

# Direct to Consumer Advertising and Prescription Choice \*

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## Abstract

This paper examines the effects of direct-to-consumer advertising (DTCA) of prescription drugs on doctor choice of drug brands. Using antihistamines as an example, we show that DTCA has little effect on the choice of brand despite the massive DTCA expenditure incurred in this class. In contrast, directed-to-physician advertising (i.e., detailing and medical journal advertising) has positive, significant, and long-lasting effects on the prescription choice of allergy drugs. These results, together with the market expanding results shown in Iizuka and Jin (forthcoming), suggest that DTCA is effective in increasing the aggregate demand per therapeutic class but does not affect doctor choice of prescription within a class. Therefore, DTCA may be viewed as a public good for all drugs in the same class.

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# 1 Introduction

Traditionally, prescription drugs were marketed towards doctors, and direct-to-consumer advertising (DTCA) was limited. This is partly because DTCA on TV was prohibitively expensive: prior to 1997, any DTCA that contained both brand name and medical claims must disclose a “brief summary” of drug effectiveness, side effects, and contraindications. As a result, TV ads with these details were long and costly. In August 1997, the Food and Drug Administration (FDA) clarified that pharmaceutical firms can advertise brand name and indications on TV without a “brief summary.”<sup>1</sup> Following the clarification, DTCA expenditures increased substantially from \$800 million in 1996 to \$2.5 billion in 2000.

The dramatic increase in DTCA has created an intensive debate on the effects of DTCA. Proponents of DTCA emphasize the educational value of DTCA: many chronic diseases are under-diagnosed and under-treated, and DTCA can inform potential patients of the existence of such medical treatment. Opponents argue, however, DTCA may mislead patients into demanding heavily-advertised drugs, leading to inappropriate drug use and unnecessary purchase of expensive drugs.<sup>2</sup>

To understand the effects of DTCA on pharmaceutical demand, it is useful to consider the potential impact of DTCA in two steps. In the first step, DTCA may inform the public of the existence of the medication and thereby bring potential patients to the doctor. If true, DTCA expands the prescription drug market. The second possibility is that, after the patient visits the doctor, DTCA affects the doctor’s prescription choice. For example, a patient who watched a TV commercial of a prescription drug may persuade the doctor to prescribe the medicine, even if it is not the appropriate one. Clearly, proponents of DTCA stress the potential benefit from the first step, and opponents of DTCA are concerned about the harm generated by the second step.

Our previous study (Iizuka and Jin, forthcoming) examined the first step (i.e., the market-

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<sup>1</sup>DTCA still needs to include a “major statement” of the most important risks and refer consumers to other sources for more comprehensive information.

<sup>2</sup>Both sides of the debate are well documented. See Holmer (1999) and Holmer (2002) for a summary of the proponent’s position, and Hollon (1999) and Wolfe (2002) for a summary of the opponent’s position. *Health Affairs* (February 26, 2003, issue) also include several articles that discuss the role of DTCA in the prescription drug market.

expanding effect of DTCA). Specifically, we combined 1994 – 2000 drug-specific DTCA data with the 1995 – 2000 National Ambulatory Medical Care Surveys (NAMCS) and examined the effect of DTCA on doctor visits across 151 drug classes, where a drug class was defined by the four-digit National Drug Code (NDC). Consistent with the proponents' claim, we found that higher DTCA expenditures were associated with increased doctor visits, especially after the FDA clarified DTCA rules in August 1997. After 1997, every \$28 increase in DTCA led to one drug visit within 12 months.

This paper contributes to the debate by examining the second question, i.e., whether DTCA affects physician prescription choice once the patient visits a doctor. We focus on the prescription of non-sedating antihistamines, one of the most heavily DTC-advertised classes.

Combining monthly advertising data and individual-level prescription data from NAMCS, we estimate a discrete choice model. The prescription data cover July 1997 to December 2001. Given that advertising expenditures are likely to last more than one month, we allow advertising to depreciate over time and estimate separate depreciation rates for four types of promotional expenditures – detailing, medical journal advertising, sampling and DTCA (the first three target doctors). We find that DTCA has a positive but not statistically significant effect on specific brand choices. In contrast, advertising directed to doctors (in the form of detailing and medical journal advertising) has a much larger and significant effect on the choice of prescription. These results suggest that the primary role of DTCA is to bring potential patients to the doctor but not to affect the choice of prescription. In addition, we find that promotional expenditures targeted to doctors last longer, while DTCA depreciates 86.4% in just one month.

This paper contributes to a small, but growing literature that analyzes the demand effects of DTCA.<sup>3</sup> Most of the existing evidence is based on aggregate data. Calfee et al. (2002) estimated a monthly time-series regression of total Statin drug prescriptions on advertising expenditures during 1995 and 2000. They found that advertising had no statistically significant effect on new Statin prescriptions or renewals, but television advertising increased the proportion of cholesterol patients who had been successfully treated. Rosenthal et al. (2003) investigated

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<sup>3</sup>Even a smaller collection of literature exists on the supply side of DTCA. Rosenthal et al. (2002) analyzed the industrywide trends for DTCA and found that DTCA is highly concentrated on a subgroup of products and the spending fluctuates over time. Iizuka (2004) examined the determinants of DTCA and found that DTCA tends to concentrate in classes that involve fewer competitors. He also found that drugs that are new, of high quality, and for under-treated diseases are more frequently advertised.

the effects of DTCA and detailing on the aggregate sales of prescription drugs, using monthly data for five therapeutic classes between August 1996 and December 1999. They find that DTCA has a significant effect on total class sales but does not have any significant impact on market shares within each class. As noted before, Iizuka and Jin (forthcoming) combined monthly DTCA data with NAMCS data and found that DTCA increases patient's visit to the doctor office.

A working paper by Wosinska (2002) is probably the closest to the current paper. Using individual claim data from Blue Cross of California between 1996 and 1999, she examined the impact of DTCA on the prescriptions of cholesterol-reducing drugs. She found that DTCA has a small but significant impact on the demand of cholesterol drugs if the brand is on the formulary. Aside from examining a different therapeutic class, this paper is different from Wosinska's in two ways: first, we use national representative data and control for various patient and doctor characteristics, which is difficult to achieve by using claim data from a single insurer. More importantly, we allow four types of promotional expenditures to depreciate over time and estimate a separate depreciation rate for each. In doing so, we are able to distinguish the instant impact of advertising from the effect that depreciates over time.

Finally, we recognize that the demand effect of direct-to-doctor advertising (i.e., detailing promotion) has been examined in earlier literature.<sup>4</sup> However, no paper in this literature has looked at the effect of advertising directed to consumers. To be sure, this is mainly because DTCA increased in significance only recently, after the FDA clarification in 1997.

The rest of the paper is organized as follows. Section 2 describes the data and Section 3 sets up the empirical model. Estimation results are reported in Section 4. In Section 5, we conduct a supply side analysis that complements the demand side findings. Our conclusion is offered in Section 6.

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<sup>4</sup>Hurwitz and Caves (1988) looked at a cross-section of 56 off-patent drugs and found that detailing promotion has a positive effect on the market shares between branded and generic drugs. Rizzo (1999) looked at the demand for anti-hypertension drugs for 1988–1993 and found that detailing promotion lowers price sensitivity. Gonul et al. (2001) showed that detailing and free samples affect physician prescription behavior for an undisclosed therapeutic class. Azoulay (2002) found that, in addition to detailing promotion, scientific evidence from medical literature affected the diffusion pattern of antiulcer drugs.

## 2 Data

### 2.1 Data Source

We combine individual-level data from the National Ambulatory Medicare Care Survey (NAMCS) and brand-level advertising data for non-sedating antihistamines from TNS Media Intelligence/Competitive Media Reporting (CMR) and IMS Health. Each year, NAMCS provides a national representative sample of individual visits to office-based physicians. For each office visit, it includes the month of visit along with detailed information on patient demographics, insurance status, physician specialty, time spent with the patient, diagnoses, dispositions, and prescription choices, if any.<sup>5</sup>

DTCA expenditure data is obtained from CMR. CMR monitors advertising outlays in units and dollars in several different media-including network TV, cable TV, newspapers and magazines. DTCA dollars reflect the net costs of buying such elements as television time and print space.<sup>6</sup> They were reported monthly from 1994 to 2001.

In addition to DTCA, pharmaceutical firms promote their drugs via professional channels targeting physicians. This includes detailing, medical journal advertising, and free samples. We obtain these data from IMS Health. Specifically, detailing expenditures are estimated based on the time that pharmaceutical firms' salespersons spent in doctor offices detailing their brand name drugs. The value of free samples are based on their retail values. We obtain monthly data for these direct-to-doctor advertising between July 1997 and December 2001 and annual data between 1994 to 1997. In the empirical analysis, we focus on the visits that occurred between July 1997 and December 2001 but use advertising data between January 1994 and June 1997 to construct advertising stock (see Section 3 for more detail).

Since NAMCS does not collect information on prescription copays, we obtain monthly wholesale price data for allergy drugs from IMS Health. We compute patient-day price based on the sales dollars and quantity sold for each drug. We note that the wholesale price is not ideal since this may poorly correlate with the patient's copay, but this is the best we can do for

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<sup>5</sup>See Cherry. et al 2001 for more detailed description of NAMCS.

<sup>6</sup>But they may not reflect the discounts typically given to large buyers who bundle various products' ads with one advertising agency.

a national representative sample. Aware of this caveat, we use the wholesale price as a proxy control and do not interpret its impact as price elasticity. The price data covers the same period as the professional advertising data, i.e., between July 1997 and December 2001. All data are matched by drug names and by the month of visit.

## 2.2 Non-sedating Antihistamines

The drug class we examine is the non-sedating antihistamines. Non-sedating antihistamines have gained popularity because it relieves the symptoms of seasonal allergy without causing drowsiness. In this paper, we focus our attention to the second-generation non-sedating antihistamines, i.e., Claritin, Zyrtec, and Allegra.<sup>7</sup> Neither generic nor over-the-counter (OTC) versions of these drugs were available during the time period of our data. Claritin switched to the OTC market at the end of December 2002, and Clarinex entered the prescription drug market in January 2002. Prescriptions of non-sedating antihistamines have increased dramatically between 1997 and 2001 (see Figure 1). Among the three drugs, Claritin has clearly dominated the therapeutic class. More recently, however, newer drugs, especially Allegra, have gained market shares. In NAMCS, we observe a total of 2,543 patient-visits between July 1997 and 2001, which resulted in the prescription of one of the three allergy drugs.<sup>8</sup>

Non-sedating antihistamine is one of the most heavily advertised classes using direct-to-consumer channels. However, the use of DTCA differs somewhat among the three drugs, which allows us to identify the effects of advertising on the choice of prescription drugs. While Claritin is clearly the leader in DTCA expenditures in this class (see Figure 2), this does not appear to have helped increase or maintain its market share: Claritin's market share has declined since 1997 regardless of the large amount of DTCA (see Figure 3). This suggests that DTCA may not have a strong impact on the physician's prescription choice in this market. Table 1 reports descriptive statistics.

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<sup>7</sup>There were two other prescription drugs in this class. Seldane was approved in 1985 but withdrawn in 1997. Hismanal, was introduced to the market in January 1998, but withdrawn on June 21, 1999. Very few observations in our data set (Jul. 1997 to Dec. 2001) result in a prescription of Seldane or Hismanal. As a result, we ignore Seldane and Hismanal from the choice set and exclude all the NAMCS patients that received any Seldane or Hismanal prescription.

<sup>8</sup>On rare occasions, multiple allergy drugs are prescribed in one visit. We dropped these observations from our sample.

### 3 The Model

The main interest of this paper is to examine the effect of DTCA on the choice of prescription drugs, i.e., brand switching effects. If a physician maintains her authority to choose a drug, DTCA may encourage people “to seek medical help,” but may not affect brand choice. On the other hand, if DTCA enables patients to “persuade” the physician to prescribe what they want, DTCA may have a significant positive effect on brand choice. Of course, opponents of DTCA are concerned about the latter as a consequence of the surge in DTCA.

To distinguish these two arguments, we estimate demand for prescription drugs using a multinomial logit model. Specifically, we assume that physician  $k$  chooses a drug  $j$  for patient  $i$  at time  $t$ , among  $J$  alternatives, which maximizes the objective function represented by  $V_{ijkt}$ :

$$\max_{j \in J} V_{ijkt} = f(A_{jt}, X_{jt}, P_{jt}, Y_{it}, H_{kt})$$

where,  $A_{jt}$  is a vector of promotional expenditures for drug  $j$  at  $t$  whose definition we describe below,  $X_{jt}$  is a vector of product characteristics of drug  $j$  at  $t$ ,  $P_{jt}$  is the whole price of drug  $j$  at  $t$ ,  $Y_{it}$  is a vector of patient  $i$ 's attributes at  $t$ , and  $H_{kt}$  is a vector of physician  $k$ 's specialty at time  $t$ . Assuming the error term is distributed as Type I extreme value, we estimate the model by multinomial logit.

We distinguish four types of promotional expenditures in  $A_{jt}$ : DTCA, detailing promotion, professional journal advertising, and free samples. This allows us to separately examine the impact of different promotional devices available for pharmaceutical firms. Because the effect of advertising is expected to last more than one month but depreciate over time, for each type of advertising, we model  $A_{jt}$  as the advertising stock for drug  $j$  as of time  $t$ :

$$A_{jt} = F_{jt} + \delta \cdot A_{jt-1}$$

where  $F_{jt}$  is the *flow* of advertising (e.g., DTCA) at time  $t$ , and  $A_{jt-1}$  is advertising stock in the previous period. We assume advertising stock depreciates by a constant rate  $\delta$  per month and estimate  $\delta$  for each type of advertising variable. To construct advertising stock, we need data prior to July 1997. For DTCA, we have actual monthly DTCA expenditure data

between January 1994 and June 1997. For professional advertising variables, however, we only have annual data between 1994 and 1997 (note that we have monthly data after July 1997). Therefore, we allocate annual advertising expenditures to each month using the observed pattern of advertising spending between 1998 and 2001.<sup>9</sup> This allows us to accommodate the seasonal nature of the disease and corresponding advertising expenditures. In the estimation, we have also tried  $\log(A_{jt})$  or the quadratic term of  $A_{jt}$  instead of linear  $A_{jt}$ . Since the main results never change, we only report those with linear  $A_{jt}$ .

Product characteristics  $X_{jt}$  include both product specific dummies and the age of the drug since entry. Patient characteristics  $Y_{it}$  include insurance status (i.e., Medicare, Medicaid, private insurance, and self-pay) and demographics (i.e., age, gender, and race). Physician characteristics  $H_{kt}$  include doctor specialties, i.e., family practice, internal medicine, and all others. We include extensive interaction terms between physician/patient characteristics and drug dummies to control for individual heterogeneity.

One may argue that pharmaceutical firms choose advertising expenditures endogenously in anticipation of consumer response. If this is true, advertising expenditure could be correlated with aggregate demand shocks such as changes in demographics. Using micro-level data in a national representative sample allows us to include extensive interactions between patient/doctor characteristics and drug dummies, thus alleviating the problem. Moreover, advertising expenditures are usually determined three to four months ahead of time, so it is less likely that the simultaneity problem (or reverse causality) biases the estimates. Even if the bias exists, we would expect pharmaceutical firms to invest more advertising during the time period or in the brand that is more responsive to advertising, which suggests an upward bias. Since we find no significant impact of DTCA on the demand of antihistamine drugs, the concern of bias is likely minimal.

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<sup>9</sup>To be specific, for each type of advertising, we first compute the expenditure share of each month for each year between 1998 and 2001. Then, we take the average across the four years to determine the advertising share of each month.

## 4 Empirical Results

Table 2 Model 1 shows the results from our base model. To address our main interest, we focus on the coefficients for the four types of promotional activities. First of all, the coefficient for DTCA is not statistically different from zero, suggesting that, regardless of the massive DTCA campaign on allergy drugs, DTCA had no positive impact on physician’s prescription choices. This contrasts with the results in Iizuka and Jin (forthcoming) that DTCA increases visits to physicians substantially. Interestingly, the coefficients for detailing promotion and medical journal advertising are positive and significant, suggesting that prescription choices are influenced by the promotional efforts targeted at doctors. These results suggest that consumer-directed and professional-directed advertising play quite different roles in promoting prescription drugs; while DTCA increases patients visits to doctors, professional advertising affects the doctor’s prescription choice. The third type of professional advertising – free samples – does not appear to affect the choice of prescription in any significant way.

The estimated depreciation rates reported at the top panel of Table 2 suggest that professional advertising lasts longer, while DTCA is short lived. These depreciation rates are estimated precisely except for DTCA, which is not statistically different from zero. The estimate suggests, for example, the effect of detailing advertising reduces to 85.8% one month later, while the corresponding number for DTCA is only 13.6%. Put it differently, after three months, detailing promotion is still effective at 63.2%, while the effect of DTCA is practically zero.

Since the impact of DTCA is not only weaker for the current month, but also depreciates much faster in the following months, the overall effect of DTCA on the choice of prescription is much weaker than that of professional advertising, especially detailing and medical journal advertising. To give an example, suppose an average firm increases detailing promotion by \$1 million in a specific month (at the mean of all observed variables). This investment increases the cumulative stock of detailing promotion over the next 12 months by \$5.93 million.<sup>10</sup> If another firm tries to use DTCA to offset the business-stealing effect created by the first firm’s detailing, this firm would have to increase DTCA by as much as \$13.55 million in the same month.<sup>11</sup> This shows that the business-stealing effect of DTCA is much weaker than that of detailing. The

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<sup>10</sup> $1 + 0.858 + 0.858^2 + \dots + 0.858^{11} = 5.9265$ .

<sup>11</sup>We obtain this result in the following way. First, if one spends \$1 million in DTCA in a specific month, the cumulative stock of this DTCA over the next 12 months is  $1 + 0.136 + 0.136^2 + \dots + 0.136^{11} = \$1.1568$  million. Using the coefficients reported in Table 2, we can compute the necessary DTCA expenditures to offset detailing

same argument goes for professional journal advertising.

The other coefficients also provide insights into the demand for allergy drugs. The coefficient for price suggests that prescription choices are not sensitive to the wholesale price. As noted before, however, this may be because our price measure correlates poorly with the patient’s out-of-pocket costs. Dummy variables corresponding to Allegra and Zyrtec are not different from zero, suggesting that on average the efficacy of the three allergy drugs are not different.

We find, however, that allergy drugs are prescribed differently depending on patient demographics and physician specialty. In particular, women are less likely to receive Claritin relative to men, and older age increases the probability of receiving Allegra relative to Claritin and Zyrtec, in order. In contrast, insurance status does not appear to affect the choice of allergy drugs. However, we should be cautious because NAMCS collects information on the type of insurance that most likely covers the visit, not the resulting prescription. We also find that family doctors are less likely to prescribe Zyrtec relative to Allegra and Claritin, while internal medicine doctors are more likely to prescribe Allegra than Claritin or Zyrtec.

Table 2, Models 2 and 3 add an interaction term between DTCA and detailing, and DTCA and medical journal advertising, respectively, to Model 1. In these specifications, we examine the possibility that DTCA and professional-directed advertising complement (or substitute for) each other. For example, DTCA may increase doctor attention to a specific drug hence increase the marginal effects of detailing promotion, or vice versa. We find that the coefficients for the interaction terms are positive in both cases but not statistically significant, suggesting that the two forms of advertising neither complement nor substitute for with each other.<sup>12</sup>

Opponents of DTC advertising have argued that DTC advertising would lead to the increase of prescriptions of expensive drugs even if equally effective and cheaper drugs are available. This is possible if DTC advertising reduces consumer’s price sensitivity by creating loyalty or “prestige effects” to the advertised drugs. We examine this claim by including the interaction advertising as  $5.9265/1.1568 * 0.3294/0.1245 = 13.55$ .

<sup>12</sup>The depreciation rate of DTCA becomes significant in Model 2, but the coefficients for *DTCA*, *detailing* and *DTCA · detailing* are all insignificant from zero. Moreover, the overall likelihood of Model 2 is so close to that of Model 1, a likelihood ratio test (with test statistics 2.02, p-value 0.16) suggests that Model 2 does not improve the fit significantly.

term between price and DTC advertising in the previous model. If the claim is true, we should observe a positive coefficient for the interaction term. Table 2 Model 4 shows the result. The coefficient for  $P \cdot DTC$  is positive but not statistically different from zero, and thus we do not find evidence that supports the claim that DTC advertising reduces price elasticity. Again, the reader should be cautious when interpreting these results, as the wholesale prices used in this paper may not represent the actual cost of drug that the patient would incur out of his/her own pocket.

To summarize, we analyzed the effect of DTCA on the choice of prescription drugs. Results show that DTCA has little effect on the choice of prescription drugs. This is particularly true in comparison with the effects of professional advertising (i.e., detailing and medical journal advertising) directed to physicians. For most of the specifications we examine, professional advertising has positive, significant, and long-lasting effects on the choice of drugs, while DTCA does not show any significant effect on the choice of prescription.

Our results do not contradict the findings in Wosinska (2002). We document the average effect of DTCA on all brands, while she presented the differential effect of DTCA on brands on the formulary versus brands out of the formulary. Unfortunately, NAMCS does not collect formulary status for all the three allergy drugs in the choice set,<sup>13</sup> so we can't identify the effect of formulary status on the doctor's prescription choice. However, in theory an average zero effect and a differential effect by formulary status could co-exist. Another discrepancy between our research and that of Wosinska (2002) is that we account for the depreciation of drug advertising, and she used advertising flows as of the current month. However, our results do not change if we adopt her approach, suggesting that methodology is unlikely to be the reason driving the results. Finally, we note that both studies are class specific. The extent to which either result is applicable to other drug classes warrants future research.

## 5 Discussion

If we integrate the results shown above and the results from Iizuka and Jin (forthcoming), DTCA seems effective in increasing the aggregate demand per therapeutic class but does not affect doctor choice of prescription within a class. This suggests that the effect of DTCA is

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<sup>13</sup>It only collects the formulary status of the prescribed brand.

primarily market-expanding rather than business-stealing, and therefore DTCA may be viewed largely as a public good for all drugs in the same class. In this section, we provide supply-side evidence that supports this argument.

If DTCA is a public good, one may immediately ask why drug firms do not simply free ride on others' advertising efforts. Which companies, if any, have incentives to use DTCA given the nature of the advertising? To consider these questions, note that even if the public-good nature of DTCA does not allow an advertising company to reap the full benefits, the company may still find it worthwhile to advertise if the absolute effect of market-expansion is large enough. This suggests that companies with larger market shares are more likely to use DTCA, since they benefit more from the increased market size. Moreover, we would also expect that there is a cut-off point below which low-market share firms do not advertise at all. In fact, we can obtain a crude estimate on this threshold using the results from Iizuka and Jin (forthcoming). In that paper, we reported that every \$28 DTCA after 1997 would generate one patient visit in the next 12 months. This implies that if one extra visit generates one prescription, consumer compliance rate is 60%, and every filled prescription implies \$80 profits for the drug manufacturer, the manufacturer will advertise as long as its market share is over 58.3%.<sup>14</sup>

To check these predictions, we look at all therapeutic classes included in NAMCS and examine which firms use DTCA more intensively in promoting their drugs. Here, we implicitly assume that the public good argument applies to all therapeutic classes, although our analysis up to this point focuses on antihistamines. The assumption is consistent with the existing evidence that DTCA has a much smaller or no impact on prescription choice relative to detailing (e.g., Rosenthal et al. (2003), Wosinska (2002)). We match the DTCA data for all prescription drugs obtained from CMR and NAMCS by drug name and year of visit. Since NAMCS is a national representative, we use the weight it assigns to each individual visit to compute the market share of each prescription drug in its drug class, where drug class is defined by the 4-digit National Drug Code as of 2000.

Table 3 tabulates yearly DTCA expenditure by whether a drug's market share within its class was 0-20%, 20-40%, 40-60%, or 60+% in the previous year. Focusing on all drug-year observations from 1995 to 2000 (prescription only), the table shows that drugs with market shares 40% or higher spent a lot more on DTCA per drug-year than those with smaller market shares. Put more crudely, the propensity of DTCA increases dramatically with market share:

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<sup>14</sup>That is,  $28/(80 * 0.6) = 0.583$ .

for drugs with 20% or less market shares in year  $t-1$ , only 3.7% advertise in year  $t$ . In contrast, for drugs with 60+% market shares, 19% advertise. If restricted to the classes that ever used DTCA, a drug with a 60+% market share on average accounts for 69% of the total DTCA expenditure in its class, while a drug with a 20-% market share only contributes 4%.<sup>15</sup>

This supports the argument that “larger” drugs benefit more from the market-expanding effects of DTCA, and therefore have more incentives to advertise than their “smaller” competitors within the same therapeutic class. Thus, the supply-side evidence is consistent with the demand side results that DTCA may be viewed as a public good in a therapeutic class.

## 6 Conclusion

This paper examined the effect of DTCA on doctor choice of prescription drugs. Using antihistamines as an example, we showed that DTCA has little effect on the choice of brand despite the massive DTCA expenditure incurred in this class. In a sharp contrast, we found that directed-to-physician advertising (i.e., detailing and medical journal advertising) has a positive, significant, and long-lasting effect on the prescription choice of allergy drugs.

These results, together with the market expanding results shown in Iizuka and Jin (forthcoming), suggest that DTCA is effective in increasing the aggregate demand per therapeutic class but does not affect doctor choice of prescription within a class. Therefore, DTCA may be viewed as a public good for all drugs in the same class.

Regarding the debate on the effect of DTCA, our results support the view of proponents that DTCA has little impact on the choice of prescription once the patient arrives at the physician office. We note, however, that welfare implications are far reaching, partly because our model does not consider the potential substitution between the antihistamines we examined and other alternatives such as non-drug treatments and over-the-counter medications.

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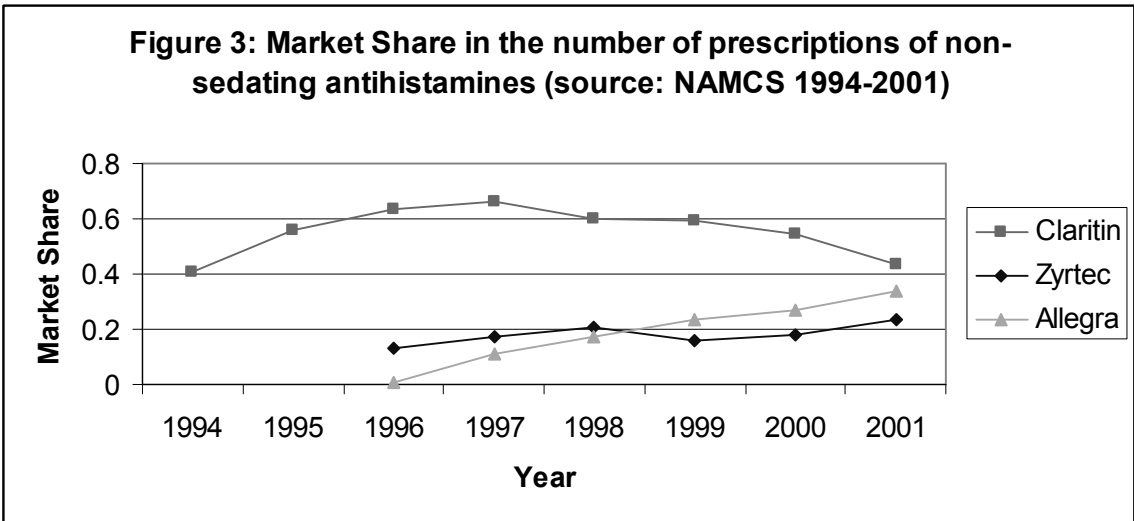
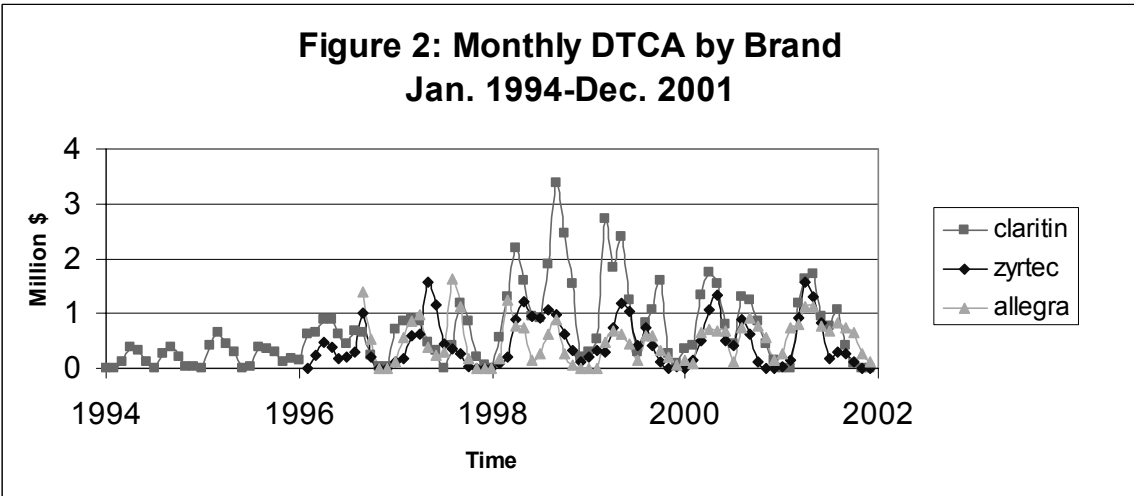
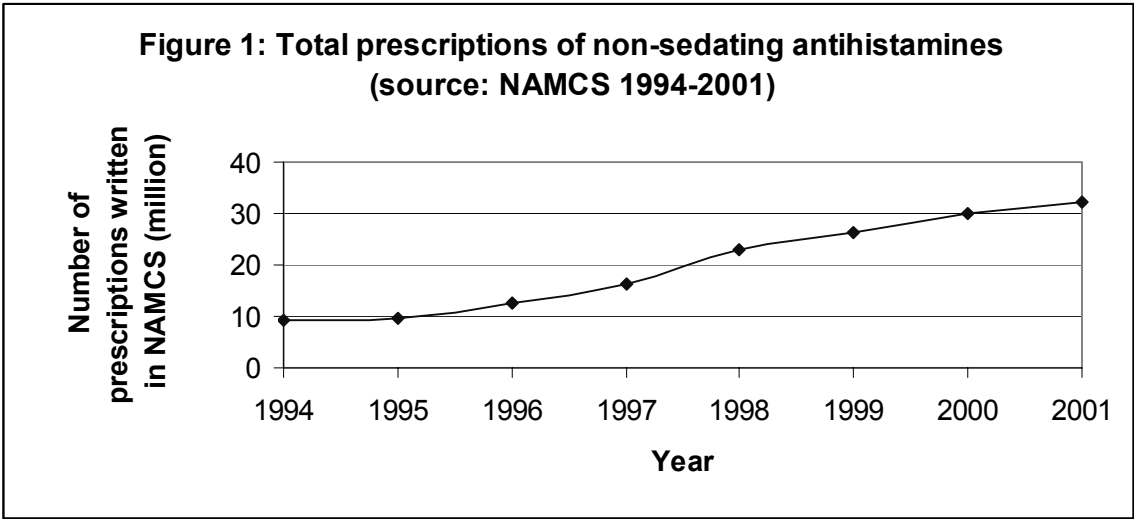
<sup>15</sup>All these patterns are robust if we control for drug class fixed effects and common year dummies.

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Note: Market shares of Claritin, Zyrtec and Allegra do not add up to one, because non-sedating antihistamines also include Seldane and Hismanal. Seldane entered the market in 1985, but was withdrawn in 1997. Hismanal was introduced in 1998 but withdrawn in 1999.

Table 1: Summary Statistics

Drug Characteristics (Observation = drug-month, Jan. 1994 to Dec. 2001)

Month of drug entry	Claritin		Zyrtec		Allegra	
	Apr. 1993		Feb. 1996		Sept. 1996	
	Mean		Mean		Mean	
Monthly DTCA (million \$) since entry	0.692	(0.689)	0.459	(0.436)	0.499	(0.391)
Monthly Detailing (million \$) since entry	0.608	(0.221)	0.480	(0.114)	0.567	(0.226)
Monthly Prof. Jnl. Advertising (million \$) since entry	0.035	(0.026)	0.020	(0.019)	0.054	(0.038)
Monthly Free Samples (million \$) since entry	1.189	(0.503)	0.526	(0.193)	0.717	(0.325)
Wholesale price per patient-day (\$, Jul. 1997 to Dec. 2001 only)	1.876	(0.063)	1.429	(0.016)	1.556	(0.075)

Patient and Doctor Characteristics (OBS = NAMCS patient record, Jul. 1997 to Dec. 2001)

	Mean	
Age	41.562	(22.565)
Female	0.604	(0.489)
White	0.877	(0.329)
Private Insurance	0.676	(0.468)
Medicare	0.139	(0.346)
Medicaid	0.063	(0.242)
Family doctor	0.319	(0.466)
Internal Medicine	0.147	(0.354)
Chosen prescription = Claritin	0.542	(0.248)
Chosen prescription = Zyrtec	0.202	(0.161)
Chosen prescription = Allegra	0.256	(0.190)
OBS	2543	

Data source: IMS, CMR and NAMCS. Standard deviation in parentheses.

Table 2: Multinomial Logit Estimation, Dependent Variable = Brand Choice of Claritin, Zyrtec or Allegra

	Model 1		Model 2		Model 3		Model 4					
	Coeff.	Std. err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. err				
Wholesale Price	1.200	0.969	1.335	1.052	1.218	0.989	1.364	0.969				
Log (years since drug entry)	0.837	0.983	1.802	1.105	0.909	0.926	0.818	1.072				
Stock of DTCA (million \$)	0.125	0.076	-0.114	0.109	-0.122	0.146	-0.559	0.451				
δ of DTCA	0.136	0.516	0.906	0.090	***	0.215	0.322	0.052	0.441			
Stock of Detailing (million \$)	0.329	0.189	*	0.055	0.285	0.332	0.189	*	0.343	0.200	*	
δ of Detailing	0.858	0.070	***	0.735	0.219	***	0.849	0.079	***	0.871	0.063	***
Stock of Prof. Journal Ad. (million \$)	1.941	0.516	***	1.761	0.632	***	1.643	0.515	***	2.209	0.545	***
δ of Prof. Journal Advertising	0.969	0.027	***	0.960	0.046	***	0.970	0.025	***	0.969	0.027	***
Stock of Free Sampling (million \$)	-0.108	0.086		-0.059	0.076		-0.103	0.086		-0.137	0.098	
δ of Free Sampling	0.969	0.016	***	0.977	0.023	***	0.969	0.016	***	0.966	0.016	***
DTCA * Detailing				0.059	0.059							
DTCA * Prof. Jnl. Advertising							0.216	0.163				
DTCA * Price										0.377	0.249	
Dummy of Zyrtec	-0.308	1.564		0.904	1.525		-0.214	1.482		-0.336	1.731	
Dummy of Allegra	-2.829	2.099		-1.192	2.240		-2.663	2.004		-3.065	2.326	
Allegra * Female	0.216	0.102	**	0.219	0.102	**	0.217	0.102	**	0.215	0.102	**
Zyrtec * Female	0.307	0.109	***	0.309	0.109	***	0.306	0.109	***	0.308	0.109	***
Allegra * White	0.246	0.154		0.233	0.154		0.250	0.154		0.244	0.154	
Zyrtec * White	0.305	0.168	*	0.299	0.168	*	0.303	0.168	*	0.297	0.168	*
Allegra * Age	0.018	0.003	***	0.018	0.003	***	0.018	0.003	***	0.018	0.003	***
Zyrtec * Age	-0.010	0.003	***	-0.009	0.003	***	-0.010	0.003	***	-0.010	0.003	***
Allegra * Medicare	-0.328	0.214		-0.338	0.214		-0.328	0.214		-0.322	0.214	
Zyrtec * Medicare	0.361	0.234		0.341	0.234		0.364	0.234		0.371	0.234	
Allegra * Medicaid	-0.737	0.289	**	-0.746	0.289	***	-0.731	0.289	**	-0.731	0.289	**
Zyrtec * Medicaid	-0.194	0.252		-0.203	0.252		-0.201	0.252		-0.200	0.252	
Allegra * Private Insurance	-0.156	0.160		-0.155	0.160		-0.153	0.160		-0.149	0.160	
Zyrtec * Private Insurance	-0.247	0.166		-0.250	0.166		-0.245	0.166		-0.244	0.166	
Allegra * Family doctor	0.156	0.114		0.138	0.115		0.153	0.114		0.157	0.114	
Zyrtec * Family doctor	-0.274	0.121	**	-0.296	0.121	**	-0.290	0.121	**	-0.281	0.121	**
Allegra * Internal medicine doctor	0.276	0.138	**	0.240	0.139	*	0.273	0.138	**	0.273	0.138	**
Zyrtec * Internal medicine doctor	-0.064	0.153		-0.101	0.154		-0.082	0.153		-0.072	0.153	
OBS	2543			2543			2543			2543		
Log likelihood per observation	-0.956			-0.956			-0.956			-0.956		

Notes: The sample consists of NAMCS records on anti-histamine prescriptions, July 1997- December 2001. \*\*\* p<0.01, \*\*p<0.05, \* p<0.1, two-tail.

Table 3: Relating DTCA of the current year to market shares as of the previous year

Observation = drug-year

Sample Period = NAMCS 1995 to 2000

Market Share in # of drug mentions (year t-1)	Full Sample			Advertising Classes Only	
	OBS	DTC Expenditure (\$1000) (year t)	DTC at all? (year t)	OBS	DTC Share Within Class (year t)
0-20%	5702	469.67	0.04	2518	0.04
20-40%	484	2254.01	0.12	164	0.20
40-60%	166	5333.02	0.16	49	0.32
60+%	148	4888.44	0.19	37	0.69

Data source: all prescription drugs mentioned in NAMCS 1995-2000. Market share is calculated by the number of mentions for drug j in NAMCS of year t-1, divided by the total number of drug mentions within the same drug class in NAMCS of year t-1, all weighted. "DTC at all" refers to a dummy variable equal to one if there is any DTC advertising expenditure for drug j in year t. An observation of drug-year is included in the subsample of "Advertising Classes Only" if there is any DTC advertising expenditure in the corresponding drug class in year t.