Stigler (1961), Telser (1964), Nelson (1974), and McAuliffe (1987). This view emphasizes the positive role that advertising plays in giving the consumer information on product features, prices, and quality, thereby enhancing consumer knowledge. The increased knowledge provided by advertising, according to this school, both reduces search costs and forces producers to improve the quality of their products. As asserted by Ferguson (1982), consumers benefit from the lowered cost of information about brand qualities and a lowering of the average price per unit of quality. With respect to industry concentration, the Information school predicts that advertising actually facilitates entry by allowing innovative products or product features to be effectively communicated to consumers (Taylor et al. 1995). By allowing new products to gain rapid acceptance if they have an advantage, firms are able to exploit economies of scale and offer lower prices. Thus, advertising’s impact on prices is to lower them, according to the Information school.

### ***Contingency Perspectives***

Building on the perspectives provided by the schools, various authors have argued that the impact of advertising on prices is dependent on a multitude of factors. For example, Popkowski-Leszczyc and Rao (1989) and Kaul and Wittink (1995) find that price advertising at the retail level increases price sensitivity, while non-price advertising

by manufacturers decreases price sensitivity. While these studies offer considerable empirical support, the focus of our study is on the impact of manufacturers' DTC advertising of prescription drugs on the price sensitivity of consumers. Since virtually none of the DTC advertising done by manufacturers to date is price-oriented, this perspective would appear to be supportive of the Information school.

Perhaps the most influential perspective aimed at resolving the competing predictions of the two schools is Robert Steiner's (1973) dual stage model. This model proposes that advertising has an influence on prices, but that this influence will vary by the level of the channel. Essentially, Steiner argues that manufacturer's advertising increases consumer demand, bringing more traffic to retail stores. While this allows manufacturers to charge higher prices to retailers, it also increases competition among retailers and lowers retailer margins. Thus, this reflects a situation in which consumer price sensitivity across brands is reduced in response to advertising, while retail margins decline. The dual stage model is not without critics. For example Ferguson (1982) asserts that the model is inconsistent with the economic theory of derived demand, in that elastic consumer demand will lead to elastic demand among retailers. Whether this criticism is accurate is not our concern, because our focus in this study is on prices to consumers, as opposed to retailers. Therefore, the variable of interest is consumer price sensitivity. The dual stage hypothesis argues that prices to consumers are not raised as a result of advertising and thus, on this level, is consistent with the Information school.

Additional factors have been proposed to mediate the advertising/price sensitivity relationship. For example, Kalra and Goodstein (1998) argue and find that the impact of advertising on consumer price sensitivity is dependent on the goals of the advertising, as

some advertising is aimed at product differentiation, while other advertising is aimed at narrowing perceived product differences. Another article, by Mitra and Lynch (1995), suggests that two variables, consideration set size and relative strength of preference, mediate the effect of advertising on consumer price sensitivity. Still another argument, put forward by Kanetkar, Weinberg and Weiss (1992), argues that the level of exposure in the context of television advertising can impact the effect of advertising on price sensitivity, with very high levels of exposure resulting in increased price sensitivity.

While each of the above perspectives may have some merit, none has yet been tested sufficiently across a variety of contexts, so as to be accepted as resolving the debate between the two schools of thought.

#### ***Hypotheses: Pharmaceutical Advertising and Price Sensitivity***

In general, the two schools make opposing assertions regarding the impact of advertising on the price sensitivity of consumers. The Information school would argue that advertising increases price sensitivity while the Market Power school, in contrast, asserts consumers become less price sensitive due to the market power accrued by the advertiser. As discussed previously, Steiner's dual stage model as well as the existing (albeit limited) empirical evidence from the pharmaceutical industry is more consistent with the Information school. Furthermore, previous empirical research suggests that DTC advertising should have an impact on the quantity demanded by consumers (Narayanan et al. 2004). Although not unanimous (see, for example, Toop et al. 2003) the majority of past research on DTC advertising in both the U.S. and New Zealand tends to support the notion that DTC advertising is beneficial to consumers through patient education and awareness as well as consumer empowerment (e.g., Calfee 2002; Hoek and Gendall

2002; Singh and Smith 2005; Weissman et al. 2003). While either school's predictions could be used to form a hypothesis, we choose to follow the Information school because the weight of the available empirical evidence lends support to the Advertising= Information school of thought with regard to the impact of pharmaceutical advertising.

Thus,

H1a: DTC advertising for a prescription drug increases the price sensitivity of consumers for that drug.

H1b: Journal advertising for a prescription drug increases the price sensitivity of consumers for that drug.

H1c: Detailing for a prescription drug increases the price sensitivity of consumers for that drug.

H1d: Sampling for a prescription drug increases the price sensitivity of consumers for that drug.

## **Methodology**

In order to conduct the analyses and test of hypotheses, national data sets for the previously mentioned therapy classes were utilized. Based on the previous discussion, we consider these therapy class markets as having differentiated products. Within each group of drugs used to treat the various disorders, there are several different classes. Thus, all of these drugs can be considered differentiated competitors within several different classes of the same overall market.

Data on sales, promotional activities, and other features of these pharmaceutical markets were provided by IMS, Inc. IMS is the leading provider of pharmaceutical data to the industry. The IMS data set includes sales by wholesalers to drug stores, mass

merchandisers, propriety stores, and hospitals. These sources account for the vast majority of all drugs sold in the therapy classes under review. This data set has class totals and totals for each product in class (both branded and generic). In studying the pharmaceutical market, it is natural to focus on the competitive effects of DTC advertising on branded pharmaceuticals. Therefore, our analysis will concentrate on brand name and branded generics in each therapy class that used promotional techniques (i.e., DTC, journal advertising, detailing, and/or sampling). The unit of analysis is a particular drug engaged in a particular promotional activity as described in Figure 1. Data are pooled over the years 2001-2005. Following previous research (e.g., Rizzo 1999), we estimated a fixed-effects model with drug-specific dummy variables.

Specifically, to examine the effects of DTC advertising, journal advertising (JRN), contact detailing (CON), and retail value of samples (RVOS) on price sensitivity we estimate the model

$$\ln q_{it} = \beta_{1i} + \beta_2 \ln p_{it} + \beta_3 jrn_{it}(\ln p_{it}) + \beta_4 JRN_{it}(\ln p_{it}) + \beta_5 con_{it}(\ln p_{it}) + \beta_6 CON_{it}(\ln p_{it}) + \beta_7 rvos_{it}(\ln p_{it}) + \beta_8 RVOS_{it}(\ln p_{it}) + \beta_9 dtc_{it}(\ln p_{it}) + \beta_{10} DTC_{it}(\ln p_{it}) + \beta_{11} Exper_{it}(\ln p_{it}) + \beta_{12} \ln cp_i + \beta_{13} Exper_{it} + \beta_{14} Exper_{it}^2 + e_{it} \quad [1]$$

where  $q_{it}$  is the quantity sold for brand  $i$  in time  $t$  (in 000s),  $p_{it}$  is the price of brand  $i$  at time  $t$  (in dollars per unit), the lower case advertising variables represent the flow or current period advertising (in \$000's), the upper case advertising variables represent the current stock of advertising up to time  $t$  (in \$000's),  $Exper_{it}$  is the number of months that drug  $i$  was on the market prior to time  $t$ , and  $cp_i$  is a weighted average of competitors' prices at time  $t$ . We take logs of both price and quantity so that  $\beta_1$  represents the price sensitivity and  $\beta_3 - \beta_{11}$  represent the incremental effects of advertising and length of time

on the market on price sensitivity. We do not take logs of the advertising variables since the amounts equal zero for many observations in our data. We expect  $\beta_2 < 0$  since this is the price sensitivity without any advertising. Positive values for  $\beta_3$  through  $\beta_{10}$  indicate that increases in advertising reduce price sensitivity, whereas negative values indicate that increases in advertising increase price sensitivity. We expect  $\beta_{11} < 0$  as products that have been on the market longer develop customer loyalty, thereby reducing price sensitivity.

Similar to prior research (Lilien, Kotler, and Moorthy 1992), we create the initial stock variable for each advertising category based on the advertising for the first period in our sample. Since we have monthly data, we create the DTC stock, for example, as

$$DTC_{i,Jan.01}^B = \sum \rho^t dtc_{i,Jan.01}, \quad t = 0 \text{ to } \min(12, T - 1) \quad [2]$$

where  $T$  is the number of months the drug was on the market prior to January 2001.

That is, we calculate the initial stock to be a geometric sum of the advertising for January 2001, using either the smaller of 12 months or the number of months the product has been on the market. Once the initial stock is calculated, the stock for each subsequent period is calculated as

$$DTC_{it}^B = \rho DTC_{i,t-1}^B + dtc_{i,t-1}, \quad [3]$$

where  $0 < \rho < 1$  and  $jrn_{i,t-1}$  is the flow of journal advertising during the previous period deflated by the Consumer Price Index. We calculate the stock for each of the other advertising categories (JRN, CON, and RVOS) in the same manner and based on previous literature chose  $\rho = 0.7$  (Lilien et al 1992).

Since we have panel data, we estimate a fixed effects model with brand-specific dummy variables. Thus, in equation [1], we specify the intercept as  $\beta_i$  to allow the

intercept to vary by brand. The fixed effects model allows us to control for brand-specific effects such as the degree of generic competition, and is relatively simple to implement in an unbalanced panel such as this. We estimate the model using OLS, with dummy variables for each brand. In each of the five drug classes that we examine, an F-test indicates that the intercepts do differ across brands.

## **Results**

The adjusted R-squared for the proposed models range from is 0.9890 to .9979 as depicted in Table 1-5. This indicates that all of the models do an excellent job explaining the variation in sales.

H1a posited that DTC advertising expenditures for a prescription drug would increase the price sensitivity of consumers for the advertised drug. The results for the interaction between DTC advertising and price are mixed, but are not significantly different from zero. The lone exception is the overactive bladder class, where our results show a significant decrease in price sensitivity. However, beyond H1b, the hypotheses in general are not supported; nevertheless the majority of the evidence suggests that pharmaceutical marketing activities, particularly DTC advertising, do not significantly impact price sensitivity of consumers.

All drugs have very price sensitive demand and all are significant and greater than 1 (in absolute value). In particular, cholesterol and erectile dysfunction drugs seem to be especially price sensitive. In the case erectile dysfunction, this result may be due to reimbursement policies, since these drugs may not be covered by insurance as a result of being classified as “lifestyle” drugs.

With the possible exception of product sampling, there is not much evidence that promotional activities of any type reduce price sensitivity (i.e. generates a positive and significant coefficient in the table). Specifically, product sampling reduces price sensitivity for antidepressants, insomnia/sleep disorders, and overactive bladder, but increases for cholesterol. This finding may result from the drug efficacy being readily apparent within these particular therapeutic classes, particularly sleep and overactive bladder.

By category, journal advertising significantly increased price sensitivity for antidepressants and overactive bladder and was in the hypothesized direction for erectile dysfunction and cholesterol, thus lending support for H1b. Detailing decreases price sensitivity for cholesterol drugs and overactive bladder, a finding that is not entirely consistent with Narayanan et al (2004). The interaction between experience and price is positive and significant across all therapeutic classes. It appears that in these markets the product price and length of time on the market are the real driving factors. This finding is consistent with research by Bhattacharya and Vogt (2003) who proposed a pattern of increasing prices and decreasing promotional activities over a drug's life cycle. However, this differs from other previous research by Rizzo, whose results suggest that detailing was important but experience did not have an impact. It should be noted that he looked only at antihypertensive drugs, which have more drugs on the market, many of which have been on the market a long time and thus are in the mature stage of the product life cycle. Therefore, the difference we find can be explained by Rizzo's use of a more mature market. Many of the drugs in our sample (especially erectile dysfunction and overactive bladder) are much newer markets. Thus, it may be that in several years time

our results would look similar. That is, once the market is mature you've got only the established brands left and so advertising matters more. Furthermore, generic entry might require a manufacture to advertise more in order to promote the efficacy and safety of a new compound, and increase adoption. However, early in the market there is greater price competition and competition among brands to promote adoption and increase market share.

We would expect that competitor pricing would have a positive influence on sales; however, this was found to be the case with cholesterol only. Therefore, it appears there is not a great deal of substitution among products for these particular drugs. This is consistent with Rizzo (1999), who did not find much substitution among products. In other words, patients take the drug prescribed and stick with it rather than switching. This could be the result of the consumer's health plan formulary restrictions, which limit choice through their reimbursement policies.

Experience increased sales for erectile dysfunction and cholesterol, but decreased sales in antidepressants and overactive bladder, and is insignificant for the other drugs. However, experience squared is negative and significant as expected; thus there are diminishing returns to time on the market. This is also consistent with Rizzo's prior work. On the one hand, experience could increase sales as the product develops brand loyalty, but it could also decrease sales as new (and better) substitutes become available.

**TABLE 1**  
**Parameter Estimates of the Category Sales**  
**Model: Sleep (Insomnia)**

<b>Parameters</b>	<b>Estimate</b>	<b>Standard Error</b>
Price	-2.0686**	.66011
JRN stock x price	.00029**	.00009
CON stock x price	-.00008	.00005
RVOS stock x price	.00032**	.00005
DTC stock x price	.00001	.000005
Experience x price	.01144**	.00263
Competitors' price x price	-1.2191	.84072
Experience	.00751	.00573
Experience <sup>2</sup>	-.00004**	.00001
Adjusted R <sup>2</sup>	.9947	
F-test	5011.91	
# Observations	638	

\*Significance at the 95% level

\*\*Significance at the 99% level

**TABLE 2**  
**Parameter Estimates of the Category Sales**  
**Model: Erectile Dysfunction**

<b>Parameters</b>	<b>Estimate</b>	<b>Standard Error</b>
Price	-4.9353**	.69323
JRN stock x price	-.00004	.00003
CON stock x price	-.000001	.00001
RVOS stock x price	6.756E-8	.000002
DTC stock x price	.000003	.000002
Experience x price	.00993*	.00484
Competitors' price x price	-.12559	.19516
Experience	.02600*	.01312
Experience <sup>2</sup>	-.00039**	.00004
Adjusted R <sup>2</sup>	.9957	
F-test	4831.13	
# Observations	331	

\*Significance at the 95% level

\*\*Significance at the 99% level

**TABLE 3**  
**Parameter Estimates of the Category Sales**  
**Model: Overactive Bladder**

Parameters	Estimate	Standard Error
Price	-3.7746**	.61927
JRN stock x price	-.00037**	.00009
CON stock x price	.00002*	.00001
RVOS stock x price	.00003**	.00001
DTC stock x price	.000013*	_.000006
Experience x price	.01635**	.00278
Competitors' price x price	1.0568**	.31531
Experience	-.00701*	.00292
Experience <sup>2</sup>	-.00006**	.00001
Adjusted R <sup>2</sup>	.9979	
F-test	9861.11	
# Observations	408	

\*Significance at the 95% level

\*\*Significance at the 99% level

**TABLE 4**  
**Parameter Estimates of the Category Sales**  
**Model: Cholesterol**

Parameters	Estimate	Standard Error
Price	-5.2249**	.81938
JRN stock x price	-.00004	.00005
CON stock x price	.00013**	.00001
RVOS stock x price	-.00001**	_.000003
DTC stock x price	-.000003	_.000005
Experience x price	.02281**	.00507
Competitors' price x price	-4.7195**	1.38747
Experience	.08105*	.00575
Experience <sup>2</sup>	-.00039**	.00003
Adjusted R <sup>2</sup>	.9938	
F-test	4129.69	
# Observations	545	

\*Significance at the 95% level

\*\*Significance at the 99% level

**TABLE 5**  
**Parameter Estimates of the Category Sales**  
**Model: Antidepressants**

Parameters	Estimate	Standard Error
Price	-1.6944**	.61091
JRN stock x price	-.00021*	.00009
CON stock x price	.00001	.00002
RVOS stock x price	.00003**	.00001
DTC stock x price	-.00001	.00001
Experience x price	.01985**	.00422
Competitors' price x price	-.99956	1.59645
Experience	-.03968**	.00706
Experience <sup>2</sup>	-.00004	-.000025
Adjusted R <sup>2</sup>	.9890	
F-test	2891.68	
# Observations	865	

\*Significance at the 95% level

\*\*Significance at the 99% level

### Discussion and Policy Implications

The direct results of promotional activities, particularly DTC advertising on price sensitivity vary widely and generally show no significant effect for these classes of drugs. Several possible explanations for the results found with regard to the stated hypotheses are feasible. For example, as suggested by Gonul and colleagues (2001), consumers might regard a higher price as a signal of quality, a price premium justified by improved safety and efficacy of the drug, and therefore request the more expensive drug when drug safety and efficacy is of prime consideration. Alternatively, a patient may believe that a drug works in a particular case based on prior experience, and there would

be no reason to deviate from it. In these situations, price would be less of a concern. As further noted by prior research, patients might consider the higher price as a credible signal of quality. Indeed, prior research on the effects of advertising as a signal of quality for experience and credence goods (which describes prescriptions drugs) shows that the incidence of advertising can also be perceived as an indication of higher quality because of the costs and effort associated with its development (Nelson 1974).

The finding that advertising did not have a significant impact on prices suggests that DTC advertising is not a contributor to increasing health care costs. Therefore, this finding, combined with the best evidence from prior studies suggests that restricting or banning DTC advertising would not lead to any significant decline in health care costs. Furthermore, the awareness and treatment of some diseases such as depression and cholesterol might actually decline.

While our finding of no significant effect is not entirely consistent with the predictions of either the Market Power or Information school, advocates of the Information school are more likely to argue for DTC advertising's positive impact on consumers based on these results. While the Market Power school primarily emphasizes high prices, barriers to entry, and profits, the Information school focuses more on increased competition (not just price based competition) and the information provided to consumers. In light of recent survey evidence that suggests that consumers believe they are better informed about pharmaceutical products as a result of DTC advertising, the Information school's position would appear to be more tenable (e.g., Huh and Becker 2005; Macias and Lewis 2005; Singh and Smith 2005; Weissman et al. 2003).

For managers of pharmaceutical companies, our results suggest that, at least in categories where a number of differentiated products that fulfill the same medical need are on the market, heavy DTC advertising is not likely to be effective in allowing the company to increase prices. For instance, in the erectile dysfunction and cholesterol products categories, our data would suggest that increasing the price to substantially above that of competitors is likely to lead some consumers to defect to competing brands.

### **Conclusions**

This study set out to examine the competing predictions of the Advertising = Information vs. Advertising = Market Power schools of thought in the context of DTC prescription drug advertising. Notably, this is the first known study to directly estimate the effects of DTC advertising and other marketing mix variables on the price sensitivity of demand in this industry. These results suggest that the price elasticity of demand in the pharmaceutical drug markets examined is not dependent on promotional activities of the firm. Because these therapy classes exhibit a great deal of variation and many of the findings are therapy class specific, it is difficult to report sweeping conclusions. Nevertheless, based on the review of these five therapeutic classes, the following generalization can be made: price is not found to increase as a direct result of DTC advertising. Consequently, as the Information school of advertising would suggest, DTC advertising increases consumer awareness of treatment options available in the pharmaceutical industry without diminishing competition.

Consistent with the Information school these results would suggest that DTC advertising plays a positive role by informing consumers about the benefits of new and existing drugs. As such, pharmaceutical promotional activities, including DTC

advertising, appear to help medical professionals and consumers become more knowledgeable about their disease and the available treatments. Subsequently, better informed consumers should be able to take a more active role in the management of their disease, communicate more effectively with their doctors, be more prone to understand usage of the pharmaceuticals and, hence, use them more effectively (Calfée 2002).

In addition, other marketing mix variables typically employed by pharmaceutical firms such as detailing (personal selling), sampling, and journal advertising were analyzed in a similar manner to determine their impact on consumer price sensitivity. Of these, product sampling was the only variable to significantly impact price sensitivity across several therapy classes.

Future research should investigate additional therapy classes to validate these results and determine if our findings are generalizable beyond these five therapeutic classes. Moreover, testing and validating Steiner's (1973) dual stage model with pharmaceutical pricing data from both the wholesale and retail level would be an important contribution to this line of research which thus far has not been comprehensively investigated.

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**Figure 1 Drugs in Sample that used Promotional Techniques**

<i>Sleep Disorder</i>				
<b>Brand Name</b>	<b>Date Introduced</b>	<b>Class</b>	<b>Manufacturer</b>	<b>Promotional Mix</b>
Ambien	March 1993	NON-BARB, OTH	Sanofi Aventis	JRL, CON, RVOS, DTC
Ambien CR	September 2005	NON-BARB, OTH	Sanofi Aventis	JRL, CON, RVOS, DTC
Ambien Pak	April 2004	NON-BARB, OTH	Sanofi Aventis	JRL, CON, RVOS
Doral	December 1989	NON-BARB, OTH	Medpointe Co.	CON
Halcion	December 1982	NON-BARB, OTH	Pfizer	CON
Lunesta	March 2005	NON-BARB, OTH	Sepracor Inc.	JRL, CON, RVOS, DTC
Restoril	May 1981	NON-BARB, OTH	Mallinckrodt	JRL, CON, RVOS
Sonata	September 1999	NON-BARB, OTH	King Pharm	JRL, CON, RVOS
Rozerem	August 2005	MELATONIN AGONISTS	Takeda Pharm USA	JRL, CON, RVOS
Somnote	February 2000	NON-BARB CHLORAL, ETC	Breckenridge	JRL, CON, RVOS

<i>Overactive Bladder</i>				
<b>Brand Name</b>	<b>Date Introduced</b>	<b>Class</b>	<b>Manufacturer</b>	<b>Promotional Mix</b>
Detrol	March 1998	UT ANTISPASMODICS	Pfizer	JRL, CON, RVOS, DTC
Detrol LA	January 2001	UT ANTISPASMODICS	Pfizer	JRL, CON, RVOS, DTC
Ditropan	October 1975	UT ANTISPASMODICS	McNeil Pharm	JRL, CON, RVOS
Ditropan XL	January 1999	UT ANTISPASMODICS	McNeil Pharm	JRL, CON, RVOS, DTC
Enablex	January 2005	UT ANTISPASMODICS	Novartis Rx	JRL, CON, RVOS
Flavoxate HCL - GLB	October 2003	UT ANTISPASMODICS	Global Pharm Corp	JRL
Flavoxate HCL - PDK	2000	UT ANTISPASMODICS	Paddock Labs Inc	JRL
Oxytrol	April 2003	UT ANTISPASMODICS	Watson Labs	JRL, CON, RVOS, DTC
Sanctura	August 2004	UT ANTISPASMODICS	Esprit Pharm Inc.	JRL, CON, RVOS, DTC
Urispas	November 1970	UT ANTISPASMODICS	McNeil Pharm	DTC
Vesicare	December 2005	UT ANTISPASMODICS	Astellas Pharma US	CON, RVOS, DTC

<i>Erectile Dysfunction</i>				
<b>Brand Name</b>	<b>Date Introduced</b>	<b>Class</b>	<b>Manufacturer</b>	<b>Promotional Mix</b>
Caverject	August 1995	SEXUAL FUNCTION DISORDER	Pfizer	JRL, CON, RVOS
Caverject Impulse	July 2002	SEXUAL FUNCTION DISORDER	Pfizer	JRL, CON, RVOS
Cialis	November 2003	SEXUAL FUNCTION DISORDER	Lilly	JRL, CON, RVOS, DTC
Edex	August 1997	SEXUAL FUNCTION DISORDER	Schwarz Pharma	JRL, CON, RVOS
Levitra	August 2003	SEXUAL FUNCTION DISORDER	Schering	JRL, CON, RVOS, DTC
Muse	December 1996	SEXUAL FUNCTION DISORDER	Vivus, Inc	CON, RVOS, DTC
Viagra	April 1998	SEXUAL FUNCTION DISORDER	Pfizer	JRL, CON, RVOS, DTC

<i>Cholesterol</i>				
<b>Brand Name</b>	<b>Date Introduced</b>	<b>Class</b>	<b>Manufacturer</b>	<b>Promotional Mix</b>
Altoprev	July 2002	HMG-COA REDUCTASE INHIB	Sciele Pharma	CON, RVOS, DTC
Baycol	December 1997	HMG-COA REDUCTASE INHIB	Bayer Pharm	JRL, CON, RVOS, DTC
Crestor	August 2003	HMG-COA REDUCTASE INHIB	Astrazeneca	JRL, CON, RVOS, DTC
Lescol	April 1994	HMG-COA REDUCTASE INHIB	Novartis Rx	JRL, CON, RVOS, DTC
Lescol XL	November 2000	HMG-COA REDUCTASE INHIB	Novartis Rx	JRL, CON, RVOS, DTC
Lipitor	January 1997	HMG-COA REDUCTASE INHIB	Pfizer	JRL, CON, RVOS, DTC
Mevacor	September 1987	HMG-COA REDUCTASE INHIB	Merck & Company	CON, RVOS
Pravachol	November 1991	HMG-COA REDUCTASE INHIB	Bristol Myers Squibb	JRL, CON, RVOS, DTC
Zocor	January 1992	HMG-COA REDUCTASE INHIB	Merck & Company	JRL, CON, RVOS, DTC
Advicor	January 2002	CHOLESTEROL RED COMB	Kos Pharm Inc	JRL, CON, RVOS
Vytorin	July 2004	CHOLESTEROL RED COMB	Merck/Schering Plough	JRL, CON, RVOS, DTC
Zetia	November 2002	CHOLESTEROL ABSORPTION I	Merck/Schering Plough	JRL, CON, RVOS, DTC

<i>Antidepressants</i>				
<b>Brand Name</b>	<b>Date Introduced</b>	<b>Class</b>	<b>Manufacturer</b>	<b>Promotional Mix</b>
Celexa	July 1998	SSRI	Forest Pharm	JRL, CON, RVOS, DTC
Lexapro	August 2002	SSRI	Forest Pharm	JRL, CON, RVOS
Luvox	December 1994	SSRI	Solvay Pharm	JRL, CON, RVOS
Paxil	January 1993	SSRI	Glaxo Pharm	JRL, CON, RVOS, DTC
Paxil CR	April 2002	SSRI	Glaxo Pharm	JRL, CON, RVOS, DTC
Pexeva	January 2004	SSRI	JDS Pharma	JRL, CON, RVOS
Prozac	January 1988	SSRI	Lilly	JRL, CON, RVOS, DTC
Sarafem	August 2000	SSRI	Warner-Chilcott	JRL, CON, RVOS, DTC
Zoloft	February 1992	SSRI	Pfizer	JRL, CON, RVOS, DTC
Cymbalta	August 2004	SNRI	Lilly	JRL, CON, RVOS
Effexor	March 1994	SNRI	Wyeth-Ayerst	JRL, CON, RVOS
Effexor XR	October 1997	SNRI	Wyeth-Ayerst	JRL, CON, RVOS, DTC
Bupropion SR	February 2004	NEWER GENERATION ANTIDEP	Teva Pharm	JRL
Desyrel	March 1982	NEWER GENERATION ANTIDEP	Bristol Myers Squibb	JRL, CON, RVOS
Serzone	January 1995	NEWER GENERATION ANTIDEP	Bristol Myers Squibb	JRL, CON, RVOS
Wellbutrin	July 1989	NEWER GENERATION ANTIDEP	Glaxo Pharm	JRL, CON, RVOS, DTC
Wellbutrin SR	November 1996	NEWER GENERATION ANTIDEP	Glaxo Pharm	JRL, CON, RVOS, DTC
Wellbutrin XL	September 2003	NEWER GENERATION ANTIDEP	Glaxo Pharm	JRL, CON, RVOS, DTC