Füsun F. Gönül, Franklin Carter, Elina Petrova, & Kannan Srinivasan

Promotion of Prescription Drugs and Its Impact on Physicians' Choice Behavior

The authors investigate whether and how pricing and promotional activities influence prescription choice behavior using a comprehensive panel of physicians and data on competitive price and promotional activities. The authors find that physicians are characterized by fairly limited price sensitivity, detailing and samples have a mostly informative effect on physicians, and physicians with a relatively large number of Medicare or health maintenance organization patients are less influenced by promotion than other physicians are.

To the best of our knowledge, this article is the first attempt at an exploratory study on the effects of a widely used competitive marketing practice in the prescription drug industry: personal detailing to physicians and dispensing free samples by pharmaceutical companies' sales representatives. Considering that there is not much prior research in this area (partly due, perhaps, to difficulties related to data collection, confidentiality issues, and so forth), we view the primary contributions of our findings to be its initial insights into this matter and its guidance for further research. The health care industry in general and the prescription drug industry in particular employ an unusual combination of marketing effort, namely, personal detailing and free samples. Studying the impact of these marketing activities accomplishes two objectives: First, we can determine their effectiveness from the firm's perspective, and second, we can infer their implications for consumers and thus shed light on related public policy issues.

In the changing health care environment, managed care organizations (MCOs) play an important role in cost containment. Among other things, they encourage physicians to be more cost-conscious and gradually replace more drastic treatment options, such as surgery, with preventive medicine and pharmaceutical treatments whenever possible (Miller and Luft 1994).

Because health care is largely viewed as a social good, marketing expenditures may be viewed as wasteful or excessive unless the marketing activity benefits the consumers. Intense personal detailing to physicians by prescription drug manufacturers is a time-honored practice. Drawing a natural parallel between detailing drugs and advertising consumer goods, it can be argued that detailing, similar to advertising, is both a market power tool and an information source (see Nelson 1974). However, as prior marketing studies have indicated, these two roles of advertising have a fundamentally different impact on consumers' price sensitivity, decreasing it in the former case and increasing it in the latter. Therefore, we consider it useful to glean insights into the mechanisms driving product choice in the prescription drug market and to study these mechanisms' effects on price sensitivity.

The marketing strategies employed in the pharmaceutical industry sharply contrast with those typically adopted in other markets. One of the primary reasons for the difference is that in the prescription drug market there is a distinct breach in the traditional buying decision process: The decision maker is the physician, who chooses among an array of drug alternatives, but it is the patient who takes the drug and ends up paying (either out of pocket or through health insurance coverage) for the choices made by the physician. Therefore, it is conceptually harder to define the customer in such transactions: The intermediary role played by the physician cannot be ignored.

The marketing literature is replete with examples in which the chooser is not the user. Organizational buying, toy purchasing, and textbook buying provide other examples of situations in which the decision maker is necessarily different from the user (Kotler 2000). The complexity of industrial buying situations, in which the buying center makes the decisions on purchases of goods and services that the employees of the company use, are discussed by Bonoma (1982). Krapfel (1985) puts forth a model for the advocate role of organizational buyers. In a similar vein, we expect that in the marketing of prescription drugs there is an important distinction from the traditional marketing practices studied so far, and we suggest that this warrants additional research.

The involvement of physicians as key decision makers is the reason that they are the focus of most promotional efforts of pharmaceutical companies. In addition to detailing, physicians are often supplied with substantial amounts of free products for direct assessment of the effectiveness of

Füsun F. Gönül is Associate Professor of Marketing, Simon School of Business, University of Rochester. Franklin Carter is Assistant Professor of Pharmaceutical Marketing, Haub School of Business, Saint Joseph's University. Elina Petrova is a doctoral student in marketing, and Kannan Srinivasan is H.J. Heinz II Professor of Management, Marketing, and Information Systems, Graduate School of Industrial Administration, Carnegie Mellon University. The authors thank participants of Columbia, Groningen, Koc, New York, Penn State, Rochester, and SUNY Buffalo marketing workshops and the two anonymous *JM* reviewers for valuable comments.

a drug, which they can then dispense to patients at no cost. Therefore, from the manufacturer's point of view, physicians are the customers. We believe that physicians have strong incentives to keep their patients satisfied with the provided medical service.

Physicians may be viewed more favorably by their patients if they demonstrate additional responsiveness and empathy by considering the patients' financial situation and the specifics of their health insurance plan when choosing among drugs of similar efficacy for a patient's medical condition (which should be the issue of prime concern). Often the recourse of patients who doubt the judgment of their health care providers is to seek another opinion. Even though switching physicians on the basis of an unsatisfactory experience related to drug costs is unlikely, potential loss of patients' patronage could be a reasonable concern to physicians regardless of its causes.

It is conceivable that physicians can infer a patient's willingness and ability to pay a higher price from either the type of insurance held (e.g., private insurance versus Medicare) or other cues revealed during the discussion with the patient (e.g., if the patient asks how expensive the drug is or indicates price concerns in some other way). Accommodating patients' price sensitivity while accounting for their medical conditions, along with giving free samples to some patients, may be considered a tangible indication of care and involvement that can further enhance the relationship between physician and patient. However, it should be noted that patients' potential difficulty in making price comparisons with other drugs after a prescription is written and filled could dampen the proposed vicarious price sensitivity exhibited by a physician who wants to demonstrate goodwill to the patient. It might often be sufficient to make the patients believe that their price concerns have been addressed in the best possible way given their condition, which thus becomes a credence issue.

Conversely, it can be argued that physicians' utility functions might not always match those of their patients because of constraints imposed by MCO formularies or the increasing involvement of patients that has been enhanced by direct-to-consumer (DTC) advertising of prescription drugs. As noted in the health care literature, physicians are frequently asked to justify not only the drugs they prescribe but also the ones they choose to dismiss. These extra pressures on physicians from MCOs, patients, and manufacturers' sales representatives create a challenging environment in which the prescription decision is made.

Several other pertinent issues should be noted at this point. First, for the physician there is a trade-off between the benefits acquired through time spent with sales representatives (who provide them with information and free samples) and the opportunity cost of that time, which can be spent otherwise (seeing more patients, reading professional materials, conferring with colleagues, or simply enjoying leisure time). Second, information about new drugs and their applications and side effects is largely available from other sources physicians have access to: medical symposia and conferences, research articles, and medical journals, to name a few. Third, there is anecdotal evidence that inertia and loyalty to specific drugs play some role in the choice of a drug prescribed by a physician. All these factors can render the influence of detailing and samples much less important.

We combine several large data sets obtained from Scott-Levin Inc., a pharmaceutical consulting firm. The data sets are collected from nationally representative samples of physician audits, personal detailing audits, and retail pharmacy audits. The prescriptions are written for a specific therapeutic state that is chronic and relatively more common among the elderly population. The end result is a unique data set for this field that combines patient's insurance coverage data, retail price data, detailing and samples data, and the physicians' prescription choice data.

In the next section we set up the background and hypotheses pertaining to pharmaceutical prices, promotion, and insurance coverage. We then describe the data sets and outline the model and the estimation method. In the following section, we present the results of our estimation, and then we discuss managerial and public policy implications and state the limitations of the study. We conclude with a summary of our findings and directions for further research.

Background and Hypotheses

Price Effects

A common belief in the theoretical literature is that physicians are not price sensitive when selecting which drugs to prescribe, because they act as the patients' agents and the cost savings accrue to the patient, not to the prescriber (see, e.g., Leffler 1981). The list of empirical studies on physicians' price sensitivity for prescription drugs is relatively short, and the evidence is inconclusive. In a controlled health insurance experiment, Newhouse (1993) finds no conclusive evidence that the average cost of prescriptions written by physicians varies according to the patients' insurance coverage. Thus, the study reports no evidence that physicians prescribe lower-cost drugs to patients who are covered by less generous insurance plans. However, Newhouse suggests that this inconclusive finding could be due to the averaging method used over the duration of the experiment. Hellerstein (1997) examines physicians' preferences for brand-name versus generic drugs. She finds that physicians with a relatively large number of patients who have health maintenance organization (HMO) affiliations are more likely to prescribe generic drugs.[1] Hellerstein speculates that this finding can be attributed to the cost-containment emphasis of HMOs and the self-selection of low-cost physicians to HMOs. Alternatively, she suggests that HMO physicians may be more in the habit of writing generic prescriptions because they are sensitive to price. In contrast, she finds that the individual patient's HMO affiliation does not play a role in the prescription of generic drugs. Hellerstein's findings about the patient's affiliation are inconsistent with those from the physicians' pool of patients' affiliations. She explains this inconsistency by the use of dummy variables

[1]We use the term "HMO" as in the cited study. The two major types of managed health care plans are HMOs and preferred provider organizations.

(generic versus brand name) instead of actual drug prices in the model.

In the changing health care industry, however, prices may be expected to influence the choice of drugs prescribed by physicians. Prescription drug prices have increased at a rate higher than inflation, and progressively patients defray a higher percentage of the drugs' cost. Physicians are increasingly competing for patients. Therefore, we expect that physicians, trying to accommodate their patients' price sensitivity, will act in a price-sensitive way even though they do not directly bear the cost of the drug.

Furthermore, bearing in mind the importance of prescribing the right drug that would lead to efficacious treatment with few side effects or complications given a patient's condition, physicians might choose to forgo the price considerations if they believe that price is an indicator of quality and the patient's condition warrants a higher efficacy treatment. Prior research in marketing has shown that both price and advertising can be perceived as signals of quality (Milgrom and Roberts 1982, 1986; Nelson 1974). If this is the case and physicians are regarded as customers in a situation of incomplete information (in which the uncertainty comes from the unknown efficacy of the detailed drug for a patient's treatment), then it can be expected that physicians might consider the higher price as a credible signal of quality. In addition, prior research on the effects of advertising as a signal of quality for experience and credence goods has shown that the incidence of advertising (of which detailing and free samples are a form) can also be perceived as an indication of higher quality because of the costs and effort associated with it (Nelson 1974).

Prescription products are similar to credence goods whose immediate effects are obvious neither to the user (the patient) nor to the decision maker (the physician). These effects often must be taken on faith, especially for maintenance drugs such as the ones we study. Maintenance drugs are taken for chronic diseases, so there is often no immediately obvious effect from using the drug. In such cases, placebo effects are common, as is cited in medical journals. This creates a situation in which patients and physicians continue to use the drug that the patient perceives as working. There is anecdotal evidence from physician discussions that even when the main ingredients are known to be the same in competitive brands of drugs, physicians keep prescribing the same drug for refills if the drug has been reported as working by the patient, so that possible placebo effects of the original brand remain undisrupted. If the physician believes that a drug works in a particular patient's case, there is no reason to deviate from it in subsequent prescriptions because of the risks associated with switching treatment. Therefore, in these situations price would become less of a concern.

Many generic products do not capture the lead in the pharmaceutical industry because of the strong (and positive) price–quality signaling effects. Generic aspirin is a case in point. It has a low market share despite having a low price and the same ingredients as those found in the leading brands. Its lower price makes it less attractive.

Physicians, being intermediaries in the buying decision process of prescription drugs (a position reflecting their key role between the drug manufacturer and the patient who is the ultimate consumer), are often placed in a situation of uncertainty as to which drug is the best for each particular patient's case. Considering the broad substitutability among many drugs on the market and the similar claims their manufacturers make, the prescription choice decision, often critical, is increasingly harder to make. Physicians might regard a higher price as a signal of quality, a price premium justified by the higher efficacy of the drug, and therefore prescribe the more expensive drug when drug efficacy is of prime consideration.

The type of formulary used by a particular HMO specifies not only which drugs are suggested by the HMO but also what percentage of the drug cost will be covered by the HMO if the prescribed drug is on the HMO formulary.[2] The diversity of co-payment schemes and the variable degree of restrictions on drug coverage outside the formulary further complicate the issue of price sensitivity and its importance to both the physician and the patient as a result of the shared-cost effect and the constraints imposed by formularies.

There is a host of diverging arguments that lead to opposite implications about physicians' price sensitivity. Therefore, instead of strongly arguing one way or another about the price effect, we believe that it is best to let the data suggest the impact of price on physicians' choice behavior.

Empirical Question 1: Do direct promotional effects (detailing and free sampling) by pharmaceutical companies affect the price sensitivities of physicians who operate in regulated managed care environments?

Insurance Effects

Patients with private health insurance pay a higher premium and enjoy a wider selection of physicians and hospitals. Patients with HMO insurance tend to have generous prescription drug coverage. In addition, drugs that are on HMO formulary lists enjoy higher prescription rates, as discussed previously.

In contrast, most Medicare patients are retirees with limited income who must pay for prescription drugs themselves, unlike patients with HMO or private insurance who carry prescription coverage. Therefore, Medicare patients are expected to be price sensitive, and their physicians are expected to be more responsive to drug prices than other physicians are. We expect that the physicians' vicarious price sensitivity will be reinforced when patients hold Medicare insurance.

Therefore, we expect the interaction effect between price and Medicare to be negative, decreasing the prescription probability of a drug. That is, we hypothesize that if patients have Medicare coverage, physicians are more price sensitive than if the patients have private or HMO coverage.

H_1: The type of health insurance will have a moderating effect on the prescription probability of a drug, increasing physicians' price sensitivity when patients have Medicare coverage than when they have private or HMO insurance.

[2]A formulary is a continuously revised list of medications that is subject to the approval of the MCO and is intended to optimize patient care through rational selection of drugs.

Impact of Detailing and Free Samples

Sales representatives in the pharmaceutical industry (detailers) offer information on generic and current modes of therapy, the appropriate drug usage, indications, contraindications, and side effects. In addition to information about drug usage and positioning, detailers give retail price information and dispense free samples. Physicians are expected to benefit from spending time with sales representatives, because the information they receive ultimately leads to higher patient recovery rates that speak well of the physicians' competence and expertise.

Several studies on advertising have suggested that when used as a persuasive tool, advertising affects the consumer by focusing on the differentiating features and attributes of the product and thus reduces price sensitivity. In contrast, advertising that provides information about the existence and availability of competitive products broadens the consideration set and thus increases price sensitivity (see, e.g., Mitra and Lynch 1995; Nelson 1970, 1974; Nerlove and Arrow 1962).

Yet another aspect of direct drug promotion adds to the complexity of the issue. Prior research (Mitra and Lynch 1995) has attempted to reconcile the opposite effects of reminder advertising (which broadens the size of the consideration set and thus increases price sensitivity) and differentiating advertising (which strengthens the preference for a brand and thus decreases price sensitivity). We believe that detailing and samples can induce both reminder and differentiating effects, which makes Mitra and Lynch's (1995) work relevant for our study. They find that for product markets in which consumers must rely on memory to generate alternatives, increased advertising of brands may increase price sensitivity. Conversely, in the case of point-of-purchase information, the net effect of advertising is to decrease price sensitivity. Although it is clear that physicians retrieve drug alternatives from memory before writing a prescription (rather than check the contents of their medicine cabinet), free samples left by drug representatives after the detailing session might act as long-term reminders of the existence of the drug and dampen the increased price sensitivity effect.

There is a natural similarity between advertising in general and detailing and samples in the prescription drug industry. Because physicians receive visits from the representatives of competing pharmaceutical companies, we expect that the persuasive aspect of the sales presentations will be mitigated by physicians' increased awareness of competitors' prices. In other words, we believe that the persuasiveness of detailing and sampling activity will be canceled out across the visits of different sales representatives, making the increased awareness of drug features and availability the only remaining effect to influence (increase) physicians' price sensitivity. However, we leave this as an open question to address in our analysis:

> Empirical Question 2: Do detailing and samples increase physicians' price sensitivity as a result of increased awareness of competitors' prices or decrease it as a result of enhanced perception of product differentiation?

The emergence of managed care has reduced the impact of detailers; however, they are still a strong source of information in the promotion of drugs (Ziegler, Lew, and Singer 1995). There is an unresolved debate whether detailing is a warranted or a redundant promotional activity. The federal government and consumer advocates often criticize pharmaceutical firms for what they consider excessive and wasteful expenditure in detailing and promotion. These expenses, the critics argue, unnecessarily raise the prices of prescription drugs.

Pharmaceutical lobbyists respond that promotional expenditures are necessary to compete effectively in the marketplace, that the generated extra revenues can be allocated to research and development, and that prescription drug expenses are only one-seventh of the total health care costs (PhRMA 1994). In the pharmaceutical advertising literature, Leffler (1981) and Hurwitz and Caves (1988) argue that advertising increases competition and reduces prices. Hence, they posit that limiting advertising expenditures may have negative social welfare effects. Even though our article will hardly help solve the controversy, we hope it will shed light on the effects of detailing on physicians and ultimately on patients' and social welfare.

In the prior health care literature, Berndt and colleagues (1994) find that detailing is critical to increasing industry sales of anti-ulcer drugs. In marketing, there is a large amount of literature on personal selling, albeit in contexts different from our focus on the effects of detailing to physicians. Detailing is a valuable, though not unique or entirely accurate, source of information for physicians, providing them with useful product knowledge about drug toxicity, efficacy, and the cost to the patient. To that extent, detailing may enable physicians to make careful trade-offs between costs and benefits for each patient, thus offering a more customized service and enhancing social welfare.

The effects of samples in nonpharmaceutical contexts have been studied in more detail (Marks and Kamins 1988). However, dispensing samples in the health care industry is different from doing so in nonpharmaceutical markets, because drug samples are often accompanied by detailing and accepting them might imply some commitment to prescribe the product in the future. In addition, samples can be the only visible reminder of the product after the sales representative has left the physician's office. Thus, samples can have a more lasting influence on the physician because they add tangibility to the sales presentation.

> H_2: Detailing and samples will have positive main effects on the prescription probability of a drug.

Although exposure to detailing may be useful for the physician, it inevitably takes away from valuable work time. Any communication with the physician—direct mail, direct selling, continuing medical education, show displays, public relations, wellness promotions—competes for share of the physician's time and mind. Consequently, we anticipate that the marginal impact of cumulative detailing and samples will diminish in its effectiveness. There may be a threshold level of detailing and samples beyond which the effect becomes negative.[3] Physicians may tire of excessive detailing and samples and may be less willing to prescribe the drug.

> H_3: Detailing and samples will have diminishing marginal effects on the prescription probability of a drug.

[3]Van Zandt (1993) conducts a survey of physicians with hypothetical scenario data and finds that the main effect of samples is positive with diminishing returns.

Impact of Insurance Coverage on the Effects of Detailing and Sampling

Previously we argued that physicians will exhibit greater price sensitivity when prescribing drugs to Medicare patients. Recall that these patients spend a higher percentage of their income on health care. In this context, we set out to examine carefully the role of detailing and samples with Medicare insurance as a moderating factor. The presumption that physicians carefully trade off cost and benefit while prescribing drugs to this extremely price sensitive segment would manifest itself in a more mitigated impact of detailing and samples on the prescription probabilities for the Medicare segment (negative interaction effect). Any absence of such interaction or the presence of a positive interaction may lend some credence to the argument that these costly marketing activities merely convince physicians to prescribe the drug, thus raising justifiable concerns about social welfare.

Physicians who prescribe to HMO patients may also be less susceptible to the promotional efforts of sales representatives because of the restrictive HMO formulary lists. Therefore, we also expect negative interaction between HMO coverage and detailing and samples.

H_4: Compared with private insurance, Medicare and HMO coverage will have a negative moderating effect on detailing and samples, reducing their impact on the prescription probability of a drug.

We summarize our hypotheses in Table 1. In the "Methodology" section, we define the coefficients we use in Table 1.

Data

For a comprehensive analysis of the impact of marketing on prescription drug choices, a panel of physicians with information on their exposure to personal detailing and the prescription choices made is needed. The physician-level data sets provided by Scott-Levin Inc. are uniquely comprehensive in this regard.[4] For this study we combine three large data sets from Scott-Levin: drug and diagnosis data, personal selling data, and retail price data.[5]

TABLE 1
Summary of Hypotheses

Empirical Questions and Hypotheses	Effect
Empirical Question 1	$\beta_P < 0$ or $\beta_P > 0$
H_1	$\beta_{P-Medicare} < 0$ $\beta_{P-Medicare} < \beta_{P-HMO}$
Empirical Question 2	$\beta_{DP} < 0$ and $\beta_{SP} < 0$ or $\beta_{DP} > 0$ and $\beta_{SP} > 0$
H_2	$\beta_D > 0$ $\beta_S > 0$
H_3	$\beta_{D-Sq} < 0$ $\beta_{S-Sq} < 0$
H_4	$\beta_{D-Medicare} < 0$ $\beta_{S-Medicare} < 0$ $\beta_{D-HMO} < 0$ $\beta_{S-HMO} < 0$

The drug and diagnosis data include the physician's identification number, the date the prescription was written, the product code, and the patient's type of insurance. The physicians in the panel kept track of their patients' visits between January 1989 and December 1994. Because physicians' time is valuable, they are asked to fill out survey sheets for a typical week of the month. This gives a sample of patient visits per physician, but it does not contain information about every visit. However, this does not bias our choice model results, because we do not model physicians' longitudinal choice behavior, such as brand switching or brand loyalty.

No physician in our sample prescribes the same drug 100% of the time. Even when we relax the brand loyalty criterion to prescribing the same drug at least 70% of the time, we find that only three physicians could be described as loyal by this criterion. This tentative result indicates that less than 2% of the sample shows evidence of brand loyalty, but again, the data set does not allow for a thorough examination of this issue. However, we do not rule out the possibility that though the majority of physicians appear to be switchers in their overall prescription behavior across patients, they might be persistent in repeatedly prescribing a drug to each patient.

Personal selling data were collected for the same time period as was the first data set. The physicians were asked to keep track of the detailing (minutes) and samples (number of containers) they received from sales representatives for drugs for specific therapeutic states and the dates they received them. We chose a therapeutic state that is a relatively common chronic condition among the elderly population. A physician may prescribe one of seven different products for this therapeutic state.

Retail price data are available for a shorter time span, from January 1991 to December 1994. The data set uses a panel of more than 800 pharmacies throughout the United States. The data contain the full price the pharmacy charges for the prescription drug, regardless of co-payment situations, as well as how the prescription was paid by the consumer: personally or by an insurance plan.

Table 2 displays descriptive statistics for 157 physicians and their patients' visits (related to the specific therapeutic state we have chosen) over a period of four years. The top three products rank high in samples and detailing minutes as well as in market share. Insurance plan frequencies in the data are as follows:

1. Private: private insurance (44%),
2. HMO: HMO or preferred provider organization (13%), and

[4]Most empirical studies on the pharmaceutical industry use data sets from IMS International, which collects data on the health care industry. However, the data set poses certain problems. See Berndt and colleagues (1994, Appendix) for a detailed account of the quirks in the IMS data.

[5]Both the therapeutic state and the brand names of the prescription drugs are kept confidential at the request of Scott-Levin Inc. Although there are a few generic drugs for the therapeutic state, their market share is less than 1%. Therefore, we exclude them from our study without loss of substantial information.

TABLE 2
Descriptive Statistics

Rx Product	Frequency of Choice (%)	Price ($)	Cumulative Discounted Sum of Sample Containers	Cumulative Discounted Sum of Detailing Minutes
Product 1	20.06	34.20 (.58)	32.28 (36.50)	13.55 (14.53)
Product 2	31.65	42.25 (1.83)	31.00 (31.14)	9.41 (10.42)
Product 3	23.75	50.49 (4.18)	31.74 (32.25)	12.83 (13.62)
Product 4	10.42	35.73 (1.90)	24.24 (21.39)	8.82 (8.10)
Product 5	8.07	34.84 (1.05)	21.62 (33.09)	7.71 (9.46)
Product 6	2.63	31.75 (.90)	18.06 (23.07)	8.26 (6.73)
Product 7	3.41	32.83 (.54)	26.25 (41.77)	8.32 (10.67)

Notes: The number of observations is 1785 patient visits. The sample spans January 1991 through December 1994. Mean values and standard deviations (in parentheses) are shown; however, standard deviations for percentage terms are not computed. Detailing and samples are defined as cumulative discounted sums up to the time of the writing of the prescription, as described in the "Methodology" section.

3. Medicare: Medicare, Medicaid, or Workers' Compensation (42%).

Most of the patients in the second category are covered by an HMO plan (more than 75%); most of the patients in the third category carry Medicare insurance (more than 90%). Although the data set provides a code for no insurance, our sample happens to contain no such patients.

Methodology

Model

To estimate the effects of price, type of insurance, and direct selling efforts on prescription choice, we use a multinomial logit model (McFadden 1974). However, prescription behavior patterns might be strongly influenced by factors other than the explanatory variables we include in our model. Examples are physicians' unobservable personal characteristics (e.g., inertia, loyalty to certain drugs), unobserved factors related to patients (e.g., the severity of their condition, their health history, other drugs they are currently taking that may cause interactions or exacerbate side effects), or even unobserved specifics unique to the interaction between the physician and the patient (e.g., some patients may like to get more involved in the drug choice because of experience, knowledge, word of mouth, or DTC advertising effects, whereas others leave the choice completely to the physician). Because of data limitations, little can be done to control for these unobserved factors. However, ignoring these factors might bias the coefficients of the included explanatory variables. This is known as aggregation bias (Chamberlain 1980).

We opt for a latent class model that allows for a semiparametric distribution of heterogeneity that is more flexible than any prespecified distribution (Kamakura and Russell 1989). We specify a multinomial logit model with an unknown number of latent classes and interactions and quadratic terms to capture better the specifics of prescription choice and the relationships among model parameters. We define the indirect utility as follows:

$$
\begin{aligned}
(1)\quad U_{itjk} &= \alpha_{jk} + \gamma_{HMOj}HMO_{it} + \gamma_{MEDICAREj}Medicare_{it} \\
&+ \beta_{Pk}Price_{tj} + \beta_{P-HMO}(Price_{tj} \times HMO_{it}) \\
&+ \beta_{P-MEDICARE}(Price_{tj} \times Medicare_{it}) \\
&+ Cum.Detailing_{itj} \times (\beta_D + \beta_{D-Sq}Cum.Detailing_{itj} \\
&+ \beta_{DP}Price_{tj} + \beta_{D-HMO}HMO_{it} + \beta_{D-MEDICARE}Medicare_{it}) \\
&+ Cum.Samples_{itj} \times (\beta_S + \beta_{S-Sq}Cum.Samples_{itj} + \beta_{SP}Price_{tj} \\
&+ \beta_{S-HMO}HMO_{it} + \beta_{S-MEDICARE}Medicare_{it}),
\end{aligned}
$$

where j denotes the brand; i denotes the physician; t stands for the prescription incidence; and k = 1, 2,..., K, where K is the number of latent classes to be estimated by the model. We let the intercepts and the price coefficient be segment specific, as noted by their k subscripts. Allowing all coefficients to be segment specific is possible in theory, but our data are not long enough per physician to enable us to estimate reliably the heterogeneity distribution on all coefficients. For identification purposes, one of the three types of insurance coverage should be specified as the default. We chose the default type of insurance plan to be private insur-

ance. Furthermore, we arbitrarily let Brand 7 be the reference brand and set its drug-specific coefficients (α_7, $\gamma_{HMO,7}$, $\gamma_{Medicare,7}$) equal to zero, again for identification reasons. The drug-specific intercepts must be different for each brand, because they will reveal brand-specific characteristics. The insurance coefficients should also be different, because unlike price, detailing, and samples, the type of insurance itself does not vary by the prescription incidence. The parameters for variables that contain price, detailing, and samples do not need to vary across products, because the variables themselves are product specific. Note that including quadratic terms for Detailing and Samples in our model does not necessarily impose a curvature but will help uncover diminishing marginal effects or an inverted-U shape of the relationship.[6]

Cumulative Discounted Sums of Detailing and Samples

For each prescription physicians write, they are likely to be influenced by past personal selling efforts. We discount the cumulative personal selling effort consistently with the methods used in the advertising literature. The major premise of these methods is that physicians are influenced by the recent visits of sales representatives more than by the distant ones. The discounted formulation for detailing has been used in another context by Berndt and colleagues (1994). Discounting enables us to include effects such as memory decay and the fading impact of past detailing and samples with time.

$$(2)\quad (\text{Cumulative Detailing})_{it\mathrm{j}} = \sum_{\tau=0}^{t} \delta^{(t-\tau)}\text{Detailing}_{i\tau\mathrm{j}}$$

$$(\text{Cumulative Samples})_{it\mathrm{j}} = \sum_{\tau=0}^{t} \delta^{(t-\tau)}\text{Samples}_{i\tau\mathrm{j}},$$

where the (monthly) discount factor δ is set at a fixed value to yield a reasonable annual discount rate.[7] We compute the discounted sum of detailing minutes and the number of received samples for all products by the time of prescription. Henceforth, for brevity we use the terms Detailing and Samples to refer to the cumulative discounted sums.

Results and Discussion

Model Goodness of Fit

In addition to the multinomial logit model with latent classes specified previously, we estimate several models that are nested within the full model (such as models with no heterogeneity and no interaction or quadratic terms). We find that the full latent class model attains a higher likelihood value than the nested models with fewer parameters. The Akaike information criterion (AIC) and Bayesian information criterion (BIC) also indicate a better fit for the full latent class model than for the nested ones.[8]

We experiment with two different values of the discount factor (δ = .99 and δ = .80) in the cumulative discounted sums of detailing and samples as specified in Equation 2. We find that the former provides for a better fit as indicated by the AIC and BIC. The results are directionally the same, showing the robustness of our model to the discount factor in that range. Henceforth, we use the results from the better fitting model to guide our discussion. The model has excellent fit between predicted and actual market shares for each data period. The actual market shares for each product are within the prediction confidence limits except for a few cases of extreme highs or lows. (The figures are available on request.) The estimated optimal number of segments is three, as indicated by the AIC and BIC. The estimation results of this model are summarized in Table 3.

Estimates

Intercepts. Of the 18 brand- and segment-specific intercepts, 11 are statistically significant. Brand preferences appear to be polarized when we account for heterogeneity; in other words, each of the three segments is dominated by a different brand. In the first segment of physicians, Brand 2 appears to be dominant, and Brand 6 is least favored judging by the magnitudes of the intercepts (see the first column of Table 3). Brands 1, 3, and 5 are also preferred, but not as strongly as Brand 2. In the second segment, Brand 5 is the most preferred brand, followed by Brand 1. Physicians in this segment appear indifferent to the rest of the products. Dominant in the third segment is Brand 4, but this segment does not favor Brands 1, 3, and 5. Thus, accounting for unobserved heterogeneity in brand preferences reveals that physicians can be split into segments that are characterized by relatively pronounced preferences for certain brands.

The finding that different brands are preferred by different segments of physicians leads us to infer that physicians tend to favor certain brands differently in the absence of external factors such as price and promotion. Accounting for unobserved preferences reduces the estimation biases for the coefficients of the included explanatory variables. It is tantamount to explaining the inherent heterogeneity away. We do not know which physicians belong to these segments, but we have reduced the bias in the coefficients of the remaining explanatory variables by controlling for latent classes. If, in contrast, we had found that the intercepts (i.e., intrinsic brand preferences) were similar across segments, we would have expected more heterogeneity in the impact of price and the promotional variables, which would have rendered our focal results more tentative.

Insurance coefficients. We find that the HMO and Medicare coefficients are significant for most brands, indi-

[6]An alternative would have been to use logarithmic transformations of Detailing and Samples—log(Detailing) and log(Samples)—which would have imposed concavity outright. However, we prefer to use a model with linear and quadratic terms because it is more flexible and does not introduce unnecessary concavity.

[7]The discount factor = 1/(1 + the discount rate).

[8]The AIC and BIC reduce the likelihood fit by adjusting for the number of parameters and/or the number of observations. AIC = −2 × log-likelihood + 2 × (number of parameters); BIC = −2 × log-likelihood + (number of parameters) × log(number of observations). They are lower for a better fitting model, which is the case with the full latent class model. The detailed results of the nested models are not shown for space considerations but are available on request.

TABLE 3
Physicians' Prescription Choice Model with Latent Classes: Maximum Likelihood Estimates

Covariate	Estimate (Standard Error)		
Intercept (α_{11}, α_{12}, α_{13})	2.3817*** (.4032)	.9240*** (.3625)	−.9411*** (.3220)
Intercept (α_{21}, α_{22}, α_{23})	3.3434*** (.4533)	−.5040 (.4803)	.2105 (.4017)
Intercept (α_{31}, α_{32}, α_{33})	2.2308*** (.5873)	.3002 (.6331)	−1.4519*** (.6080)
Intercept (α_{41}, α_{42}, α_{43})	−.2435 (.5336)	.3684 (.3758)	.9627*** (.2827)
Intercept (α_{51}, α_{52}, α_{53})	1.5582*** (.4259)	1.3693*** (.3610)	−1.1301*** (.3644)
Intercept (α_{61}, α_{62}, α_{63})	−2.8955** (1.5169)	−.1747 (.4464)	.0656 (.3152)
HMO ($\gamma_{HMO,1}$)		.6436* (.4332)	
HMO ($\gamma_{HMO,2}$)		−1.1946* (.7450)	
HMO ($\gamma_{HMO,3}$)		−1.5789* (1.2610)	
HMO ($\gamma_{HMO,4}$)		−.6110* (.4969)	
HMO ($\gamma_{HMO,5}$)		−.8400** (.5016)	
HMO ($\gamma_{HMO,6}$)		−.8018 (.7323)	
Medicare ($\gamma_{Medicare,1}$)		.8116*** (.3584)	
Medicare ($\gamma_{Medicare,2}$)		1.1549*** (.4419)	
Medicare ($\gamma_{Medicare,3}$)		2.1348*** (.6077)	
Medicare ($\gamma_{Medicare,4}$)		1.0108*** (.3515)	
Medicare ($\gamma_{Medicare,5}$)		.4108 (.3745)	
Medicare ($\gamma_{Medicare,6}$)		.1045 (.3960)	
Price (β_{P1}, β_{P2}, β_{P3})	−.0085 (.0228)	.0568** (.0254)	.0891*** (.0252)
Price × HMO		.0731* (.0590)	
Price × Medicare		−.0224 (.0234)	
Detailing		.1085*** (.0204)	

TABLE 3
Continued

Covariate	Estimate (Standard Error)		
Detailing^2	−.0007*** (.0001)		
Detailing × HMO	−.0091 (.0198)		
Detailing × Medicare	−.0147** (.0084)		
Detailing × Price	−.0012*** (.0004)		
Samples	.0345*** (.0089)		
Samples^2	−.0001* (.00003)		
Samples × HMO	−.0145*** (.0062)		
Samples × Medicare	−.0141*** (.0040)		
Samples × Price	−.0002* (.0002)		
Portion of latent classes (1 2 3)	42%	31%	26%
Log-likelihood	−2533.44		
AIC	5160.88		
BIC	5418.77		

*$p < .01$.
**$p < .05$.
***$p < .01$.

cating that the type of insurance coverage has a substantial direct impact on the prescription probability of that drug. We point out that all coefficients are relative to that of Brand 7, which was chosen as the reference brand for model identification purposes. The negative coefficients should be interpreted as indicating that the five brands are on fewer formulary lists than the reference brand and Brand 1. Note that we do not have data on formulary lists, which also change over time, so our attempts to interpret the results from the perspective of their inclusion in HMO formularies are speculations.

All six Medicare constants are positive relative to that of Brand 7, and four of them are highly significant. That the signs of the coefficients can be interpreted only relative to Brand 7 indicates that Brand 7 is the least preferred brand for Medicare patients. If we were to expound on the reasons Brand 7 is so unpopular for Medicare patients, given that it has a comparatively reasonable price and is not the least preferred brand overall (see Table 2), a possible explanation would be the presence of side effects that are more common or adverse in the case of elderly patients. However, this is just a speculation, because we lack relevant information.

Price effects. The results of the latent class model unambiguously show that when physicians' distinguishing prescription patterns are accounted for in the basis for segmentation, two of the three segments have positive price coefficients, which thus provides an answer to Empirical Question 1. The two segments together constitute approximately 57% of prescription incidences (segment proportions are shown in the last row of Table 3: Prob[Segment 2] = .31 and Prob[Segment 3] = .26). The relationship between price and prescription probability for the first segment remains weakly negative: The price coefficient is negative but insignificant at $p > .10$.

The results can be interpreted from various aspects. A possible explanation of the preceding findings is that physicians are often driven by the gravity of a patient's condition and the possible interactions between the drug and other types of medication taken by the patient, which would understandably become a major consideration in the choice of a drug and would override the less critical price concerns. For example, if price is perceived as correlated to drug efficacy and the absence of side effects and contraindications, the incidence of prescribing more powerful drugs will produce positive price coefficients. This is the well-known

"price as a signal of quality" argument. Also, prescriptions for refills tend to repeat the initially prescribed drug, so the prescription pattern per patient will persist across the patient's visits, making price a less important factor. As we mention previously, physicians keep prescribing the same drug for refills if the drug has been working for the patient, so that possible placebo effects of the original brand remain undisrupted. The positive price coefficients for two of the three segments could also be a result of some selection process by which patients with more serious conditions would be referred to a specialist who would prescribe a more expensive but more efficacious drug because of the severity of the patient's condition. Unfortunately, we cannot provide support for this explanation because, as already mentioned, our data do not contain the necessary information. However, this issue warrants further examination with the right kind of data.

H_1 suggests that the price effect is more negative for elderly patients on Medicare than for patients with private or HMO insurance. In our model, the impact of price for private insurance patients is given by the price coefficient alone, with no interactions, because private insurance is the reference category among the insurance dummy variables. Therefore, we find initial directional support for our hypothesis, because the Price × Medicare interaction coefficient is negative but insignificant (Table 3).

The positive interaction effect between price and HMO insurance indicates that the effect of reduced price sensitivity is further enhanced if the patient has HMO insurance. Note that this result is relative to the reference category of private insurance and suggests that physicians appear less price sensitive for HMO patients than for private insurance patients. Although we find this result surprising given that the possession of private insurance might indicate a patient's preference for quality care over cost (which ideally would have produced the lowest prescription drug price sensitivity for patients with private insurance), we believe this finding should be interpreted in the context of three factors: (1) Physicians are restricted by the HMO formularies, and price becomes far less of an issue to physicians if the drug is endorsed by the patient's HMO formulary; (2) HMO patients usually pay nothing or just a small fraction of the drug cost; and (3) there is great variability in private insurance plans' extent of drug coverage. Consequently, price becomes a factor of little concern to physicians and patients in the case of HMO coverage, even when compared with private insurance.

Furthermore, we find that there is a significant, negative interaction effect between price and detailing, indicating that the informative aspect of detailing as a type of advertising overrides the sales pitch persuasiveness. The same kind of negative interaction is also found between price and samples, providing an answer to Empirical Question 2. Thus, we find that personal selling of prescription drugs to physicians as a specific type of brand-level advertising increases price sensitivity, consistent with prior research (Mitra and Lynch 1995).

Personal selling effects. The coefficients of detailing and samples are both positive and significant, providing support for H_2 and indicating that the main effects of personal selling are as conjectured, which increases the prescription probability of a drug, ceteris paribus. However, consistent with H_3, we find that excessive detailing or samples are counterproductive: Their quadratic effects are negative and significant, which implies that these promotional activities have an inverted-U shape. This shape implies that too little or too much cumulative personal selling is suboptimal and that any repetitive detailing or free sample activity must be done with caution. The implied adverse effects of excessive detailing and samples can be attributed to frustration caused by waste of time, fatigue with the promotion, or perception that the drug manufacturer is too desperate or too aggressive.

Thus, our model is flexible in offering a variety of alternatives to pharmaceutical companies to help determine how long and how often they should schedule visits to physicians and at what level free samples start lowering the prescription probability of a drug. Pharmaceutical companies could adopt our model and run it through their own databases to arrive at optimal scenarios specific to their products and markets. The sensitivity analysis of the optimal levels of detailing and free samples produces values that exceed those of the currently established practices, as indicated in our data. This empirical result suggests that pharmaceutical companies are operating on the increasing part of the curve and their direct selling efforts are below the level of activity that is most effective. On the basis of our analysis, we conclude that there is room for enhancing the effectiveness of personal promotional efforts by drug manufacturers.

Public policy effects. We turn to public policy issues next and explore the interactions between pharmaceutical promotion variables and health insurance coverage. The estimation results indicate that detailing and samples are less likely to influence physicians who see a higher percentage of HMO or Medicare patients, providing full support for H_4. All four interaction effects mentioned in H_4 are negative, and three of them are significant.

Therefore, we conclude that both Medicare and HMO coverage, compared with private insurance, detract from the main positive effect of detailing and samples on the drug prescription probability. These results can be explained by physicians' likelihood of prescribing from fixed formularies suggested by the HMO, which makes them relatively insulated from personal selling efforts. In the case of Medicare, in which physicians have more flexibility in selecting a drug, the revealed diminished effectiveness of personal selling can be attributed to the majority of patients being elderly people who are likely to suffer from other ailments, so considerations related to the patient's condition, other medications taken by the patient, or even cost would prevail. The finding that detailing and free samples to physicians whose patients are largely covered by Medicare or HMOs are not as effective as they are to physicians whose patients are largely covered by private insurance may be an indication of wasted resources and therefore warrants further research.

Implications for Managers and Policymakers

The results of this study point to conclusions with practical managerial and public policy value. We find evidence that physicians exhibit dissimilar brand preferences in the absence of external factors such as price and promotion.

However, we cannot determine whether these distinctive preferences are related to the propensity of physicians to favor a certain set of features in drugs (e.g., ingredients, lack of side effects) or to the particular characteristics of their pool of patients. Drug manufacturers that have the expertise and knowledge to compare the chemical composition and efficacy of alternative drugs would be in a much better position to conduct their own segmentation studies and decide whether it is the drugs or the patients that predetermine the existing preference segmentation of physicians and to adjust their targeting and promotional efforts accordingly.

Our findings indicate that the majority of physicians either demonstrate a lack of price sensitivity or are characterized by fairly limited price sensitivity. Consequently, we suggest that in general, detailing focused on the low price of a drug as its main differentiating feature will not be very effective. However, the increased price sensitivity in the case of Medicare patients suggests that when detailing to physicians with a large number of such patients, sales representatives should point out the lower price of the drug compared with alternatives. In the case of physicians who see mostly patients with HMO and Medicare insurance, we infer that detailing and free samples are not very effective. Therefore, we recommend that the pharmaceutical companies review their personal selling strategies for such physicians, because they could be wasting their promotional resources. In contrast, personal selling to physicians who see mostly patients with private insurance is effective, and drug manufacturers should start targeting these physicians in a more systematic way.

Our study reveals that the scope of personal selling should be carefully scheduled in terms of frequency, length of sessions, and number of free samples given away, so that the company can optimize the effectiveness of its direct promotional efforts and expense. The finding that exposing a physician to personal selling can become counterproductive beyond a certain amount of cumulative detailing minutes and samples is an important insight and should be taken into account. In this regard, we recommend that managers set a system for scheduling visits to physicians and specify the focus of the message (contingent on the prevalent type of insurance held by physicians' patients), the duration of detailing sessions, and the number of free samples to be dispensed per session to ensure optimal effects of personal selling. The exact optimal levels can be computed from the formulas in our model.

Considering other types of marketing activities pharmaceutical companies engage in—for example, DTC advertising—one implication of our research is that setting a schedule for personal selling to physicians and synchronizing it with the timing of DTC campaigns might develop promotional synergy and lead to enhanced effectiveness (for limited empirical evidence on the synergy between pharmaceutical detailing and DTC advertising of prescription drugs, see Gönül, Carter, and Wind 2000). Furthermore, such planning would establish economies of scope for the drug manufacturer by capitalizing on interactions between patients and physicians through a concerted marketing effort targeted at them simultaneously through different promotional channels.

In addition, our analysis sheds light on issues of interest to public policymakers. First and foremost, it helps disperse the concerns that personal selling is ethically objectionable because it might inordinately affect physicians. We find no evidence of such influence, and our findings suggest that detailing and free samples are mostly informative and increase price sensitivity. Another controversial aspect of personal selling to physicians is its cost compared with its social value. We find that the effectiveness of personal selling follows an inverted-U pattern, so that there are optimal values of both detailing minutes and free drug samples. Exceeding those values has dissipative economic impact on the company and potentially on society. Therefore, we find some reasons for concern related to potential waste of resources if this type of marketing activity is not administered systematically or monitored more stringently by the pharmaceutical companies.

Second, because HMO formularies impose restrictions on the drugs to be prescribed by physicians, personal selling to physicians with mostly HMO patients is wasteful. The social value of personal selling to physicians with Medicare patients can be viewed as positive, because it increases physicians' price sensitivity and thus leads to optimized utility on behalf of the patient. In general, we find no reasons to believe that direct selling—as one of the strategies of health care communications—has negative social consequences. However, there is room for pharmaceutical companies to customize their personal selling efforts and optimize the allocation of direct promotional resources, as suggested previously. We acknowledge that because our results are based on a single product category (drugs for a specific therapeutic condition), a cross-category analysis will substantially strengthen or challenge the findings reported in our article.

In our model, we control for unobserved heterogeneity in brand-specific constants and price effects by introducing a segment structure on the sample of physicians. We realize that other coefficients can be made heterogeneous as well. However, to justify a full heterogeneity specification, significantly larger numbers of observations per physician may be necessary to yield stable estimates. The additional data points may also help us resolve the impact of pricing on prescription choice more satisfactorily. For two segments, physicians appear to use price as a signal of quality. Further analysis on larger data sets may be necessary to validate these findings. Also, the reader should bear in mind that price changes over the estimation period are quite limited.

Accurate and comprehensive data sets are scarce in pharmaceutical marketing research. Although our data set is sufficient for the purposes of this study, it still lacks some important data. For example, medical information on patients' condition and treatment history are potentially important covariates. However, we do not know of a data set that includes competitive price and promotion information about manufacturers as well as patient-specific information. This is a subject for further research, given data availability. An interesting area for further research is the pressure that DTC advertising of prescription drugs exerts on the physician's choice of a prescription drug (Gönül, Carter, and Wind 2000). The synergy and potential conflict between DTC advertising and traditional detailing to physicians could also be investigated. Richer data sets that include patient-level advertising exposure and physician-level marketing exposure are needed to untangle these issues in depth.

Conclusion

The significance of public policy issues in the pharmaceutical industry cannot be overstated. The interests of managed care institutions and pharmaceutical companies alike give priority to prescription drug treatments over costly inpatient care. In addition, physicians are limited in their choice of prescription drugs through formulary agreements that lower cost. We find that allowing for segments of physicians is insightful because it reveals intrinsic brand preferences of physicians and reduces the estimation bias. We find evidence that in general, physicians' price sensitivity comes second to considerations about drug efficacy and patients' conditions. We investigate the role and impact of personal selling (detailing and samples) on the choice of prescription drugs. If such a promotional activity primarily provides beneficial information to physicians, it will be regarded as useful. However, if detailing inordinately influences prescription patterns, the expenditure and role of detailing and sampling activities should be reviewed by public policy advocates. We find evidence that detailing positively affects the prescription probability of a drug up to a point, after which excessive detailing becomes countereffective. The effectiveness of dispensing free samples to physicians follows the same pattern.

We find evidence of the informative value of personal selling, which makes physicians aware of new drug alternatives and their specifics and prices. To that extent, we conclude that the impact of detailing and samples is limited and mostly informative. Therefore, the concern that these activities may excessively influence physicians' prescriptions remains unfounded within the context of our analysis. Last but not least, we find that pharmaceutical manufacturers may be wasting resources when sending sales representatives to physicians whose patients carry mostly Medicare or HMO coverage, because detailing and free samples are not as effective for such physicians.

In summary, we conclude that there are no reasons for public concern regarding the social implications of the reviewed personal selling practice employed by drug manufacturers, because its effect is mostly informative. Moreover, we find that there is room for enhancing the effectiveness of direct promotional efforts to physicians by more specific segmentation, targeting, and positioning contingent on the intrinsic brand preferences demonstrated by certain health care professionals and the prevalent type of insurance held by their patients. In addition, the amount and scheduling of detailing and free samples can be optimized for maximizing the return on this type of promotion. Last, we suggest that finding ways to synchronize personal selling to physicians with DTC advertising may achieve further synergies, but the social benefits of such public drug advertising and its possible ramifications should be explored in depth.

REFERENCES

Berndt, Ernst R., Linda T. Bui, David H. Reiley, and Glen L. Urban (1994), "The Roles of Marketing, Product Quality, and Price Competition in the Growth and Composition of the U.S. Anti-Ulcer Drug Industry," Working Paper No. 19-94, Program on the Pharmaceutical Industry, Massachusetts Institute of Technology.

Bonoma, Thomas V. (1982), "Major Sales: Who Really Does the Buying?" *Harvard Business Review*, 60 (May/June), 111–19.

Chamberlain, Gary (1980), "Analysis of Covariance with Qualitative Data," *Review of Economic Studies*, 47, 225–38.

Gönül, Füsun F., Franklin Carter, and Jerry Wind (2000), "What Kinds of Patients and Physicians Value Direct-to-Consumer Advertising of Prescription Drugs?" *Health Care Management Science*, 3, 215–26.

Hellerstein, Judith K. (1997), "The Demand for Post-patent Prescription Pharmaceuticals," *RAND Journal of Economics*.

Hurwitz, Mark A. and Richard E. Caves (1988), "Persuasion or Information? Promotion and the Shares of Brand Name and Generic Pharmaceuticals," *Journal of Law and Economics*, 31 (October), 299–320.

Kamakura, Wagner A. and Gary J. Russell (1989), "A Probabilistic Choice Model for Market Segmentation and Elasticity Structure," *Journal of Marketing Research*, 26 (November), 379–90.

Kotler, Philip (2000), *Marketing Management: Millenium Edition*. Englewood Cliffs, NJ: Prentice Hall.

Krapfel, Robert E., Jr. (1985), "An Advocacy Behavior of Organizational Buyers' Vendor Choice," *Journal of Marketing*, 49 (4), 51–59.

Leffler, Keith B. (1981), "Persuasion or Information? The Economics of Prescription Drug Advertising," *Journal of Law and Economics*, 24 (April), 45–74.

Marks, Lawrence J. and Michael A. Kamins (1988), "The Use of Product Sampling and Advertising: Effects of Sequence of Exposure and Degree of Advertising Claim Exaggeration on Consumers' Belief Strength, Belief Confidence, and Attitudes," *Journal of Marketing Research*, 25 (August), 266–81.

McFadden, Daniel (1974), "Conditional Logit Analysis of Qualitative Choice Behavior," in *Frontiers of Economics*, P. Zarembka, ed. New York: Academic Press, 105–42.

Milgrom, Paul and J. Roberts (1982), "Limit Pricing and Entry Under Incomplete Information: An Equilibrium Analysis," *Econometrica*, 50 (March), 443–59.

——— and ——— (1986), "Price and Advertising Signals of Product Quality," *Journal of Political Economy*, 94 (4), 796–821.

Miller, Robert H. and Harold S. Luft (1994), "Managed Care Plan Performance Since 1980: A Literature Analysis," *Journal of the American Medical Association*, 271 (19), 1512–19.

Mitra, Anusree and John G. Lynch Jr. (1995), "Toward A Reconciliation of Market Power and Information Theories of Advertising Effects on Price Elasticity," *Journal of Consumer Research*, 21 (March), 644–59.

Nelson, Paul (1970), "Information and Consumer Behavior," *Journal of Political Economy*, 20 (March/April), 311–29.

——— (1974), "Advertising as Information," *Journal of Political Economy*, 24 (July/August), 729–45.

Nerlove, Mark and Kenneth J. Arrow (1962), "Optimal Advertising Policy Under Dynamic Conditions," *Economica*, (May), 129–42.

Newhouse, Joseph P. (1993), *Free for All? Lessons from the RAND Health Insurance Experiment*. Cambridge, MA: Harvard University Press.

PhRMA (1994), "Pharmaceutical Marketing Practices: Questions and Answers," paper presented at the PhRMA Marketing Practices Committee, Washington, DC (September).

Van Zandt, William (1993), "How Much Sampling Is Enough?" *Pharmaceutical Executive*, (September), 92–96.

Ziegler, Michael G., Pauline Lew, and Brian C. Singer (1995), "The Accuracy of Drug Information from Pharmaceutical Sales Representatives," *Journal of the American Medical Association*, 273 (16), 1296–98.