Does the Market Punish Aggressive Experts? Evidence from Caesarean Sections

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May 2008

Preliminary. Please do not cite.

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1. Introduction

There are many markets in which a seller simultaneously diagnoses a customer's needs and recommends a product or service to meet them. Customers have limited information on which to judge the merits of the recommendation and may, as a result, agree to excessively costly or unnecessary services. Plumbers, auto mechanics, and lawyers are just a few of the sellers who face the resulting potential for conflict of interest. This problem has received considerable attention in medicine, where physicians simultaneously diagnose their patients' conditions and recommend treatments. Physicians stand to prosper by recommending and performing costlier treatments than are indicated by an objective diagnosis. This is referred to in health economics as "supplier-induced demand."

This asymmetry of information poses a theoretical conundrum. What prevents sellers from always exaggerating the value of their products? A simple but compelling explanation is that consumers may choose not to purchase the product if the seller routinely exaggerates its value.[1] A corollary of this is that consumers may choose not to patronize sellers who exaggerate. For example, Dranove (1988) suggests patients may avoid physicians who have a reputation for doing too many high cost procedures.

In this paper, we examine whether the market does, in fact, punish overzealous sellers. We focus on the market for deliveries, a procedure in which a practicing obstetrician/gynecologist is faced with the choice of prescribing one of two possible modes: vaginal birth vs. a more highly reimbursed alternative, a cesarean section. Our aim is to test whether physicians who prescribe a disproportionate number of cesarean sections

[1] This is a standard result in the vast literature on "credence goods" and "experience goods." For credence goods, consumers may be unable to accurately gauge the value of the good even after purchase. For experience goods, consumers do learn the value after purchase. See Laffont and Martimort (2001) for a review of the broad literature. It does not matter for our analysis whether health care is defined as an experience good or credence good.

(compared to what might be expected based on patient characteristics) experience a decline in patient share.

Following Phelps (2003), who equates a physician's predilection to perform a high cost procedure to that physician's "practice style," we measure the practice styles of obstetricians in several counties in Florida. We then estimate a model of consumer choice of provider, where one of the factors weighing on patient's choice is practice style. Estimation is complicated by the fact that physician practice style is not truly exogenous – a physician might choose to have an aggressive practice style (i.e. perform more expensive procedures) in order to make up for falling market share. We account for endogeneity of a physician's practice style by using the practice style of the residency program where the physician trained as an instrument. In most of the counties that we study, including the largest, we find that maternity patients prefer not to visit physicians with aggressive styles (i.e. physicians who overprescribe cesarean sections), *ceteris paribus*. The effect is most pronounced for high income patients and HMO patients, two segments of the market that might be very attractive to some obstetricians.

The remainder of this paper is structured as follows: Section 2 consists of a brief review of related research, and outlines the setting used in this paper. Section 3 presents the data, and Section 4 discusses the empirical approach used. Section 5 presents a discussion of results obtained from estimating choice models at the patient-level. Section 6 introduces our instrumental variables approach and Section 7 concludes.

2. Theoretical background

Our empirical work is motivated by two separate literatures, those on medical practice variations and supplier-induced demand. Wennberg (1972) was perhaps the first to document the fact that treatments received by patients depended heavily on where they lived and who provided their care, and not solely on their objective medical condition. Since this seminal work, there has been a considerable literature documenting the extent of these practice variations.[2]

There is considerable debate as to the sources of practice variations. Phelps and Mooney (1993) and Phelps (2003) postulate that physicians form beliefs about appropriate care during their medical and residency training, but learn from colleagues through Bayesian updating, and as a result, there is convergence around community norms.[3] Wennberg et al (2004) offer supporting evidence of variability in resource use across medical schools. Practice variations within local markets may also be a response to heterogeneity in patient preferences. Epstein and Nicholson (2006) provide evidence that obstetrics patients have preferences over practice styles and select their physicians accordingly. Thus, we might expect physicians to knowingly differentiate their styles as a way of establishing a profitable "competitive position" in the market.

The health economics literature uses the term "demand inducement" to capture the idea, inherent in theories of credence goods markets, that physician experts can exploit information asymmetries by exaggerating the value of costly medical care.[4] In effect, physicians prescribe care that is not in the best interest of their patients. Roemer (1961), Fuchs (1978) and many subsequent studies suggest that physicians do induce demand, for example by recommending highly remunerative surgical services. Gruber and Owings (1996) study demand inducement for cesareans. Cesareans are a candidate for inducement

[2] See Phelps (2003) for a discussion of this literature.
[3] Burke, Fournier and Prasad (2004) construct a formal model in which physician choices are shaped by a desire to conform to peers or spillovers of knowledge, but do not explain where peers form their own practice preferences.
[4] See Darby and Karni (1973) for the seminal article on credence goods.

because they tend to be more remunerative than the alternative vaginal delivery. For example, Gruber and Owings report that physician charges for cesareans in 1989 were a third again higher than the charges for vaginal deliveries. Physicians may also prefer the convenience of scheduled cesareans, which also tend to take less time to perform. Consistent with notions of inducement, Gruber and Owings find that obstetricians in states experiencing relative increases in supply of obstetricians responded by performing relatively more cesareans.

There is similar evidence of "inducement" for credence goods outside of medicine. For example, Harrington and Krynski (2002) find evidence that funeral home directors induce consumers to choose burial over cremation and Bartels, Fiebig, and van Soest (2006) find that plumbers tend to "overprescribe" repairs for homeowners.

We tie together the literatures on practice variations and inducement as follows. We suppose that physicians have different practice styles, and that the physicians with the most aggressive styles are those who most exaggerate the value of costly treatments. This raises the following question: What prevents sellers from choosing the most aggressive practice styles? In the credence good literature, the willingness of sellers to exaggerate value is limited by the credulity of their customers. In equilibrium, sellers exaggerate by less than the maximum possible amount, and buyers account for this when evaluating the sellers' messages and making their purchase decisions.[5] This is not sufficient in the presence of practice variations, where some physicians seem to get away with a higher degree of

[5] Other factors may limit the willingness of physicians to induce demand. McGuire and Pauly (1991) cite ethical constraints, namely that physicians factor patient utility into their own utility function, and suffer a utility loss from inducement. Physicians might also be constrained by malpractice concerns, though some authors have suggested that cesareans pose less of a malpractice risk than vaginal delivery.

exaggeration. But it does suggest a corollary: physicians who adopt aggressive styles may have fewer patients overall.

The mechanism that we posit is a simple one. Patients learn about the practice styles of individual doctors, even though they lack substantial personal experience. Hubbard (2002) presents evidence that that this is exactly what occurs in the market for vehicle emissions testing. He finds that car owners steer their business towards emissions testers who tend to be more generous in giving out passing grades. If car owners seek out testers with favorable reputations, it is reasonable to suppose that maternity patients might do so as well. Not only are the stakes considerably higher, preferences for practice styles may be very strong. In particular, McCourt et al. (2007) perform an extensive review of the literature on women's preferences for mode of delivery and find that women overwhelmingly prefer spontaneous vaginal birth. It is also reasonable to suppose that maternity patients are capable of performing a successful search. Like car owners seeking out emissions testing services, women with strong birthing preferences would have ample time to gather information about physician practice styles. They are also likely to know many other women who have recently given birth and would probably be informed about the mode of delivery.

Thus, we posit the following tension in the market for delivery services: Obstetricians stand to increase their earnings by performing more cesarean deliveries. In doing so, however, they stand to drive away maternity patients (either all or a sizable segment) who prefer obstetricians with more conservative practice styles. Our aim is to test whether the latter occurs and therefore serves as a natural limit on inducement.

3. Data

We obtained patient level hospital data for the years 1994-2003 from Florida's Agency for Health Care Administration (AHCA). AHCA data are similar to other state inpatient data that have been widely used in health services research. The dataset contains moderately detailed information about every hospitalization, including the patient's Diagnosis Related Group, some secondary diagnoses, limited demographic information, the type of insurance (e.g., HMO), and the patient's residence zip code. AHCA data also include the license number of the "operating physician"; in the case of childbirth, this is the physician who performs the delivery.

We match the physician license numbers to an online licensing data base that gives us background information about each licensed physician in Florida, including their medical school and place of residency training. We obtained rankings of medical schools from *US News and World Reports*' "America's Best Graduate Schools 2006" survey. We also used data from residentphysician.com to determine ranking of residency programs based on the total amount of grants and awards received. Programs that do not appear in the rankings are assigned the lowest rank.[6]

4. Methods

Our ultimate goal is to assess how individual physician practice styles affect patient choice of physician. This suggests a three-step procedure:

1) Develop a measure of patient preferences for cesarean sections

[6] Some doctors in our data received their training several decades ago. We do not have access to older rankings. We did observe that most of the top ranked medical schools have longstanding reputations for quality; thus, we do not believe that the rankings that we use are very far removed from the rankings that might have been constructed in the past.

2) Measure physician practice styles by examining treatment choices while controlling for patient preferences

3) Incorporate that measure in a model of patient choice

Specifically, we do the following. First, we use data from 1994-2003, excluding 1999-2000, to estimate a linear probability model that predicts whether a patient delivers by cesarean section. We take the coefficients on patient characteristics from this model to predict patient preferences for cesareans in 1999. Second, we compute each physician's "practice style" in 1999, calculated as the difference between the actual and expected number of cesareans (where the expectation is based on the patient observables.) Third, we estimate conditional logit models of patient choice of physician in 2000, where the key predictor is the physician's practice style (computed from the 1999 data.) We now provide more details on our methods.

4.1 Measuring Patient Preferences for Cesareans

We use data from the entire state of Florida for the years 1994-2003. The dependent variable is a 0/1 indicator for whether or not the patient received a cesarean section. In selecting the predictor variables, we must bear in mind that we will be using the results of this first stage regression to compute the expected number of cesareans to be performed by each physician. In turn, patients will compare this expectation against the actual number to estimate each physician's "style."

Following the prior literature on patient preferences for interventions such as cesarean sections, we consider a large set of predictors, including patient demographic characteristics (age, race, insurance status, and the average income of the patient's residence zip code), clinical characteristics (a vector of secondary diagnoses such as multiple gestation, hypertension etc.), and a vector of physician fixed effects.[7] We exclude "prior cesarean" from the predictors because this is endogenous to the characteristics of the other patients.

4.2 Measuring Physician Practice Styles

We use the regression results from the preceding analysis to predict patient preferences for the year 1999. We then compute $PSection_i$, the number of cesarean sections each physician *i* would have been predicted to perform had that physician abided by patient characteristics. We also compute $Section_i$, the actual number of cesarean sections performed by physician *i* and compute $Style_i = (Section_i - PSection_i)/Births_i$, where $Births_i$ refers to the total number of deliveries performed by physician *i*.

The first panel of Table 1 reports summary statistics for $Style_i$ (for 1999) for the entire state and for the six markets that we study in the second stage of the analysis. The Table shows that there is considerable variation in practice style. There is a bit less variation within specific markets, consistent with the notion that some portion of physician practice style is location-specific. An important implication is that when patients are selecting their obstetrician, they have a wide choice of practice styles to choose from. Our key predictor variable in the third stage, $Excess_i = \max(0,(Section_i - PSection_i)/Birth_i)$, represents the extent to which physician *i* overperforms cesarean sections.[8]

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[7] Patients may be privy to a much smaller set of information about the physician's other patients, limited only to demographic variables and perhaps one or two readily observed clinical characteristics such as whether the physician handles many multiple gestations. Physicians may also vary in the extent to which they report clinical characteristics. Limiting the analysis to these limited predictors limits any potential for bias that might result. We re-estimated our model while controlling for only this "limited" set of predictors. Our results are similar, if not slightly stronger.

[8] Some patients may have unobservable characteristics that lead them to have a preference for cesareans. This suggests that the variable $Excess_i$ may overstate the "true" extent to which physician *i* overperforms cesarean sections. We do not think this is a problem for our study for two reasons. First, we believe that when patients assess physician practice styles, they are not privy to other patients' unobservable characteristics and therefore will form estimates of style that are similar to those that we compute. Thus, it is appropriate to use our measures of $Excess_i$ in the patient choice equation. Second, the coefficient on

In addition to avoiding physicians with high values of $Excess_i$, patients may also avoid physicians who underprovide cesareans. To account for this, we include a variable $Deviation_i$ that is defined as follows

$$Deviation_i = \text{abs}((Section_i - PSection_i)/Birth_i), \text{if } Style_i < 0$$

$$= 0, \text{ if } Style_i > 0$$

Note that by including both $Excess_i$ and $Deviation_i$ in the choice models that follow, we allow for asymmetric patient responses to physicians who overprovide and underprovide cesareans. To compute the effect of an aggressive style, we examine the coefficient on $Excess_i$. We can also compute the effect of a "passive" style (underperforming cesareans) by simply examining the coefficient on $Deviation_i$.

Some physicians perform only a handful of deliveries in a given year and patients may not be able to form good estimates of their styles. We limit our analysis to "high volume" physicians defined as those who performed at least 50 deliveries in 2000. These physicians account for over 90 percent of the deliveries in the market that we study. The remaining physicians represent the "outside good" in the conditional logit models that we describe below.

4.3 Estimating Patient Choice of Physician

We estimate separate patient choice models for each of several markets in Florida, taking care to choose our "markets" so as to facilitate the choice analysis. In particular, we

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$Excess_i$ will be a lower bound on the "true" effect provided that the "true" style is an attenuation of $Excess_i$ of the form $\gamma \cdot Excess_i$, where $0<\gamma<1$.

treated each county as a candidate market.[9] We then limited our attention to those counties with the following characteristics:

(1) The county has a central city with a population of at least 50,000

(2) There are at least 20 and no more than 200 high volume providers in a given year

(3) At least 75% of the women residing in these counties delivered their children at hospitals in the county

Based on these criteria, we identified the following six counties (and central cities): Brevard (Melbourne), Escambia (Pensacola), Lee (Fort Myers), Leon (Tallahassee), Orange (Orlando), and Volusia (Daytona Beach). It was also important in some specifications to exploit geographic diversification and hospital fixed effects. Of our six counties, only Orange County (home to Orlando) had more than 50 zip codes or more than 5 hospitals. Thus, we restrict most of our analysis to Orange County. Even so, Orange County alone has approximately 90 high volume obstetricians (nearly the total of the other counties combined). This restriction therefore does not hinder our ability to generate significant findings.

We estimate a conditional logit model of patient choice of physician in each market. Our key predictors are the measures of physician practice style, $Excess_i$, and $Deviation_i$. In order to allow for different effects of physician practice style on different patient segments, we include interaction terms between patient characteristics (such as income[10] and whether the patient is insured by an HMO) and each of $Excess_i$, and $Deviation_i$. Our control variables include travel times from each patient's resident zip code to each physician's "primary"

[9] Given the criteria that follow, the decision to use the county as the basis for market definition is innocuous. We exclude metropolitan areas that are larger than counties on the grounds of tractability.

[10] We include income as a categorical variable: the "High" category consists of observations above the 75th percentile.

hospital (defined as the hospital at which the physician performed the most deliveries), and interaction terms between patient characteristics and travel time.

We control for the average overall quality of each physician (and each hospital) in the following way. In one specification, we include a vector of physician fixed effects and interaction terms between patient characteristics and hospital fixed effects.[11] Because $Excess_i$, and $Deviation_i$ are both perfectly collinear with the fixed effect for physician *i,* we retain only the style interaction terms in this specification. This allows us to determine whether aggressive practice styles are more or less attractive to certain patient segments, but does not allow us to determine whether aggressive practice styles are more or less attractive overall.

In a second specification, we retain the primary predictors of physician practice style, $Excess_i$, and $Deviation_i$, and include a vector of physician characteristics (e.g. ranking of residency program the physician trained at, year physician graduated from medical school) in place of the physician fixed effects. While these variables control for physician-related factors that could affect patient choice, they do not completely capture physician quality. To the extent that $Excess_i$, and $Deviation_i$ are correlated with unobserved aspects of quality, the coefficients on these variables will be biased.[12]

Since a physician's choice of practice style may not be truly exogenous to factors affecting demand for that physician, failure to account for endogeneity could lead to biased estimates of the effect of practice style on demand. To address this problem, we employ an instrumental variables approach, where we make use of information on each physician's training in order to construct the instrument. We present more details on our instrumentation strategy in Section 6.1.

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[11] Note that we cannot include hospital and physician fixed effects in the same regression since they are collinear.

[12] We found no consistent pattern of correlation between $Excess_i$, and $Deviation_i$ and observable quality (residency rankings), suggesting that there may be minimal correlation with unobservable quality.

5. Results

In Table 1b, we present some summary statistics for key variables for patients living in Orange County in the year 2000 (these are the choosers in our choice model). We observe around 14,700 births in our sample, with a little over a fourth being delivered by cesarean section. The mean age of the patient (mother) in our sample is 27. The majority of patients are white and insured by an HMO or through Medicaid. Almost 12% of patients had a prior cesarean section and a little more than 1% of mothers give birth to multiple babies.

5.1 Estimating Patient Preference for C-Sections

Table 2 presents the results of our linear probability estimates of the mode of delivery. The estimate includes a vector of year dummies in order to control for aggregate trends and a vector of physician indicator variables that capture time-invariant differences across physicians in their propensity to perform cesarean sections (controlling for patient characteristics).

While this model is used mainly to retrieve patient preferences for cesarean sections, the coefficient estimates on individual predictors are also of interest. The estimates on the year dummies (not presented in Table 2) indicate an overall growth in cesarean sections over time from 1994 to 2003. The coefficients on the variables measuring age of the patient (introduced into the model as categories) imply that older patients have a greater chance of having a cesarean section, all else held equal. Patients aged 40 and above have a 21 percent higher probability of undergoing the procedure compared to those under 20 years of age. Hispanic patients have a slightly higher propensity (2 percent) for cesarean sections when compared to White (and Black) patients. Patients insured with HMOs, PPOs and Medicare all have higher propensities for undergoing cesareans when compared with Medicaid patients (the omitted category), although the magnitudes are quite small (<0.5%), except in the case of Medicare patients (8%).

As expected, the clinical characteristics of the patient are strong predictors of the probability of a cesarean section. For example, a patient diagnosed as bearing multiple fetuses has a 26 percent higher probability of receiving a cesarean section compared to a patient bearing a single fetus. Finally, patients originating from high income zip codes have a lower probability of receiving a cesarean: a 1-standard deviation increase in per capita income (measured at the zip code level) reduces the probability of receiving a cesarean section by 0.7 percent for patients residing in that zip code. Overall, we are able to generate a fairly strong predictive model, with an adjusted R-Squared of almost 0.24.

5.2 Estimating Patients' Choice of Physician

As mentioned earlier, we estimated the patient choice models separately for each of the six counties identified above. We estimated patient choice models with and without physician fixed effects. In all of the models, we find that patients strongly prefer to visit a nearby provider.

Our main interest is the preferences of patients for physicians with aggressive practice styles. Recall that we compute these preferences by looking at the coefficients on $Excess_i$ and $Deviation_i$. In the models with physician fixed effects, we are able to determine whether patients with particular characteristics have stronger or weaker preferences for aggressive style than do other patients.[13] We study the following characteristics: HMO (versus other insurance), and income. We select these characteristics because they represent

[13] We are unable to study the impact across all patients in the Fixed Effects models because of the collinearity of the practice style measure with the physician Fixed Effect

segments that some physicians may target for their practice. In the models without fixed effects, we can compute the effect of an aggressive style on all patients as well as the effect on HMO and wealthy patients.

Table 3 summarizes our findings for the fixed effects choice models for the largest county, Orange. We find that HMO patients as well as high income patients have a statistically significant distaste for aggressive physicians. In order to better interpret the magnitudes of these coefficients, we compute relative market shares for an aggressive physician. In each market, we compare two physicians – one with the median practice style for that market and one whose style is at the 75th percentile (we call the latter a "representative aggressive physician." Our findings are presented in Table 3b. We find that for Orange County, the representative aggressive physician's market share for HMO patients is 4.85 percent and high income patients is 4.9 percent (versus 5 percent for the median physician.) Table 3c presents analogous estimates for a "passive" physician[14] - the effect disappears for HMO patients, but high income patients seem to exhibit a preference for such physicians.

Table 4 summarizes our findings for the regression models for Orange County that do not include physician fixed effects. We are now able to estimate the effect of having an aggressive style on all patients as well as on specific patient segments. The coefficients imply a strong distaste for aggressive physicians among all patients, as well as for the specific patient segments we study. As before, we compute the market share of a representative aggressive physician and present the results in Table 4b. Based on these estimates, an aggressive physician experiences a loss in share of 8% (4.6 percent market share compared to 5 percent for the median physician) across all patients. Losses in the HMO and high income

[14] We define a passive physician as one whose practice style places her at the 25th percentile of the distribution of practice style in each county

segments are also substantial. There seems to be a dislike for passive physicians as well (Table 4c), but the magnitude of this dislike is much smaller in comparison. In a later section, we discuss the economic magnitude of these results in detail.

Tables 5a and 5b presents a summary of the main results from the other five counties that we study. While some of the estimates are not statistically significant at conventional significance levels, the pattern seems clear. In a majority of markets studied, aggressive physicians tend to lose market share, especially among high income patients and HMO patients. We do not comment on the magnitudes of the non-fixed effects results at this time, as they may be subject to bias that we address in the next section.

6. Testing For Inducement

The inverse relationship between aggressive style and patient demand that characterizes the "punishment" hypothesis is, ironically, also consistent with the inducement hypothesis. That is, physicians in less demand may attempt to make up for it by performing more cesarean sections.[15] In other words, failure to account for endogeneity of physician practice style might lead us to overestimate the extent to which aggressive physicians end up losing market share. We now provide a test of the punishment hypothesis using an instrumental variables technique.

6.1 Instrumenting for Physician Practice Style

Our goal is to find a variable that would explain variation in physician practice style but would be otherwise unrelated to factors affecting demand for that physician. We

[15] One might argue that physicians who perform a lot of caesarians have less time to see other patients. Caesarians usually require less time than vaginal deliveries and are often easier to schedule, suggesting that aggressive physicians should have more time available to see other patients.

propose the use of the practice style of the residency program attended by the physician as an instrument for current practice style. To the extent that practice styles are developed by physicians early on in their careers (as shown in Dranove, Ramanarayanan and Rao (2006)) and are fairly persistent over time, our instrument should be a good predictor of current practice style. Moreover, we can directly control for residency program quality, eliminating this potential omitted variable bias.

In order to compute the practice style of each physician's residency program, we make use of the Nationwide Inpatient Sample (NIS), which was developed as part of the Healthcare Cost and Utilization Project (HCUP). The NIS is a hospital inpatient database containing discharge data from over 1000 hospitals located in 37 states (as of 2005) in the United States. The data approximates a 20-percent stratified sample of U.S. community hospitals. Each observation contains various patient characteristics (demographic and clinical) as well as the identity of the hospital the patient was treated at. We use data from the years 1994-2003.

We restrict attention to maternity patients and run patient-level regressions (similar to those described in the first part of Section 4) with a cesarean indicator as the dependent variable. The main predictor is a hospital fixed effect, which we use as a measure of hospital style in that year. We match residency programs of physicians to hospitals in the NIS database by name. We found a match for residency programs for 61 of the 89 physicians who deliver at least 50 babies in Orange County in 2000. We define our instrument to be the average practice style of the hospital across all years in the NIS data.[16] Practice styles of hospitals are found to be strongly persistent over time with a correlation of over .90 between

[16] As an alternative, we also used the style of the hospital in the year closest to the year in which the physician graduated from the program. We obtained similar results with this definition of the instrument.

practice style in 1994 and 2003. This suggests that our instrument is likely to be relevant even for physicians who graduated one or more decades before our sample begins.

We estimate a two-stage conditional logit model for patients in the year 2000 who choose physicians based on physician practice styles in 1999. In order to incorporate instrumental variables into a non-linear parametric setting, we use a model of residual substitution based on Basu et al (2007). In this model, the endogenous regressor is modeled as a function of the instrument and other exogenous variables in the first stage. The residual from the first-stage is then included as a predictor in the second stage, along with the original endogenous regressor(s) and other control variables.[17] Standard errors are then computed using bootstrapping. The first-stage regression is estimated on all obstetricians in Florida in the year 1999. For the choice model in the second stage, we restrict ourselves to physicians and patients in Orange County.

In the first-stage, we regress each physician's practice style on our instrument, along with a vector of hospital fixed effects. Table 6a presents results from the first stage. The adjusted R-squared statistic for this regression is .22, and the coefficient on the instrument is positive (1.39) and strongly significant ($p<.001$). The residual from this regression is then included as a predictor in the second stage, which is estimated as a conditional logit model (similar to the one outlined in Section 4).[18] Table 6b contains results from the second stage models that include and exclude physician fixed effects. Column 1 excludes physician fixed effects, while column 2 includes them in the specification. The coefficient on the residual from the first stage is statistically significant in both models, confirming the presence of

[17] This is shown to produce consistent coefficient estimates, as opposed to a model where the prediction from the first stage is substituted for the endogenous predictor in the second stage. Refer Basu et al (2007) for more details.
[18] Since NIS data is not available for all residency programs in the data, the number of observations in the second stage choice model drops to around 556,000.

endogeneity in the main predictor. Even so, we still find that an aggressive style is associated with a lower overall market share (based on the results from the no-fixed effects model) and a lower share among HMO patients (based on both models.) An aggressive style is no longer associated with a lower share among high income patients.

To get a sense of the economic magnitude of our results, we again contrast a representative aggressive physician and a median physician, where the median physician is assumed to have a 5 percent market share. In Orange County, an aggressive physician would have a 4.6 percent market share (based on the results of the non-fixed effects model). The aggressive doctor might not mind losing some patients. According to the American Medical Association, insurers currently pay physicians a 15 percent higher "all inclusive" fee for cesarean section delivery (where the fee includes all associated prenatal and routine follow-up care.) For example, if the going fee for a vaginal delivery is $2000, the fee for cesarean section would be $2300. Thus, the aggressive physician may lose some patients, but has a higher average price per patients.

Is the tradeoff worth it? Let us continue to contrast the median physician and the representative aggressive physician. Suppose the median physician in Orange County has 200 patients, of whom 52 undergo a cesarean. This physician would receive gross revenues of $415,600. A representative aggressive physician would have 184 patients, of whom 59 are cesareans[19], for a total income of $385,700. In other words, the aggressive physician has a lower income (of about 7%), but also works fewer and more predictable hours.[20] Table 9 presents this finding as well as similar calculations for the remaining counties.

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[19] An aggressive doctor in Orange county has a practice style 6 percentage points higher than the median physician

[20] As noted earlier, caesarian section deliveries usually require less time.

7. Discussion

It is nearly 50 years since Milton Roemer suggested that physicians had the ability to create their own demand, and 30 years since Robert Evans' and Victor Fuchs' seminal studies documenting the extent of demand inducement. Although many economists have criticized the statistical methods in these and other studies, few if any economies have objected to the claim that physicians have both the financial incentive and the opportunity to adopt an aggressive practice style.

From a theoretical perspective, the key question is not whether physicians have the ability to induce demand, but why they do not all induce demand as much as possible. Dranove (1988) suggests that patients may not believe physicians with an overly aggressive practice style, but even this lack of credence does not prevent overprescription of costly treatments. McGuire and Pauly (1991) suggest that physicians may be constrained by ethical considerations. Malpractice concerns may also constrain physicians, though it should be noted that cesarean section, the focus of this paper, is often considered a defensive practice.

We introduce and test for another, very simple, constraint on inducement. We posit that physicians with aggressive practice styles face lower demand – they may receive higher fees per patient, but they also treat fewer patients. Using the practice style of the hospital where physicians performed their residency as an instrument for style, we find that aggressive obstetricians – those who perform more cesarean sections than would be expected given their patients' demographic and medical characteristics – have fewer obstetrics patients overall, *ceteris paribus*. Using current fee schedules, we find that aggressive physicians have slightly lower overall incomes, but also work fewer and more predictable hours.

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Table 1a. Summary Statistics for *Style, 1999*

	Mean	Std Dev	No. of Obs.
State of Florida	-0.018	0.169	1029
Statistics by County			
Brevard	-0.060	0.136	30
Escambia	-0.101	0.176	23
Lee	0.087	0.160	26
Leon	-0.010	0.141	17
Orange	-0.079	0.125	93
Volusia	-0.118	0.096	20

Note: *Statistics are calculated using a physician-level dataset that includes all physicians in the county (or state) who deliver at least 50 babies annually. Style is computed as the difference between the actual number of cesareans performed by the physician, and the number of cesareans she is predicted to perform based on patient characteristics.*

Table 1b. Summary Statistics for Patient Variables (Orange County, 2000)

Number of Observations = 14690

	Mean	Std Dev
Cesarean Indicator	0.26	0.44
Age	27.4	6.28
Insurance Status		
HMO	0.38	0.49
PPO	0.21	0.40
Medicaid	0.28	0.44
Medicare	0.01	0.03
Other Insurance	0.12	0.24
Race/Ethnicity		
White	0.52	0.50
Black	0.22	0.41
Hispanic	0.19	0.39
Other Race	0.07	0.25
Zip-code level Income ($)	43041.92	11562.07
Clinical Indicators		
Prior Cesarean	0.120	0.324
Multiple Births	0.012	0.110
Hypertension	0.014	0.120
Diabetes	0.008	0.089
Malpositioned Fetus	0.015	0.123
Prolonged Pregnancy	0.001	0.022
Fetopelvic Disproportion	0.010	0.101
Hemorrhage	0.017	0.128
Polyhydramnios	0.008	0.088
Oligohydramnios	0.037	0.189

Note: *We use this set of patients as the "choosers" in our choice model in the second stage. These patients choose physicians in Orange County based on their practice style in 1999.*

Table 2: Estimating Patient Preferences (Linear Probability Estimates)

	Dependent Variable: Did the Patient Undergo a Cesarean Section?
Age: 20-30	0.056***
Age: 30-40	0.140***
Age >= 40	.210***
Black	-0.002**
Hispanic	0.018***
HMO	0.003*
PPO	0.006***
Medicare	0.075***
Multiple gestation	0.261***
Malposition	0.557***
Hypertension	0.046***
Herpes	0.033***
Polyhdramnios	0.159***
Oligohydramnios	0.111***
Hemorrhage	0.321***
Prolonged pregnancy	0.077***
Diabetes	0.208***
Fetopelvic disproportion	0.596***
Fetal distress	0.231***
Trauma to perineum and vulva	-0.341***
Zip code Income (Unit: $1000)	-0.0005***
Year FE	Y
Physician FE	Y
R-Squared	0.239
Number of Observations	1469816

* signifies p<.05, ** signifies p<.01, *** signifies p<.001

Note: *Estimates are obtained off patient level regressions where the sample includes all patients treated on weekdays in the state of Florida.*

Table 3a. Conditional Logit Model of Patient Choice of Physician

(Model with Physician Fixed Effects)

Excess * High Income	-.293*
Excess * HMO	-.525***
Deviation * High Income	.121***
Deviation *HMO	0.037
Travel Time	-.136***
Patient Income * Travel Time	-0.001
Patient Age * Travel Time	.001***
HMO * Travel Time	.026***
Hospital FE * (Age, Income)	Y
Physician FE	Y
Number of Observations	1226160

* signifies p<.10, ** signifies p<.05, *** signifies p<.01

Note: *The estimation sample includes all maternity patients in Orange County in the year 2000. The choice set of physicians is restricted to those who perform at least 50 deliveries in Orange County in 2000. Excess and Deviation are both measures of physician practice style in 1999, and capture the positive and negative parts, respectively. Travel Time is computed from patient zipcode to the zipcode of the primary hospital the physician operates in.*

Table 3b. Market Share of Aggressive Physician - Orange County

Model with Physician Fixed Effects

	HMO Patients	High Income Patients
Orange County	4.85	4.92
	(.001)	*(.071)*

Note: *An aggressive physician is defined as one who is at the 75th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 3c. Market Share of Passive Physician - Orange County

Model with Physician Fixed Effects

	HMO Patients	High Income Patients
Orange County	5.02	5.05
	(.166)	*(.001)*

Note: *A passive physician is defined as one who is at the 25th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 4a. Conditional Logit Model of Patient Choice of Physician

(Model without Physician Fixed Effects)

Excess Style	-1.42***
Excess * High Income	0.268
Excess * HMO	-0.155
Deviation (Style)	-0.115***
Deviation * High Income	0.093***
Deviation *HMO	0.013
Travel Time	-0.17***
Patient Income * Travel Time	0.001
Patient Age * Travel Time	.002***
HMO * Travel Time	.024***
Hospital FE * (Age, Income)	Y
Rank of Residency Program	-.0045***
Foreign Residency Program	.066**
Number of Years since graduation	-.019***
Number of years since graduation - squared	.001***
Number of Observations	1000695

* signifies p<.10, ** signifies p<.05, *** signifies p<.01

Note: *The estimation sample includes all maternity patients in Orange County in the year 2000. The choice set of physicians is restricted to those who perform at least 50 deliveries in Orange County in 2000. Excess and Deviation are both measures of physician practice style in 1999, and capture the positive and negative parts, respectively. Travel Time is computed from patient zipcode to the zipcode of the primary hospital the physician operates in.*

Table 4b. Market Share of Aggressive Physician - Orange County

Model without Physician Fixed Effects

	All Patients	HMO Patients	High Income Patients
Orange County	4.60	4.56	4.67
	(.001)	*(.001)*	*(.001)*

Note: *An aggressive physician is defined as one who is at the 75th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 4c. Market Share of Passive Physician - Orange County

Model without Physician Fixed Effects

	All Patients	HMO Patients	High Income Patients
Orange County	4.96	4.97	4.99
	(.001)	*(.001)*	*(.185)*

Note: *A passive physician is defined as one who is at the 25th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 5a: Market Share of Aggressive Physician - Other Counties
(Models Including Physician Fixed Effects)

	HMO Patients	High Income Patients
Brevard	5.35	5.02
	(.001)	*(.83)*
Escambia	4.39	4.97
	(.001)	*(.73)*
Lee	4.92	4.95
	(.001)	*(.08)*
Leon	4.81	4.90
	(.001)	*(.05)*
Volusia	4.52	5.26
	(.001)	*(.25)*

Note: *An aggressive physician is defined as one who is at the 75th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 5b: Market Share of Aggressive Physician - Other Counties
(Models without Physician Fixed Effects)

	All Patients	HMO Patients	High Income Patients
Brevard	4.86	5.30	4.98
	(.075)	*(.01)*	*(.84)*
Escambia	4.94	4.37	4.87
	(.28)	*(.13)*	*(.13)*
Lee	4.57	4.43	4.51
	(.001)	*(.09)*	*(.18)*
Leon	4.81	4.75	4.78
	(.001)	*(.13)*	*(.08)*
Volusia	5.23	4.87	5.20
	(.08)	*(.001)*	*(.02)*

Note: *An aggressive physician is defined as one who is at the 75th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 6a. First-Stage Regression: Effect of Residency Training on Physician Practice Style

Dependent Variable: Physician Practice Style

Style of Physician Residency Hospital	1.397***
Hospital FE	Y
Number of Observations	619
Adj. R-Squared	0.22

Note: *The first stage regression is run on a physician-level dataset that includes all Ob/Gyn physicians who deliver at least 50 babies in 1999 in the state of Florida.*
** signifies p<.10, ** signifies p<.05, *** signifies p<.01*

Table 6b. Instrumenting for Physician Practice Style in a Conditional Choice Model

Models with and without Physician Fixed Effects

Excess Style	-1.49***	
Excess * High Income	0.273	0.055
Excess * HMO	-0.358*	-.369**
Deviation (Style)	-0.019	
Deviation * High Income	0.046	.082**
Deviation *HMO	-0.027	-0.014
Residual from First Stage	.147***	.298***
Travel Time	-.170***	-.149***
Patient Income * Travel Time	0.001*	-0.001
Patient Age * Travel Time	.002***	.001***
HMO * Travel Time	.017***	.017***
Hospital FE	Y	
Hospital FE * (Age, Income)		Y
Physician FE		Y
Physician Characteristics	Y	
Number of Observations	556196	556196

Note: *The second stage is run on all maternity patients in Orange County in 2000. The residual from the first stage is included here as a predictor.*
** signifies p<.10, ** signifies p<.05, *** signifies p<.01*

Table 7a.Market Share of Aggressive Physician in Orange County - IV Estimates

Model with Physician Fixed Effects

	HMO Patients	High Income Patients
Orange County	4.90	5.02
	(.045)	*(.78)*

Note: *An aggressive physician is defined as one who is at the 75th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 7b. Market Share of Passive Physician in Orange County - IV Estimates

Model with Physician Fixed Effects

	HMO Patients	High Income Patients
Orange County	4.99	5.04
	(.646)	*(.014)*

Note: *A passive physician is defined as one who is at the 25th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 8a. Market Share of Aggressive Physician in Orange County - IV Estimates

Model without Physician Fixed Effects

	All Patients	HMO Patients	High Income Patients
Orange County	4.59	4.50	4.66
	(.001)	*(.001)*	*(.001)*

Note: *An aggressive physician is defined as one who is at the 75th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 8b. Market Share of Passive Physician in Orange County - IV Estimates

Model without Physician Fixed Effects

	All Patients	HMO Patients	High Income Patients
Orange County	4.99	4.99	5.01
	(.661)	*(.596)*	*(.322)*

Note: *A passive physician is defined as one who is at the 25th percentile of the distribution of physicians in the same county, in terms of practice style. Market share is calculated relative to physician with median practice style who is assumed to have a share of 5%. P-values presented in parentheses.*

Table 9: Estimated Change in Income for Representative Aggressive Physician

	Number of Deliveries	Number of Cesareans	Total Income ($)	Change in Income (%)
Median physician	200	52	415600	
Representative Aggressive Physician				
Orange County	184	59	385700	-7.19
Brevard County	194	72	409600	-1.44
Escambia County	198	73	417900	0.55
Lee County	183	63	384900	-7.39
Leon County	192	56	400800	-3.56
Volusia County	209	67	438100	5.41

Note: *Calculations based on following assumptions: 1) Median physician has market share of 5% 2) Reimbursement for Vaginal delivery is $2000 3) Reimbursement for Cesarean sections is $2300. Market shares for representative aggressive physician in different counties is calculated from Table 5*