Advertising and the Price, Quantity, and Quality of Primary Care Physician Services

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ABSTRACT

Physician advertising has increased dramatically during the past decade, and this trend seems likely to continue. This paper examines the impact of such advertising on the price, quantity, and quality of primary care physician services.

Unlike earlier research on the effect of advertising in the professions, our study attempts to control for possible selection effects. The results suggest that physicians may advertise in order to obtain more desirable (for example, wealthier and less price-sensitive) patients. Consistent with this view, we find that advertising leads to higher price and quality (the latter measured as time spent per patient office visit) and lower total patient visits.

Had we not controlled for selection effects, advertising would appear to have lowered the price of physician services significantly. The results of this study suggest that future research on the price effects of advertising should control for potential selection factors.

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[Submitted December 1989; accepted March 1991]

I. Introduction

Efforts to understand the competitive effects of advertising have prompted considerable debate but little consensus. Advertising has many potential effects—on entry, price, quality of goods (or services), market concentration, and so on. It may enhance competition as measured by some of these criteria while inhibiting competition in other respects.

Advertising effects may differ across industries. For example, although advertising may improve consumer information and lower the cost of search in some markets, its competitive effects may be quite different in markets where goods are not standardized and information is incomplete, sluggishly transmitted, or difficult to use. Such conditions of imperfect information are particularly characteristic of markets for human resources, such as physician services.

The nature of advertising will also reflect market conditions. Where goods are standardized, price will be the instrument of competition and the focus of advertising. In industries where goods or services vary in quality and/or other salient characteristics, advertisers are more likely to focus on the features of products. Since the effects of advertising will vary by industry, by measures of competition, and by the type of advertising involved, analyses that treat advertising as a relatively homogeneous phenomenon are unlikely to be very meaningful. Within-industry studies of specific types of advertising provide a more reliable, albeit more limited, test of effects.

We wish to study the effects of advertising on the price, volume, and quality of primary care physician services. Physician advertising has increased rapidly in recent years,[1] and this trend is likely to continue.[2] A study of its effects may be relevant to advertising for other services, or categories of professionals—an important concern in our increasingly service-oriented economy.

Most previous research on the price and quality implications of adver-

1. Data from the American Medical Association's Socioeconomic Monitoring System indicate that, between 1982 and 1987, the proportion of nonfederal patient care physicians who advertised their practices grew from less than 5 percent to 20 percent—a fourfold increase.
2. Competitive pressures are increasing in the market for physician services. Kletke et al. (1987) estimate that between 1985 and 2000, physician supply will grow by 34 percent—substantially more than will the general population. Survey results presented by Folland (1987) suggest that physicians will respond to increased competitive pressures by advertising their practices.

tising has focused on manufactured goods and hence has limited relevance to physician advertising. In the manufacturing sector, products are much more standardized, and output more easily expanded, than in the physician services market.

Studies on the effects of advertising professional goods and services are more relevant. Such studies have examined advertising effects on the price and/or quality of prescription drugs (Cady 1976), eyeglasses (Benham 1972; Benham and Benham 1975), optometric services (Feldman and Begun 1978, 1980, and 1985; Begun 1979; Bond et al., 1980; Kwoka 1984; Haas-Wilson 1986; Haas-Wilson and Savoca 1990), and routine legal services (Cox et al. 1982, 1986). For the most part, this research indicates that price advertising leads to lower prices, while the effects on quality have been mixed.

The Federal Trade Commission (FTC) clearly hoped that its lengthy efforts to promote price advertising of physician services would reduce prices. Barney (1983) relates that during its court case against the American Medical Association (AMA) the FTC stated: "It is especially important that price advertising remain as unfettered as possible" (p. 97).

Theory suggests, however, that price advertising will be rare in markets such as the one for physician services. Indeed, physician advertising provides a good illustration of the so-called sign-posting phenomenon (Zeckhauser and Marks 1989). In sign-posting situations the seller disseminates a limited amount of information about selected characteristics of a product; the interesting theoretical questions relate to the content that will be chosen for signs, and the effect of posting them. Some restrictions are imposed by the dollar costs of advertising (on the seller's end) and the human information processing costs (on the buyer's). Moreover, sellers will typically have an incentive to suppress some of the information they possess: a weak repair record for a car, past dismissals for a job applicant, lack of board certification for a physician. Price information plays a distinctive role in sign-posting. With nonstandardized products—and physician services assuredly fit into this category—a low price may indicate poor quality. This factor would tend to suppress the dissemination of price information. Even for a relatively standardized commodity such as an office visit, a low price might indicate, for example, that the physician allows little time for an average visit, or has few patients.

A critical element in the sign-posting paradigm is the ability of buyers to decode the information that is provided. A customer who is unable to judge quality himself and who observes a low price for a nonstandardized commodity may well assume that knowledgeable buyers have assessed the good as being of low quality. Given the potential for such inferences, we should expect that for nonstandardized goods whose quality is difficult

to assess—surely the case with many advertised services—price posting will not be a critical element in advertising.[3]

This paper expands upon earlier studies on advertising in the professions in several respects. First, it extends the analysis to the services of physicians, probably the most important decision-making group in the growing health care sector, which by 1986 constituted nearly 11 percent of GNP (see Division of National Cost Estimates 1987).

Second, it examines effects on the quantity of services as well as on price and quality. A major aim of advertising may be to increase the number of customers, although society—increasingly in a third-party-payer capacity—may wish to limit the use of physician services.

Third, this study uses a much wider array of explanatory variables than have most previous studies of advertising in the professions. Fourth, the study controls for possible selection effects, an issue that has been largely ignored by previous work in this area. That is, our empirical estimates explicitly allow for the possibility that advertisers and nonadvertisers may differ in ways that are not directly observable.

The body of this paper is divided as follows: Part II summarizes previous work on the effects of advertising in the professions and discusses the implications for physician advertising. Part III specifies the empirical models to be estimated, and Part IV describes the data used in this study. The estimation procedure and empirical results are discussed in Part V. Part VI discusses the implications of these results and offers some concluding remarks.

II. Advertising in the Professions: Previous Work

A number of studies have investigated the effects of advertising on the price and/or quality of prescription drugs, eyeglasses, optometric services, and legal services. Somewhat surprisingly, these studies have largely ignored the effects of advertising on quantity of services.[4]

3. Others have also questioned the role of price competition in medical markets. For instance, in discussing the hospital industry, a market closely related to physician services, Joskow (1983) has argued that, in the absence of major changes in the demand and supply of health insurance, "there is little reason to believe that price competition will play an important role here; quality and amenity competition is the norm" (p. 172).

4. Prior studies may have been oriented toward issues that would be of interest to consumers, focusing on the price and quality implications of advertising rather than the efficacy of advertising in securing more business for the firm. Furthermore, theoretical research (see, for example, Akerlof 1970; Nelson 1970, 1974, 1978; Schmalensee 1978; Leland 1979; Wiggins and Lane 1983) has tended to focus on advertising in relation to price and/or quality decisions, perhaps guiding the focus of subsequent empirical research.

A. Prescription Drugs

The major study in the prescription drug area, Cady (1976), examines the effects of advertising on a price index of 10 commonly dispensed prescription drugs from a national survey of 1,933 pharmacies in 1970. For each of several model specifications, states that restricted price advertising were found to have significantly higher prices for prescription drugs. Cady also reports on advertising effects on the prices of individual drugs. In nearly every case, advertising restrictions have a strong positive effect on price.

B. Eyeglasses

Benham (1972) estimates the prices of eyeglasses[5] in states with and without advertising restrictions, finding that prices are significantly higher in states with advertising restrictions. He also finds that restrictions on price advertising alone have no significant effect on optometric prices, but complete advertising restrictions (in other words, on both price and nonprice information) do lead to higher prices. This result is somewhat surprising, since one might have thought that price advertising alone would have an effect on prices. In a related study, Benham and Benham (1975) use data on the prices paid for eyeglasses by consumers in 1970 to investigate how professional control on information affects prices, finding that such restrictions raise the price of eyeglasses significantly.

C. Optometric Services

A number of studies have examined the effects of advertising on the price or quality of optometric services. Feldman and Begun (1978) found that eye exam prices were 16 percent higher in states that banned price adver-

More recently (see Nichols 1985; Hochman and Luski 1988), theorists have begun to examine the relationship between advertising and quantity. This shift has been inspired by the pioneering work of Stigler and Becker (1977), who argue that utility is generated by "commodities" consumers produce with purchased goods or services, human capital, firms' advertising, and time. In this view, advertising may lower the shadow price of these commodities, increasing the optimal amount of commodities produced (and quantities of goods and services used as inputs) for given purchase prices of the goods (services) used in this production process. These considerations suggest that the salient empirical effect of advertising may be to change the quantity of goods or services consumed, not their purchase prices.

5. In fact, Benham examines two dependent variables: the price of eyeglasses and the combined price of eyeglasses and eye exams. He focuses primarily on eyeglasses, however, for two reasons: 1) very few states permitted advertising of eye examinations during the period of his study (1963), and 2) the cost of eye examinations varied little from state to state in his sample.

tising by optometrists and opticians. By contrast, price advertising bans on optometrists or opticians alone had little effect, leading the researchers to conclude that "the two advertising bans work by interaction—both must be present to significantly raise the price of eye examinations" (p. 247).[6] Using the same data, Feldman and Begun (1980) conclude that advertising bans raise price and increase price dispersion. Begun (1979) reports that professional controls on information increase the price of eye examinations. In a welfare analysis of the quality impacts of advertising bans and other professional regulations, Feldman and Begun (1985) conclude that elimination of advertising bans would probably lower quality of care. They note, however, that this result does not justify advertising bans, because "the extra quality engendered by regulations is not valued by consumers at its marginal cost" (p. 30).

How do the prices of advertisers and nonadvertisers compare in markets where advertising is permitted? This question is relevant for medicine since, for nearly a decade, all states have permitted physician advertising.[7,8] Bond et al. (1980) examined price data for optometric examinations and eyeglasses and for optometric examinations alone in nine major metropolitan areas. The researchers found that in markets that permit advertising, nonprice advertising had little effect on the prices of eye examinations and eyeglasses, but price advertising led to lower prices. Bond et al. also examined the effects of advertising restrictions on the quality of various services, with ambiguous results. Kwoka (1984) further explores the effects of optometric advertising, and finds an inverse relationship between advertising and price.

In comparison with optometrists in markets that restrict advertising, both studies note, nonadvertisers in markets that permit advertising

6. As in most studies of this type, the researchers used prices charged by sellers. In markets where advertising is prevalent, the average sellers' price may be much higher than the average price actually paid by buyers (to the extent that buyers patronize the low-price advertisers). Thus, the price effect of advertising bans might be even greater if one measured average buyers' price instead of average sellers' price.

7. In 1980 the New York Federal appeals court held that the Federal Trade Commission had the authority to regulate the competitive practices of professional organizations. This ruling, subsequently upheld in a 1982 Supreme Court appeal, empowered the FTC to prohibit bans on advertising in the medical profession. See Rizzo and Zeckhauser (1990) for further details.

8. Fundamentally, it is not advertising bans per se that are important, but the extent of advertising in the market (we are grateful to an anonymous referee for calling this point to our attention). Thus one would like to ask how the extent of advertising in the market affects price and other outcomes of interest. Unfortunately, market-level measures of the extent of physician advertising are unavailable at present.

spend on average more time per examination, a measure of quality, and advertisers spend less.[9]

Haas-Wilson (1986), also using FTC data, finds that advertising restrictions lowered price but had no quality effects. Haas-Wilson and Savoca (1990) measure eye care quality in terms of an index of contact lens wearers' eye health. They control for potential selection bias due to consumers' nonrandom choices of provider type. Neither the selection-adjusted nor the unadjusted estimates indicate any significant relationship between advertising restrictions and quality of care.

D. Legal Services

Two studies have examined advertising practices by individual attorneys to test for price and quality effects. Using a sample of 243 attorney respondents practicing in Phoenix, Arizona, Cox et al. (1982) find that advertisers charged significantly lower fees for routine legal services.[10] The researchers clearly recognize, however, the possible significance of selection factors:

> No inferences . . . concerning the likely effect of advertising on routine legal services may be drawn from the differences these data show . . . it is probable that the data capture the tendency for those seeking additional clients both to advertise and to charge lower fees (p. 315).

In subsequent research, Cox et al. (1986) use attorney survey data from seventeen metropolitan areas to examine the effects of advertising on the quality (measured by time spent per service) of routine legal services. The results suggest an inverse relationship between advertising and quality.

E. Physician Services: Experimental Evidence

Although there have been no empirical studies of how actual physician advertising affects the price, volume, and quality of service, an experiment conducted by Hibbard and Weeks (1989) sheds light on the likely operation of advertising in this market. They randomly assigned individuals to one of two groups, which consequently turned out to be quite similar in terms of age, sex, race, and other sociodemographic character-

9. Comparisons should be interpreted with caution since nonadvertisers constitute the entire market in restrictive regimes but only a portion in permissive regimes.

10. The services examined were simple wills, wills with trust, uncontested bankruptcies, and uncontested divorces.

istics. The control group received no information about physician fees. The experimental group received a directory of fees charged by physicians in the area for commonly performed procedures,[11] as well as a comparative chart indicating the range of fees for each procedure. Both groups were followed over a two-year period.

The results were striking. No significant differences were observed between the two groups in the average cost of a physician visit, even though the experimental group knew who were the lowest- and highest-cost providers in their areas.

The Hibbard-Weeks study suggests that consumers do not use information about physician fees to seek out the lower-cost providers. But since physician advertising in practice seldom focuses on price, the impact of actual advertising in this market remains an open question.

F. Implications for Physician Services

What are the implications for prices in the market for physician services, where advertising has been permitted for a number of years? The answer to this question depends in part on the nature of physician ads. While this issue has not been studied, available evidence strongly suggests that physician advertisements rarely include price information.[12] Given the

11. This experiment was actually conducted on two samples. One sample consisted of 658 employees of the Oregon state government. The second consisted of 717 Medicare Part B enrollees living in Oregon.

12. Feldman and Begun (1978) note, for example, that "advertising of prices by ophthalmologists is virtually nonexistent" (p. 253). Since the Feldman-Begun study dealt with a period before the FTC's challenge to the AMA's advertising ban, this finding is of limited value in inferring the nature of physician advertising in the 1980s. However, conversations with government regulators and health care advertising professionals suggest that physician price advertising continues to be quite rare. First, officials at the Federal Trade Commission, who routinely investigate complaints about physician ads, inform us that these complaints almost always involve quality of care issues and claims about superiority and credentials, not price. Indeed, Richard Kelly of the FTC's Bureau of Consumer Protection could not recall *a single instance* of a complaint regarding physician price advertising, although complaints about other forms of physician advertising are common, and price advertising complaints are common in other realms such as the eyeglass industry (personal communication, August 10, 1990).

Second, a company whose services are designed to be functionally equivalent to physician advertising reports that price is only a minor consumer concern. Prologue, Inc., a Denver-based company, supplies consumers with a variety of information on potential physicians. Officials at Prologue's headquarters told us that, although they maintain very detailed information about physicians and their practices, price information is very limited. Moreover, information on prices for specific services and procedures was rarely requested by consumers, who were far more interested in the physician's credentials, office hours, and the types of insurance he or she accepted. Clearly, since Prologue's service is designed to substitute

nonstandardized nature of physician services, price advertising may not be a very effective means of attracting customers, as the earlier discussion of sign-posting suggests.[13]

Physician advertising has been permitted in all states for nearly a decade, and a few studies have examined advertising effects in markets where advertising is permitted. Bond et al. (1980) report that nonprice advertisers do not charge prices significantly different from those of their nonadvertising competitors. This seems to suggest that physician advertisements would not lead to lower prices. On the other hand, Pauly and Satterthwaite (1981) have argued that price may play an important role in the demand for primary care physician services because health insurance coverage is generally less complete for primary care than for more specialized care such as surgery.[14]

Indeed, the conventional wisdom among economists is that physician advertising should lead to lower prices. Briefly, the reasoning is that advertising will decrease the cost of consumer search and increase the substitutability of services by different providers. The elasticity of demand for physician services will increase, and ultimately price will decline. In his classic text on health care economics, Feldstein (1988) presents this argument:

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for direct physician advertising, one would have expected it to provide a good deal more information about physician prices if physician advertisers regularly furnished this information themselves.

Attitudinal surveys of physicians indicate *why* price advertising may be rare: physicians are strongly opposed to price advertising. Over 70 percent of physicians believe that fee advertising will adversely affect their public image, and 60 percent do not believe that fee advertising will offer them any personal benefits (see Folland 1987). Furthermore, survey results reported by Harvey (1988) indicate that while physicians have become more receptive to nonprice advertising, the overwhelming majority continues to oppose fee advertising. For example, in 1977, 28 percent of physicians favored allowing physicians to advertise their professional backgrounds. By 1988, this figure had risen to 47 percent. In contrast, the percentage of physicians opposed to fee advertising in newspapers, or on radio or television, remained very high (92 and 90 percent, respectively).

13. Instead of advertising price, some physicians may advertise in order to introduce products or services. As Gray (1986) notes, plastic surgeons in particular employ this type of advertising, perhaps because it is easy to convey how the consumer may benefit from cosmetic surgical procedures such as liposuction, breast enhancement or reduction, or tummy tucks. Another, perhaps more prevalent, form of physician ad consists primarily of objective information, such as the physician's practice location, specialty, or office hours. Potential adverse reaction by consumers and professional colleagues probably limits quality claims and testimonials in physician advertising (Rizzo and Zeckhauser 1990).

14. Sloan and Steinwald (1975) report that office visit fees are fully covered by patients' insurance for only 21 percent of specialists in internal medicine. Corresponding figures are even lower for general practitioners (14 percent) and pediatricians (13 percent). The researchers also estimate the marginal coinsurance rate for an office visit at 87 percent.

> Advertising of medical services . . . provides the consumer with information on the similarity and differences of services sold by different providers, enabling the consumer to evaluate the degree of substitutability of competing providers. The demand curves of the different providers are made more elastic (p. 322).

The fact that advertising conveys information, however, does not necessarily mean that it increases demand elasticities. That conclusion depends on the informative content of advertisements and on their effect on consumers' knowledge about product quality (Comanor and Wilson 1979, p. 456). In the eyeglass industry, where products are fairly standardized, the informational content of ads may limit consumer attachment to individual firms, thereby promoting more elastic demand (Brozen 1974).

Certain distinguishing features of the physician services market suggest alternative possibilities. Since the product is far from standardized, it is generally much more difficult for consumers to compare physician prices than to compare the prices of eyeglasses or prescription drugs. Indeed, if consumers are significantly concerned about quality, advertising may even serve to differentiate physicians, as consumers respond to ads by those physicians perceived to provide higher quality—or at least to possess more of the attributes consumers want. This could lower demand elasticities, resulting in a positive relationship between advertising and price. This situation might be described by some form of monopolistic competition model, where advertising fosters some market power; each firm (physician) faces a downward-sloping demand curve, and cross-elasticities of demand between pairs of firms are low (Chamberlin 1933).

Furthermore, third-party payment, which is more readily available for physician services than for either optometric services or prescription drugs, decreases consumer incentives to search for lower-priced physicians. As a result, advertising may have limited effect in inducing consumer comparison shopping and increasing the elasticity of demand for physician services. Given that insured consumers are responsible for only a fraction of their medical costs, physicians who advertise may realize substantial increases in the number of potential patients, far beyond their ability to expand capacity.[15] They may then be able to choose the highest payers from a large pool of potential clients. Ultimately, the relationship between physician advertising and price cannot be resolved on a theoretical basis. It is an empirical issue, and a focus of this study.

15. Gray (1986) relates some interesting albeit probably extreme examples: ". . . an ad for radical keratotomy brought one Southern California ophthalmologist 900 calls in three days. A solo plastic surgeon in Virginia spends $20,000 a month on ads and does 40 cosmetic surgeries per week" (p. 180).

If physicians who advertise set higher prices, that need not imply that elasticities diminish with advertising. Advertising expands demand, and higher price may be associated with increases in marginal cost—e.g., the shadow price of time—due to expanded output. (We assume that advertising itself does not lower the marginal cost curve.) Quantity provided, however, can be an unambiguous indicator. If quantity contracts despite an outward shift in the demand curve, this implies that the demand curve has also twisted to become less elastic. In our empirical work, we shall look first at quantity.

The likely effects of physician advertising on the quality of care, a complex and elusive concept, are even more difficult to predict. One readily available quality measure that has been considered elsewhere (Bond et al. 1980; Kwoka 1984; Cox et al. 1986) is time spent per customer. For physician services, such a measure would be the average time spent by a physician on each patient visit. It is conceivable that physician advertisers may try to see more patients (spending less time with each), capitalizing on the less elastic demand for their services created by advertising, in order to defray advertising costs. On the other hand, spending time with patients may serve purposes complementary to advertising, reinforcing the effectiveness of ads in obtaining new patients. Gray (1986) relates some telling examples:

> Even if advertising brings patients into a practice, it will take good medicine and personal consideration to keep them there. Mangement consultant George Conomikes illustrates: "A large clinic spent $250,000 a year on advertising, including newspapers, radio, and TV. It attracted loads of patients, but they all had to wait an hour and more to see a doctor. Few came back."
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> Matthew Midgett, vice president of [the advertising agency] J. Pinto and Associates in La Jolla, Calif., adds: "A campaign might get patients in the front door, but if the doctor is indifferent or his assistants rude, those patients will go right out and never return. Satisfied patients, on the other hand, will do word-of-mouth advertising. That's the best kind" (p. 194).

Our naive expectation would be that advertising should raise patient volume, particularly the volume of new patients. Quite possibly, however, advertising is more effective for advertisers than it would be if nonadvertisers with the same observed characteristics chose to advertise as well. If so, the true advertising effects on patient volume could be considerably weaker.[16] If advertising physicians are seeking to capitalize

16. It is also possible that advertising may increase the number of potential patients but

on enhanced demand mainly to raise prices or the quality of care, advertising could diminish aggregate output.

III. Model Specification

We wish to determine the effects of advertising on the quantity, price, and quality of physician services, denoted as Q, P, and L, respectively. We assume that each physician has some degree of market power, and therefore equates marginal revenue and marginal cost. Structural equations for the physician's decisions are as follows: represent the quantity of physician i's services demanded as $D_i = f(P, A^*, X_d)$, where A^* is the level of the physician's advertising, and X_d is a vector of exogenous explanatory variables. The marginal cost of his/her services is $C_i = g(A^*, X_c)$, where X_c are exogenous variables determining supply. There may be an overlap between X_c and X_d. Their union is X. We would expect increases in price to lower demand. Advertising, which is costly to provide, should raise demand but reduce output at any price.[17] Advertising may also exert indirect effects by working through quantity and quality.

Several additional considerations are relevant. Our data show only whether physicians did or did not advertise, not their level of expenditure. Their spending is a latent or unobserved variable, indicated by an asterisk. We observe only a binary indicator of this level, namely a value of A equal to 1 (advertise) or 0 (not). This errors-in-variables feature alone makes it desirable to estimate advertising in a two-stage procedure. If the advertising decision is endogenous—say physicians with lower opportunity costs are more likely to advertise—that provides a further argument for a two-stage approach. For each physician we develop a cardinal proxy measure for advertising intensity, call it $ADVERT_i^p$, whose estimate we employ in our second-stage regressions for Q, P, and L.

What outcomes might we expect to see? In general, we would expect advertising to boost demand. Earlier we outlined arguments why it might either increase or decrease the price elasticity of demand. With an increase, the quantity of services provided by a profit-maximizing physician will increase as well. Price could move in either direction. If, on the other hand, advertising promotes product differentiation and diminishes

not the number of new patients, if physicians select only the most desirable ones from the larger pool of potential clients.

17. Factors of production that enhance productivity (for example, the use of computers) lower the cost of producing at any given level of output, and could increase optimal output. We do not consider advertising to be productive in this fashion.

elasticity, then quantity should contract and price surely increase.[18] The optimizing physician may also take advantage of increased demand by being more selective about patients, or otherwise altering the quality of the practice.

A. The Reduced-Form Model

To proceed from structural equations to a reduced-form presentation, assume each physician equates marginal cost and marginal revenue. Then both price and quantity can be defined as a function of advertising propensity and a vector of exogenous variables. In like fashion, quality can be chosen to optimize some positive function of profits and taste for quality. We deal with the logarithmic form and assume that the natural logarithm of the quantity [price, quality] received by a physician is linearly related to the scaled level of advertising intensity, and additional explanatory variables, namely $\boldsymbol{X}$. The level of physicians in relation to local population (physicians per capita, or *DOCPOP*), is considered to be endogenous in this analysis or measured with error, and is also estimated at the first stage.[19]

1. For Quantity

Thus we have a semi-reduced form relation for quantity:

$$(1.Q)\quad \ln Q_i = a_0 + a_1 \boldsymbol{X}_i + a_2 \ln(DOCPOP_i)^P + a_3 ADVERT_i + e_{1i}.$$

The reduced form for *DOCPOP* is given by:

$$(2)\quad \ln(DOCPOP_i) = b_0 + b_1 \boldsymbol{X}_i + b_2 \boldsymbol{Z}_i + e_{2i},$$

where

$\ln Q_i$ = the natural logarithm of quantity for the ith physician,

$\ln(DOCPOP_i)$ = the natural logarithm of per capita physicians in the ith physician's county,

$\ln(DOCPOP_i)^P$ = the predicted value of the natural logarithm of per capita physicians estimated from Equation (2),

$ADVERT_i$ = an advertising dummy variable taking the value 1 or 0,

$\boldsymbol{X}_i$ = a vector of exogenous variables that directly determine price and physician supply,

18. If demand shifts enough to the right, quantity may increase even if elasticity diminishes.
19. We thank a referee for suggesting that we treat *DOCPOP* in this fashion.

$\mathbf{Z}_i$ = a vector of exogenous variables that are orthogonal to e_{1i} and that help to determine physician supply,
e_{1i}, e_{2i} = effects of omitted variables and specification errors, and
$\boldsymbol{a}$, $\boldsymbol{b}$ = vectors of coefficients of economic interest.

In what follows, we suppress the subscript i.

2. For Price and Quality

Equations (1.P) and (1.L) for price and quality are identical in form to (1.Q), with Q replaced by P and L, respectively.

B. Traditional Versus Refined Models

The traditional approach for estimating advertising effects has been to employ a binary indicator variable (*ADVERT*) for the true level of advertising expenditures (A^*) as in equation (1.Q) above. We also report results for the traditional approach where the 0, 1 advertising variable is (mistakenly) assumed to be orthogonal to the error terms in these regressions. These results are provided in the rows labeled "traditional model" in Tables 3, 5, and 7.

Our preferred approach (the "refined model") uses a two-stage procedure that allows us to deal with errors-in-variables that are endemic to the binary advertising indicator. The refined model also allows for selection effects, that is, the possibility that advertisers differ from nonadvertisers in ways that are not directly ascertainable (in other words, not fully captured by variables in $\boldsymbol{X}$). If either circumstance proves to be the case, the error term will be correlated with the advertising decision.

To control for selection effects, we estimate the propensity to advertise using variables, $\boldsymbol{V}$, that do not independently determine quantity, price, or quality. We then obtain a predicted estimate for advertising, $ADVERT^P$, from the fitted values of the reduced-form relation:

(3) $ADVERT = c_0 + c_1\boldsymbol{X} + c_2\boldsymbol{V} + e_3$,

where

$\boldsymbol{V}$ = a vector of exogenous variables, which do not directly have a role in Equations (1.Q), (1.P), and (1.L),
e_3 = the error term, and
$\boldsymbol{c}$ = a vector of coefficients.

Equation (3) plays a role parallel to Equation (2), which treats ln(*DOCPOP*) as endogenous. This separate specification for the advertising equation gives us a method to overcome an unobserved variable and/

or endogeneity problem. Using the fitted values obtained from Equation (3), we can consistently estimate the overall effect of advertising on the three dependent variables of interest, Q, P, and L. We shall hereafter refer to the model that uses the fitted values for *ADVERT* from Equation (3) as the "refined model."

Following Heckman (1978) we estimated Equation (3) using a linear probability model. (In results not reported here, we used probit analysis at the first stage, which produced qualitatively similar results.)

Earlier, we described two potential omitted-variables problems when advertising effects are estimated using a binary advertising indicator: if either is significant, the coefficients in Equations (1.Q), (1.P), and (1.L) will differ between the traditional and the two-stage estimation procedures. We find such differences. For example, in Table 5, the traditional model would predict a negative effect of advertising on price. The refined model, by contrast, determines an economically and statistically significant positive effect.

How might these differences emerge? To illustrate, assume that advertising enables physicians to increase price, and that physicians with underutilized practices—hence, low opportunity cost for time—are more likely to advertise, other factors equal. For this reason alone, the advertisers will be charging lower prices, a factor that counterbalances the price-raising effects of advertising. The traditional model cannot disentangle these two effects. The refined model in essence removes the first (selection) effect.[20]

Moreover, observing what happens to physicians' quantities may help us to ascertain whether advertising diminishes demand elasticity for physicians who advertise. In particular, if quantity shrinks, that indicates that elasticity has diminished.

IV. Data

Physician data are taken from American Medical Association 1987 and 1988 core surveys[21] of nationally representative samples

20. Our results do not include predicted values for Q, P, or L in any of the equations, primarily because we did not have a sufficiently rich set of independent variables. In a speculative calculation of Q, we simply controlled for price and quality effects by adding actual price and quality measures as explanatory variables in the quantity regressions. The relationship between advertising and quantity was considerably weakened once actual price and quality were included, suggesting that most of the advertising effect on quantity works indirectly, through price and/or quality.

21. Core surveys are conducted annually as part of the AMA's Socioeconomic Monitoring System (SMS). They are the largest and most comprehensive of the SMS surveys.

of nonfederal patient-care physicians. Each survey sample consists of approximately 4,000 physicians (response rate was 67.0 percent for the 1987 sample and 70.8 percent for the 1988 sample). We restrict our sample to self-employed primary care physicians (primary care physicians include general/family practitioners, specialists in general internal medicine, and pediatricians).[22] We eliminated employee physicians, such as those who work for health maintenance organizations (HMOs), because they are likely to have far less autonomy in deciding whether or not to advertise. These exclusions, together with missing values in some of the response items, left a usable sample of 1,615 physicians.

A. Measures of Price, Quantity, and Quality

We use two measures of price: the price of an office visit with a new patient, ln(*PNEW*), and the price of an office visit with an established patient, ln(*POLD*).[23]

Our measures of quantity are office visits with new patients, ln(*QNEW*), and total patient office visits, ln(*QOFF*). Although our prior expectation is that new patient office visits should be more sensitive to advertising effects than are total office visits, the latter measure lets us test whether advertising affects the overall volume of patients the physician sees. Two measures of quality are examined: the average physician time spent per patient office visit, ln(*TIMEOFF*), and the average physician time spent per patient visit in all practice settings, ln(*TIMEALL*).

B. Physician Advertising Variable

Physician advertising is observed as the dummy variable *ADVERT*. Specifically, advertisers are physicians who had advertised their practices in newspapers or magazines or on radio or television during the past five years. Advertising by primary care physicians has been substantial; about 22 percent of our sample have advertised their practices.

C. Physician Supply

Physician supply is measured as the natural logarithm of per capita office-based primary care providers, ln(*DOCPOP*). Since this variable is

22. As Mechanic (1978) notes, primary care is most typically defined in terms of these specialties.

23. We elected to estimate ln(*PNEW*) and ln(*POLD*) separately because new and established patient office visits are heterogeneous procedures and, given our large sample size, it was not necessary to pool them to achieve reliable estimates.

theoretically endogenous, a simultaneous equations estimation procedure was used to obtain the predicted value of physician supply, $\ln(DOCPOP)^P$. This measure of supply serves as an explanatory variable to predict advertising propensity, and is also included in the price, quantity, and quality regresssions.

D. Other Explanatory Variables

Other variables include measures of consumer demand and physician and practice characteristics. We also include market measures of average practice costs and prices. Finally, variables used to identify the advertising and physician supply equations (discussed below) are also included in the analysis. (The Appendix summarizes the names, descriptions, mean values, and sources of variables used in this study.)

E. Some Caveats

While the data set we analyze contains a rich variety of information about physicians and their practices, it has a number of limitations. In particular, our advertising measure is less than ideal. We would have preferred to use dollar measures of physician advertising expenditures, but reliable estimates are unavailable.

The reader is also cautioned about the quality indicator we employ. Quality of care is a complex and elusive concept. Although it may be proxied in a variety of ways, any such measure, including the one used in this paper, is highly imperfect. Moreover, our findings with respect to time spent with patients should not be generalized to other measures of quality, such as patient mortality and morbidity.

To guard against heterogeneity in services provided, we have confined our analysis to primary care providers. Even so, physicians in the sample undoubtedly differ in the nature and extent of services provided. To some extent, our physician- and specialty-specific explanatory variables control for such differences. In addition, since the advertising decision is estimated at the first stage, the measure we obtain will not recognize unobserved differences between advertisers and nonadvertisers, such as differences in the nature of services provided.

This study relies on physician responses to questionnaires. It would have been preferable to use price and quality information obtained by trained surveyors who actually received the services, as in Bond et al. (1980) and Kwoka (1984).

V. Estimation and Results

We estimated results employing both two-stage least squares and three-stage least squares. The results with the two methods were very similar. We report three-stage results here.[24] The justification for this method is that error terms are likely to be correlated across the structural equations of our model. The three-stage least squares approach, which allows for potential correlations between the disturbance terms of the estimated equations, increases the efficiency of the estimates.[25]

A. The Advertising Equation

Variables used to identify the advertising equation include measures of potential new clients, consumer uncertainty, and physician uncertainty. We would expect physicians to find advertising more appealing in markets where potential new customers are abundant, and hence expected returns to advertising relatively high. Thus we include a variable (*POPNEW*) that measures the percentage of the population that moved into the physician's county during the period 1980–86.

Consumers who have little information may be particularly responsive to informative advertisements. Thus, market uncertainty on the part of consumers should also be a positive advertising determinant. To some extent, *POPNEW* captures consumer uncertainty. Following Pauly and Satterthwaite (1981), we also include population density (*POPDEN*) as another proxy measure for consumer information.[26,27]

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24. Two-stage results are available from the authors on request.

25. The three-stage approach uses residuals estimated from each equation in the two-stage least squares model to compute the variance-covariance matrix of the disturbance terms. If any one of structural equations in the two-stage model is incorrectly specified, the three-stage approach will pollute estimates for the other equations as well. As noted in the text, however, the results using two-stage and three-stage methods were very similar. The salient difference appears to be that the three-stage approach improved the efficiency of the estimates slightly.

26. Pauly and Satterthwaite (1981) argue that consumer mobility tends to be low in areas where population density is high, limiting the extent of consumer search and information.

27. Alternatively, there is some precedent for entering consumer information variables directly into the price equations. Pauly and Satterthwaite (1981) took this approach (they estimate the so-called increasing monopoly model, in which consumer information proxies are specified as direct determinants of price—see also Satterthwaite 1985). Such a specification amounts to a stern test of the advertising effect on price. By including consumer uncertainty measures directly in the price equation estimates, one can control for potential upward bias in the advertising-price estimates due to the theoretically positive (under the

A further motivation for advertising may be to reduce physicians' own uncertainty about market conditions. To capture physician uncertainty, we define a dummy variable (*NEWPRAC*), set equal to 1 if the physician changed into his or her current practice in 1980 or later, and 0 if the physician had never changed his or her practice, or changed before 1980.[28]

A second dummy variable (*MOVED*) is set equal to 0 if the physician is practicing in the same state in which he or she graduated from medical school and equal to 1 otherwise. As we have argued elsewhere (Rizzo and Zeckhauser 1990), movers may be less certain about the number of patients they will attract and, as a result, may perceive a broader range of patient caseloads as possible outcomes. Advertising may be particularly appealing to movers as a mechanism to insure against low patient caseloads.

By contrast, there is no compelling reason why the variable *MOVED* should be an important determinant of price, volume, or quality. Rizzo and Zeckhauser (1990) found no differences in the average annual earnings of movers and stayers,[29] suggesting that these two classes of physicians do not differ substantially in terms of native ability or other factors associated with the quality of care, and the price this quality can command.

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increasing monopoly model) direct effect of consumer uncertainty on price. However, the advertising results reported in the text were unchanged when consumer information variables were entered directly into the price equations (these results are available from the authors on request). Thus it appears that this potential source of bias is not important. Since our intention is to focus on advertising effects rather than to explore alternative price equation specifications, we use a more conventional specification in reporting our results.

28. Of course, physicians who have switched practices recently are almost by definition likely to see more new patients. As a result, we enter *NEWPRAC* independently in the regression equation that estimates the number of new patient office visits. Although the total patient load for physicians who have recently switched practices is likely to contain a higher proportion of new patients, it is not clear that their total patient loads, prices, or quality measures should differ from those of physicians who did not switch. Changing practices need not mean starting over from scratch. If the physician joins a group, for example, there may be a ready practice waiting for him or her. Alternatively, a practice may be purchased from a soon-to-retire physician. In preliminary statistical analysis, we tested these hypotheses by entering *NEWPRAC* independently in all price, quantity, and quality regressions. In every case but the new patients regression, *NEWPRAC* had only a small and statistically insignificant independent effect.

29. There is also little relationship between *MOVED* and average annual earnings for the data set used in this analysis. By contrast, the variance of annual earnings (a measure of uncertainty) is 55 percent higher for movers than for stayers, which is consistent with the notion that movers have more income uncertainty than do stayers.

B. The Physician Supply Equation

As argued earlier, physician supply should be treated as endogenous. Fortunately, Pauly and Satterthwaite (1981) provide a persuasive argument for identifying the physician supply equation. Specifically, they point out that provider location decisions depend on income potential as well as the attractiveness of the area as a place to work. Following them, we use five county-level measures of the attractiveness of the physician's location to identify the supply equation: the percentage of the labor force who are white collar workers (*PCTWCOL*), the size of the community (*POP*), its rate of population change (*POPCHNG*), the median value of a home (*HOMEVAL*), and the crime rate within the community (*CRIMEPOP*).

D. Results

1. Advertising

Table 1 presents the regression results for the advertising equation.[30] The variables *NEWPRAC*, *MOVED*, and *POPNEW* are directly and significantly related to physician propensity to advertise. *POPDEN* also shows a positive relationship to advertising, though it is not statistically significant.

As mentioned earlier, our predicted value of advertising, $ADVERT^P$, was estimated to avoid measurement errors and selection effects inherent in the 0, 1 advertising dummy variable, *ADVERT*. Other variables, including some entering our quantity, price, and quality equations, were employed to estimate $ADVERT^P$. We must be confident that $ADVERT^P$ still reflects the role of advertising. If it does, it will still be strongly related to *ADVERT*. To test this, we divided physicians into two groups, depending on whether their value for $ADVERT^P$ was above or below the mean for that variable. The "high" group was three times more likely than the "low" group to have in fact advertised. The proportions were 33 percent and 11 percent, respectively; the difference is significant well below the 0.01 level. Splitting the sample by the median gives nearly

30. The results of the physician supply equation (available from the authors on request) indicate that all measures of area attractiveness except *CRIMEPOP* (which had no significant effect on supply) were significantly related to physician supply at the 1 percent level, and in the directions one might expect. In addition, two measures of demand (*PCTOLD* and *PCTKIDS*) bore a positive and statistically significant (at the 1 percent level) relationship to physician supply. The other two demand measures (*EDUC* and *PCAPINC*) were positively related to physician supply but not significantly so.

Table 1
Linear Probability Model for the Determinants of Physician Advertising (N = 1,615; t-statistics in parentheses)

Explanatory variables	Dependent Variable *ADVERT*
MOVED	.07***
	(3.75)
NEWPRAC	.12***
	(4.93)
POPNEW	.37***
	(2.73)
POPDEN	.02
	(1.06)
$\ln(DOCPOP)^P$	.16
	(1.34)
FEMALE	.05
	(1.31)
FMG	−.02
	(.71)
BDCERT	−.04
	(1.57)
GROUP	.10***
	(4.70)
CORP	−.00001
	(.001)
AMA	.05**
	(2.54)
EXP	−.61***
	(7.00)
GENIM	−.12***
	(5.03)
PED	−.08***
	(2.94)
PCAPINC	−.51
	(.90)
PCTOLD	.05
	(.11)

Table 1 (*continued*)

Explanatory variables	Dependent Variable *ADVERT*
PCTKIDS	1.83
	(1.62)
EDUC	−2.23
	(.86)
YEAR88	−.02
	(1.21)

Notes: This equation uses the predicted values of physician supply ($\ln(DOCPOP)^P$) estimated according to Equation (2) in the text. Estimation of the advertising equation allows us to obtain predicted values for advertising ($ADVERT^P$), which are used to estimate the effects of advertising on quantity, price, and quality.
** Statistically significant at the 5 percent level, two-tailed test.
*** Statistically significant at the 1 percent level, two-tailed test.

identical results.[31] This increases our confidence that our results employing $ADVERT^P$ as an explanatory variable in fact reflect the role of advertising.

Interestingly, AMA members are significantly more likely than other physicians to advertise: prima facie evidence that organized medicine no longer restricts advertising, even tacitly. Other findings suggest that physicians in group practices are more likely to advertise than are solo practitioners, and that the propensity to advertise is inversely related to years of practice experience. Both specialists in general internal medicine and pediatricians are significantly less likely to advertise than are general/family practitioners.

2. *Quantity*

Table 2 presents the estimated quantity effects of advertising in the refined model. The traditional approach yielded quite similar estimated co-

31. $ADVERT^P$ is not helpful in identifying people whom one would bet will advertise at even odds. Given that only 22 percent of primary care physicians advertise, it is not surprising that only a tiny percentage of the sample has an $ADVERT^P$ value above 0.5, and those that do are mostly just a little above.

Table 2
Advertising Effects on the Quantity of Medical Care: Refined Model Estimated by 3SLS (N = 1,615; t-statistics in parentheses)

	Dependent Variables	
Explanatory variables	ln(*QNEW*)	ln(*QOFF*)
Advertising effects		
ADVERT^P	−.48	−.74***
	(.98)	(3.21)
Physician and practice characteristics		
FEMALE	−.03	−.21***
	(.50)	(4.13)
FMG	−.10*	−.11***
	(1.90)	(2.80)
BDCERT	−.09**	−.04
	(2.03)	(1.29)
GROUP	.07	.14***
	(1.11)	(3.54)
CORP	.06	.13***
	(1.38)	(4.39)
AMA	.05	.10***
	(1.20)	(3.40)
NEWPRAC	.29***	—
	(3.72)	
EXP	−2.42***	1.03**
	(3.33)	(2.35)
EXP^2	.31	−4.90***
	(.25)	(6.05)
GENIM	−.41***	−.51***
	(5.56)	(11.93)
PED	−.08	.01
	(1.15)	(.13)
Physician supply		
ln(*DOCPOP*)^P	.03	−.31**
	(.15)	(2.20)

Table 2 (*continued*)

	Dependent Variables	
	ln(*QNEW*)	ln(*QOFF*)
Factor cost and market prices		
AVGCOST	.44***	−.08
	(2.64)	(.66)
PREVCHG	.57	.19
	(.97)	(.48)
Demand level		
PCAPINC	.09	.31
	(.09)	(.41)
PCTOLD	−1.54*	−.17
	(1.90)	(.29)
PCTKIDS	2.17	.40
	(.87)	(.24)
EDUC	−7.50	−6.65**
	(1.62)	(1.96)
Year dummy		
YEAR88	.09**	.05*
	(2.32)	(1.72)

Notes: These estimates rely on predicted values of physician supply ($\ln(DOCPOP)^P$) and of advertising ($ADVERT^P$), which are estimated according to Equations (2) and (3), respectively, in the text. Two-stage least squares estimation yields very similar results.
* Statistically significant at the 10 percent level, two-tailed test.
** Statistically significant at the 5 percent level, two-tailed test.
*** Statistically significant at the 1 percent level, two-tailed test.

efficients on variables other than those pertaining to advertising. Table 3 compares advertising effects in the traditional and refined models.

If advertising diminishes quantity of office visits, and raises profit-maximizing price, that would be a strong indication that it reduces demand elasticity, given that advertising assuredly shifts out demand. Table 2 tells the story. The refined model indicates that advertising has an insignificant effect on new patient office visits, but a significant negative effect on total office visits. Perhaps advertising physicians succeed in getting higher-paying patients, as well as patients who wish to use their

Table 3
Comparison of Alternative Estimates of the Marginal Advertising Effects on the Quantity of Medical Care (t-statistics in parentheses)

	Dependent Variables	
Advertising effects	ln(*QNEW*)	ln(*QOFF*)
Traditional model		
ADVERT	.22***	−.001
	(4.95)	(.03)
Refined model		
$ADVERT^P$	−.48	−.74***
	(.98)	(3.21)

Notes: The traditional model directly uses the binary (0, 1) indicator of advertising as an explanatory variable. The refined model uses the predicted values of advertising ($ADVERT^P$), estimated according to Equation (3) in the text—see Table 2. The results from the refined model are substantially different. The advertising effect is now negative (and significantly so for ln(*QOFF*)).
*** Statistically significant at the 1 percent level, two-tailed test.

services more intensively. Such an explanation seems more plausible if, in addition to their profit motive, physicians are concerned about the quality of care they offer, including knowing patients well.

Our results indicate that members of group practices, incorporated physicians, and AMA members have more total patient office visits, while females, foreign medical graduates, and general internists have fewer total patient visits. Physician and practice characteristics show a much weaker relationship to new patient office visits.

The year dummy variable is directly and significantly related to new and total patient office visits. While the proportion of office visits has risen gradually, total patient visits in all settings (in office, hospital, and other locations) have been rather stable in recent years (Emmons and Gonzalez 1988). Thus, the pattern we observe for the year dummy variable probably reflects the changing mix of physician visits rather than increases in total patient visits.

The importance of adjusting for selection effects is revealed by a comparison with the results from the traditional one-stage model, which indi-

cates no effect on total office visits, and a significant positive effect on new patient office visits. Physicians who advertise may tend to have less well-established practices than do nonadvertisers. Hence, they see more new patients than do nonadvertisers. To assess the true impact of advertising on quantity of services, however, one needs to net out such pre-existing differences. The refined model controls for pre-existing differences between advertisers and nonadvertisers (adjusts for selection effects); the traditional approach does not.

3. Price

Table 4 presents the estimated price effects of advertising for the refined model. Table 5 compares advertising effects for the refined model and the traditional approach.

Table 4
Advertising Effects on the Price of Medical Care: Refined Model Estimated by 3SLS (N = 1,615; t-statistics in parentheses)

	Dependent Variables	
Explanatory variables	ln(*PNEW*)	ln(*POLD*)
Advertising effects		
ADVERT^P	.45**	.39***
	(2.46)	(3.39)
Physician and practice characteristics		
FEMALE	−.004	−.002
	(.09)	(.07)
FMG	−.05*	−.04**
	(1.78)	(2.34)
BDCERT	.07***	.05***
	(2.66)	(3.15)
GROUP	−.05*	−.03*
	(1.74)	(1.64)
CORP	.004	.03*
	(.14)	(1.82)

Table 4 (*continued*)

	Dependent Variables	
	ln(*PNEW*)	ln(*POLD*)
AMA	−.03	−.03*
	(1.20)	(1.85)
EXP	.96***	.39*
	(2.70)	(1.80)
EXP^2	−1.48**	−.48
	(2.22)	(1.21)
GENIM	.65***	.25***
	(19.09)	(11.47)
PED	.07**	.11***
	(2.05)	(4.98)
Physician supply		
$\ln(DOCPOP)^P$	.35***	.24***
	(3.17)	(3.38)
Factor cost and market prices		
AVGCOST	.38***	.21***
	(3.98)	(3.63)
PREVCHG	3.04***	2.05***
	(9.21)	(10.29)
Demand level		
PCAPINC	−.58	1.21***
	(.96)	(3.11)
PCTOLD	−1.05**	−.98***
	(2.24)	(3.26)
PCTKIDS	−1.80	−.78
	(1.33)	(.90)
EDUC	−.45	−.29
	(.16)	(.17)
Year dummy		
YEAR88	.07***	.07***
	(3.44)	(4.55)

Notes: These estimates rely on predicted values of physician supply ($\ln(DOCPOP)^P$) and of advertising ($ADVERT^P$), which are estimated according to Equations (2) and (3), respectively, in the text. Two-stage least squares estimation yields very similar results.
* Statistically significant at the 10 percent level, two-tailed test.
** Statistically significant at the 5 percent level, two-tailed test.
*** Statistically significant at the 1 percent level, two-tailed test.

Table 5
Comparison of Alternative Estimates of the Marginal Advertising Effects on the Price of Medical Care (t-statistics in parentheses)

	Dependent Variables	
Advertising effects	ln(*PNEW*)	ln(*POLD*)
Traditional model		
ADVERT	−.05**	−.01
	(1.96)	(.78)
Refined model		
$ADVERT^P$	.45**	.39***
	(2.46)	(3.39)

Notes: The traditional model directly uses the binary (0, 1) indicator of advertising as an explanatory variable. The refined model uses the predicted values of advertising ($ADVERT^P$), estimated according to Equation (3) in the text—see Table 4. The results from the refined model are substantially different. The advertising effect on price is now significantly positive.
** Statistically significant at the 5 percent level, two-tailed test.
*** Statistically significant at the 1 percent level, two-tailed test.

Under the traditional model, advertising appears to have lowered the price of both new patient office visits, ln(*PNEW*), and established patient visits, ln(*POLD*). But the refined model reveals a dramatically different picture: advertising leads to *significantly higher* prices in both price equations.

Thus, the selection-corrected findings do not support the view that advertising raises demand elasticities. As noted earlier, two explanations may drive these results. First, if consumers have significant concerns about quality, but are unable to observe quality directly, they may be more responsive to physician ads that focus on or provide indicators of high quality. Demand for such physicians' services may become less elastic, so that advertising enables them to charge higher prices.[32] Sec-

32. Of course, for those advertisers who do not have the attributes consumers want, advertising will have little effect. But as long as advertising allows some of the advertising cohort to raise prices, the average impact of advertising on price would be positive.

ond, because insured consumers are responsible for only part of their medical costs, they may be more responsive to advertisements than they would be if they were uninsured. As a result, advertising may increase the pool of potential patients, particularly less price-sensitive patients, thereby allowing the physician to obtain a higher-paying clientele.

We also find that prices tend to be lower for foreign medical graduates, and higher for board certified physicians. Prices are substantially higher for specialists in general internal medicine, particularly prices for new patient office visits. This could indicate that internists give their new patients more thorough initial examinations, or that they provide different services than do general/family practitioners. Other physician characteristics show a weaker relationshop to pricing.

Physician supply, $\ln(DOCPOP)^P$, has a direct and significant relationship to the price of new and established patient office visits. Conceivably physicians raise price in areas of relatively abundant physician supply in order to achieve a target level of income. This interpretation should be viewed with caution, however, since alternative explanations are possible.[33]

Variables measuring factor cost and market prices are strongly related to both measures of physician prices, and in the direction one might expect. Average hourly practice cost, *AVGCOST*, is directly related to price, as is the Medicare index of prevailing charges, *PREVCHG*. By contrast, variables measuring consumer demand are less strongly related to physician prices.

4. *Quality*

Tables 6 and 7 present the estimated quality effects of advertising. Once again, estimated coefficients on variables other than those pertaining to advertising are reported only for the refined model (see Table 6).

Table 6 shows positive and significant relationships between advertising and both our measures of quality. As Table 7 indicates, the relationship to quality is positive and highly significant, whether or not we correct for endogeneity.

33. A reviewer suggested that our omission of *POPNEW* from the second-stage price equations may have caused an upward bias in the coefficient estimates on $\ln(DOCPOP)^P$. When we included *POPNEW* explicitly in the price regressions, however, the positive relationship between physician supply and the price of new patient office visits did not diminish, and in fact increased. Nevertheless, alternatives to the target income hypothesis may explain this pattern. Phelps (1986), for instance, has noted that a positive relationship between physician supply and price may result if the extent of insurance coverage is not fully controlled for. The reason is that physician supply and price should both be relatively high where insurance coverage is more extensive, other things being equal.

Table 6
Advertising Effects on the Quality of Medical Care: Refined Model Estimated by 3SLS (N = 1,615; t-statistics in parentheses)

	Dependent Variables	
Explanatory variables	ln(*TIMEOFF*)	ln(*TIMEALL*)
Advertising effects		
ADVERT^P	.82***	.74***
	(3.81)	(3.88)
Physician and practice characteristics		
FEMALE	.07	.10**
	(1.54)	(2.41)
FMG	.08**	.10***
	(2.25)	(3.12)
BDCERT	−.001	.02
	(.04)	(.73)
GROUP	−.14***	−.18***
	(3.77)	(5.58)
CORP	−.14***	−.11***
	(4.96)	(4.16)
AMA	−.08***	−.07***
	(2.90)	(2.74)
EXP	−.76*	−.87**
	(1.85)	(2.42)
EXP^2	3.76***	3.76***
	(5.00)	(5.67)
GENIM	.41***	.34***
	(10.03)	(9.34)
PED	.06	.07*
	(1.43)	(1.88)
Physician supply		
ln(*DOCPOP*)^P	.08	.19*
	(.64)	(1.64)

Table 6 (*continued*)

	Dependent Variables	
	ln(*TIMEOFF*)	ln(*TIMEALL*)
Factor cost and market prices		
AVGCOST	.15	.07
	(1.36)	(.78)
PREVCHG	−.19	−.25
	(.51)	(.75)
Demand level		
PCAPINC	−.08	.21
	(.12)	(.34)
PCTOLD	.33	.16
	(.60)	(.32)
PCTKIDS	−1.03	−.85
	(.65)	(.60)
EDUC	8.65***	6.80**
	(2.71)	(2.40)
Year dummy		
YEAR88	−.01	−.01
	(.47)	(.58)

Notes: These estimates rely on predicted values of physician supply (ln(*DOCPOP*)^P) and of advertising (*ADVERT*^{P}), which are estimated according to Equations (2) and (3), respectively, in the text. Two-stage least squares estimation yields very similar results.
* Statistically significant at the 10 percent level, two-tailed test.
** Statistically significant at the 5 percent level, two-tailed test.
*** Statistically significant at the 1 percent level, two-tailed test.

How can we explain the positive relationship between physician advertising and quality? As noted earlier, advertising enables physicians to charge higher prices. But clients who are willing to pay these higher prices may also demand more of the physician's time. Moreover, consumers of medical care are likely to be particularly concerned about quality. Spending time with patients during office visits may be an effective way to reassure customers on this dimension, reinforcing the effectiveness of ads.

Other findings indicate that foreign medical graduates spend more time with patients, while group practice physicians, incorporated physicians,

Table 7
Comparison of Alternative Estimates of the Marginal Advertising Effects on the Quality of Medical Care (t-statistics in parentheses)

	Dependent Variables	
Advertising effects	ln(*TIMEOFF*)	ln(*TIMEALL*)
Traditional model		
ADVERT	.09***	.08***
	(3.21)	(3.26)
Refined model		
$ADVERT^P$	.82***	.74***
	(3.81)	(3.88)

Notes: The traditional model directly uses the binary (0, 1) indicator of advertising as an explanatory variable. The refined model uses the predicted values of advertising ($ADVERT^P$), estimated according to Equation (3) in the text—see Table 6. The results from the refined model reinforce the positive advertising effect on quality estimated by the traditional model.
*** Statistically significant at the 1 percent level, two-tailed test.

and AMA members spend less time. General internists appear to spend substantially more time per patient visit than general/family practitioners (the excluded group), possibly because they treat more complicated cases. The coefficients on the experience variables indicate that time spent with patients at first decreases with experience, but this pattern eventually reverses itself. One explanation is that, as the physician's practice builds, he or she devotes less time to each patient. As physicians age and perhaps cut back on numbers of patients, however, they spend more time. Alternatively, the cohort of older physicians who spend substantial amounts of time with their patients may have done so throughout their careers. That is, the estimated relationship between experience and time spent with patients may to some extent reflect an age-cohort effect rather than a life-cycle effect.

The estimated coefficients on the physician supply variable, ln($DOCPOP)^P$, are positive but only marginally significant with respect to ln(*TIMEALL*). A strong positive relationship is found, however, between the average level of educational attainment in the physician's market

area, *EDUC*, and the time the physician spends with patients. Physicians may be more easily able to cut back on their time spent with the less well-educated, who may have greater difficulty in assessing the appropriateness of care. Haug (1981) has presented international evidence suggesting that educated patients demand more explanations and are less willing to accept authority.[34]

Comparing the estimated coefficients on the variable *EDUC* in the price and quality regressions, it appears that the charge per unit of time (in other words, the quality-adjusted charge) is lower for physicians who practice in areas where the populace is better educated. This suggests that the quality-adjusted price of medical care may be lower for better-educated individuals.[35]

VI. Conclusion

We have estimated the impact of physician advertising on the quantity, price, and quality of medical care. Our primary concern was whether advertising increases price elasticity (as we would expect if advertising of price were a common practice) or decreases it (by creating product differentiation).

Results from a traditional one-stage model support the view that motivated the Federal Trade Commission's efforts to invigorate advertising in physician markets, namely that it would lead to greater price competition. Price appears to be lower for advertisers, and new patient office visits higher. Such results, however, may be misleading. Advertising was indicated only by a binary variable. Moreover, there may be a selection effect associated with advertising.

With a two-stage estimation procedure that offers a consistent estimate of the effect of advertising intensity, and allows for selection effects, the results were substantially different. Advertising has a negative impact on quantity and a positive impact on price, which strongly indicates a negative effect on the elasticity of demand.

Our analyses tell us what happens to price for a particular physician who advertises. (We would have preferred to have data for regimes that

34. Physicians may also find it more worthwhile to spend extra time with better-educated patients because such patients do more to convey information about the physician to others (in other words, they are naturally better information spreaders).

35. A study by Benham and Benham (1975) obtained similar results for the price of eyeglasses. In particular, they found that the price of eyeglasses (a relatively standardized product, in contrast to physician services) was higher for less well-educated individuals. As a possible explanation, Feldstein (1988) suggests that the less well-educated may be less efficient in searching for lower-cost care than are their better-educated counterparts.

did and did not permit advertising.) Our results can only tell us indirectly about what happens when the entire profession begins to advertise or advertises more intensely, which was the FTC's policy concern. Although advertising reduces any particular physician's demand elasticity, it might conceivably increase elasticity for other providers, which implies that the aggregate impact on elasticity is uncertain. Nevertheless, the finding that advertisers find their elasticities diminished, and charge higher prices than nonadvertisers, is hardly encouraging to the view that advertising will promote competition.

Qualitative observation suggests that advertising in markets for physicians is quite different from the price advertising seen for relatively standardized products, such as packaged foods or automobiles, which fairly clearly enhances price competition. Price is rarely advertised for physician services; quality is difficult to judge and consumers are highly concerned about the quality of care they receive, and relatively insensitive to price, given third-party reimbursement.

Why would physicians advertise if not to increase the volume of their practices? First, they may be increasing price for the patients they do serve. Second, they may be improving their mix of patients, perhaps attracting more people who have ample resources or are likely to be repeat customers, and avoiding unpromising new patients. The results suggest that advertising physicians spend more time per patient office visit with a preferred clientele.

A. Advertising and Competition

A growing body of empirical research suggests that when quality is uncertain, advertising may discourage rather than enhance competition. This prediction also emerges from the sign-posting model, which concludes that when quality is difficult to demonstrate, price competition is discouraged. Confirmation of a closely related conjecture comes from the experimental arena. Holt and Sherman (1990) conclude that when quality is unknown, price advertising cannot be presumed to improve efficiency.[36] In previous work (Rizzo and Zeckhauser 1990), we found that advertising acts as a complement to physician experience rather than as a substitute for it. Thus it is no surprise that advertising inhibits entry.

Our analysis suggests that advertisers charge higher prices, produce at a higher quality level, and have reduced output. A confident, causal explanation of this pattern must await more detailed information. The most logical explanation, based on current knowledge and economic un-

36. In their study, efficiency was measured as the ratio of total earnings of buyers and sellers to maximum possible consumer and producer surplus.

derstanding, would be that although advertising expands demand, it restricts its elasticity. Advertising physicians exploit this situation by selecting a higher price. Higher prices are possible in part because the advertisers spend more time per patient.

When the FTC struggled to remove bans on advertising in the medical profession, it hoped to increase price elasticity, enhance competition, and lower prices. But if such effects are to be achieved, advertisements must indicate price, and consumers must be able to judge quality. Neither condition seems to be met in markets for physician services.

As physician advertising increases, its effects will become a more significant policy issue. The British government is currently exploring ways to promote competition in its health care delivery system by introducing selected free-market mechanisms (Lohr 1989). As part of this plan, physicians and hospitals are being encouraged to advertise. While the British health care delivery system differs dramatically from that of the United States, our results suggest that advertising may not achieve the desired results of lower prices and increased competition.

B. Will the Effects of Physician Advertising Change?

In the future, will the advertising effects we have documented simply repeat themselves on a larger scale, or will they be quite different? The answer to this question may hinge on changes in the nature of physician advertising. In the hospital sector, some have argued that advertising is evolving in three stages:

> The first stage was simple image advertising . . . The ad would say only "this is a friendly place." The second stage is ads featuring specific products: "We do laser brain surgery here" or "We blast kidney stones with sonic waves." . . . The third stage will be comparative-data advertising. "Have your baby here because our rate of complications is the lowest in the area." Hospital advertising is moving toward real hardball (Gray 1986, 182–83).

Most critics believe that physician advertising will grow over time. Given how seldom fees are mentioned at present, it seems likely that advertising will become more fee oriented. But even if fee advertising becomes widespread, it is not clear that it will lower prices. Stevens (1988) suggests that physician fee booklets distributed in three states have failed to affect health care costs. Hibbard and Weeks (1989) also find that the availability of physician price information does not lower costs per visit. Consumer sentiments about the effects of physician fee advertising have become less favorable. Survey results reported by Harvey (1988), for example, indicate that in 1982, 41 percent of consumers believed that

physician fee advertising would lower doctors' fees. By 1988, only 30 percent of consumers shared this view. Changing consumer perceptions thus anticipated the findings of this paper.

Physician advertising is expected to grow over time. On the basis of present evidence, reduced prices are not likely to be a consequence.

Appendix
Variable Names, Descriptions, and Means

Variable Name[a]	Description	Mean[b]	Standard Deviation
ln(*PNEW*)	Natural logarithm of physician's fee for an office visit with a new patient	3.76	.53
ln(*POLD*)	Natural logarithm of physician's fee for an office visit with an established patient	3.31	.31
ln(*TIMEOFF*)	Natural logarithm of average time physician spends per office visit	−1.04	.50
ln(*TIMEALL*)	Natural logarithm of average time physician spends with patients in all practice settings	−.88	.45
ln(*QNEW*)	Natural logarithm of new patient office visits during last complete week of practice	2.04	.78
ln(*QOFF*)	Natural logarithm of total patient office visits during last complete week of practice	4.53	.57
ln(*DOCPOP*)[c]	Natural logarithm of per capita office based primary care physicians in county where physician resides, 1986	−2.69	.35
ADVERT[d]	Dummy variable. Equals 1 if physician advertised practice by newspaper, magazine, TV, and/or radio at any time during the previous five years; equals 0 otherwise	.22	.42

Appendix (*continued*)

Variable Name[a]	Description	Mean[b]	Standard Deviation
FEMALE	Dummy variable. Equals 1 if physician is female; equals 0 otherwise	.10	.30
FMG	Dummy variable. Equals 1 if physician is a foreign medical graduate; equals 0 otherwise	.21	.41
BDCERT	Dummy variable. Equals 1 if physician is board-certified; equals 0 otherwise	.61	.49
GROUP	Dummy variable. Equals 1 if physician's practice is a group practice; equals 0 otherwise	.42	.49
CORP	Dummy variable. Equals 1 if physician's practice is incorporated; equals 0 otherwise	.40	.49
AMA	Dummy variable. Equals 1 if physician is a member of the American Medical Association; equals 0 otherwise	.49	.50
EXP	Years of practice experience divided by 100	.18	.12
EXP^2	$EXP \cdot EXP$	.05	.06
GENIM	Dummy variable. Equals 1 if physician is a specialist in general internal medicine; equals 0 otherwise	.33	.47
PED	Dummy variable. Equals 1 if physician is a pediatrician; equals 0 otherwise	.19	.39
AVGCOST	Average hourly physician practice cost in state where physician resides, 1981–85	.73	.12
PREVCHG	Index of Medicare prevailing charges in county where physician resides, 1984	.19	.04
PCAPINC	Per capita income in county where physician resides, 1986	.15	.04

Appendix (*continued*)

Variable Name[a]	Description	Mean[b]	Standard Deviation
PCTOLD	Percent of population aged 65 and above in county where physician resides, 1984	.12	.03
PCTKIDS	Percent of population aged five and below in county where physician resides, 1984	.07	.01
EDUC	Mean years of educational attainment of individuals aged 25 and above in county where physician resides, 1980	.12	.01
YEAR88	Dummy variable. Equals 1 if sample drawn from 1988 survey; equals 0 otherwise	.53	.50
MOVED	Dummy variable. Equals 1 if physician is not practicing in state where attended medical school; equals 0 otherwise	.59	.49
NEWPRAC	Dummy variable. Equals 1 if physician changed practice in 1980 or later; equals 0 otherwise	.19	.39
POPNEW	Proportion of population that moved in county where physician resides between 1980–86	.07	.08
POPDEN	Population density in county where physician resides, 1986	.19	.59

a. The variables *PREVCHG*, *PCAPINC*, *PCTOLD*, *PCTKIDS*, *EDUC*, *POPNEW*, *POPDEN*, and ln(*DOCPOP*) were drawn directly or constructed from the Bureau of Health Professions' Area Resource File, September 1988 edition. All other variables were either drawn directly or constructed from the AMA's Socioeconomic Monitoring System 1987 and 1988 core surveys of physicians or the AMA's Physician Masterfile. Unless indicated otherwise, physician data are for 1987 and 1988.

b. To facilitate comparisons of coefficient estimates, continuous explanatory variables have been normalized to lie between 0 and 1.

c. In the empirical estimates, we use the predicted value of physician supply (ln(*DOCPOP*)^P), which is estimated according to Equation (2) in the text.

d. In the refined estimates, we use the predicted value of advertising (*ADVERT*^{P}), which is estimated according to Equation (3) in the text.

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