Delivering Bad News: Market Responses to Negligence

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Abstract

One of the goals of the legal liability system is to ensure that sellers provide appropriate care. In addition to direct punishment by the legal system, reputation effects may work to deter negligence. The little available research evidence suggests that reputation effects are minimal, however. We develop a theory tailored to an environment, such as medicine, in which sellers are of heterogeneous quality and face two types of demand – "private" consumers who exhibit downward sloping demand (i.e., private health insurance) and "government" consumers who exhibit perfectly elastic demand at a fixed price (i.e., Medicaid insurance). The theory predicts that high quality sellers who suffer reputation losses will see their caseloads shift from private to government patients, while low quality sellers will lose government patients and may gain private patients. Combining individual patient-level data from Florida for the years 1994-2003 with physician-level data on litigation, we find evidence that physicians experience reputation effects that are consistent with the theory.

I. Introduction

Markets generally reward high quality sellers with increased demand. Markets do not always ensure that sellers take due care, however, and the legal liability system is intended to complement the marketplace in deterring negligence.[1] If market discipline is strong and consumers readily withdraw demand when sellers are negligent, the legal liability system may be redundant and could even result in excessive levels of quality. Hence, the issue of whether market discipline deters negligence is a critical one and central to policy debates like the ongoing one about medical malpractice reform.[2]

There is some anecdotal evidence that negligent sellers suffer negative demand shocks. For example, sales of Johnson and Johnson's Tylenol plummeted in 1982 after the product was tainted by tampering and ValuJet lost customers and even changed its name after the 1996 crash of flight 592.[3] More recently, the spate of vehicle recalls faced by Toyota over allegedly defective acceleration put the automaker under intense public scrutiny and caused its U.S. market share to plummet.[4]

However, to the best of our knowledge, there are very few studies that systematically examine the demand side effects of negligence. Most of these studies use litigation as an indicator of negligence; we will do the same. Garber and Adams (1998) examine the effect of product liability trial verdicts on sales of new automobiles and on the stock price of automotive firms. They find no effect of these verdicts on sales or stock prices, leading them to conclude that consumers are either unaware of the verdicts, or do not use the information to update their beliefs

[1] Shavell (2007) surveys the literature on the optimal design of the liability system.
[2] See the discussion of deterrence and medical malpractice in Joint Economic Committee (2005).
[3] For Tylenol, see "J&J will pay dearly to cure Tylenol", *Business Week,* 11/29/1982, p. 37 which reports a short term 80 percent reduction in sales, only some of which is accounted for by a selective withdrawal of the product. For ValuJet, see Reuters, 1997, "ValuJet to buy AirWays, will drop name" *Financial Post*, 7.11,1997. Section 1, page 7.
[4] See "Edmunds sees Toyota U.S. Market share at 4 ½-year low", *The Wall Street Journal*, 02/25/2010

about auto quality. The latter explanation is particularly compelling for automobiles, as consumers have a number of alternative sources of information about product quality. Prince and Rubin (2002) conduct an event study on product liability litigation in the automobile industry but use the filing of a lawsuit (as opposed to the final verdict) as their event. They find that the filing of a lawsuit is associated with significant losses in firm value which approximately equal a worst-case scenario associated with the litigation. This leads them to conclude that firms may suffer lower demand as consumers learn about these lawsuits.[5]

There is substantial concern about deterring negligence in the healthcare sector, particularly in light of the ongoing debate about malpractice reform. Yet little is known about the extent to which the market disciplines negligent healthcare providers. In this paper we fill that gap by analyzing market responses to allegations of medical malpractice by obstetricians.[6] Obstetrics patients may be relatively poorly informed about the quality of their obstetricians and news about a negligent act, conveyed through lawsuits or word of mouth, could lead patients to revise their beliefs about quality.[7]

In a typical market, we would expect news of negligent behavior to result in a decline in sales for the affected seller. A complicating feature of the obstetrics market is the presence of Medicaid, a large government purchaser that pays a fixed fee that is often below prevailing prices for privately insured patients. Many physicians restrict access for Medicaid patients and it is not self-evident how Medicaid caseloads would adjust to negligence. We develop a simple model that fits these institutional details. The model shows that physicians who are in

[5] For examples of other studies documenting the effects of negligence on firm valuations., see Hersch and Viscusi (1990), and Dranove and Olsen (1994).

[6] Lawsuits may be markers for identifying negligent behavior and we are agnostic as to whether lawsuits are direct indicators of negligence or merely correlated in time with negligent acts.

[7] The most common sources of information are healthcare report cards which are not available in all areas and which may not cover all providers in a region. See Dranove and Jin (2009) for a review of the literature on quality disclosure and report cards with a particular focus on the dearth of quality information in the medical market.

sufficiently high demand by privately insured patients will normally restrict access to Medicaid patients. If such physicians experience a negative demand shock, for example as a result of negligence, they will simultaneously experience a *reduction* in privately insured patients and an *increase* in the number of Medicaid patients they treat. The total number of patients should be unchanged. The theory gives ambiguous predictions regarding the impact of litigation on low quality doctors.

We test these predictions by examining the obstetrics market in Florida for the period 1994-2003. Using regressions that correct for mean reversion, we obtain results that are consistent with the predictions. Specifically, high quality physicians who are sued experience a shift in caseload from private to government consumers, with no net change in caseload. We conclude that high quality physicians who are sued experience a negative demand shock, but are able to partially mitigate the impact by adjusting their patient mix. Low quality physicians who are sued experience the opposite trend – fewer Medicaid patients but (slightly) more private patients.

This study adds to the considerable stream of literature describing how the legal liability system affects seller behavior in healthcare. Perhaps the best evidence comes from studies of defensive medicine. Kessler and McClellan (1996) show that state tort reform reduces the rate of diagnostic testing and some invasive procedures. Currie and MacLeod (2008) find that the effect of tort reform on defensive behavior depends on the specific reforms. Avraham, Dafny, and Schanzenbach (2009) find that tort reform reduces insurance premiums, and interpret the reduction as resulting from decreases in medical spending. In a study about medical referrals by managed care organizations, Fournier and McInnes (2001) examine the extent to which managed care organizations refers a patient to physician with medical malpractice claims and compare it

to fee-for-service markets. They find that physicians who have additional malpractice claims over time tend to lose more fee-for-service patients than physicians with fewer claims. These studies investigate how physicians and insurance companies respond to different legal environments, but do not explain why they do so in detail. In particular, they do not sort out whether physicians are concerned about the direct costs of litigation, such as legal fees and damage awards, or the potential loss of business from patients and referring physicians who may view a lawsuit as a negative signal about quality.

The rest of this paper is organized as follows. Section 2 uses a simple theoretical model to outline the mechanism. Section 3 introduces the data while Section 4 contains discussion on our empirical methods and baseline results. Section 5 presents the results with physician quality and Section 6 explores some extensions to the analyses and details the robustness checks we performed. Section 7 concludes.

II. Model

Consider a classic price discrimination model in which a profit-maximizing monopolist seller faces demand from two types of customers.[8] Type φ (for "private customer") displays downward sloping demand $P_\varphi(Q_\varphi)$ where P and Q denote price and quantity respectively. Type γ (for "government customer") displays perfectly elastic demand at a price P_γ that is set by fiat. We assume that the seller only has limited number of (potential) buyers of type γ given the price, P_γ , and denote this number as $Q_{\gamma max}$. We also assume that the seller faces upward sloping marginal costs.

[8] Our model can be interpreted as one in which physicians are utility maximizers who weigh revenues against the dollar costs of their leisure time. This would generate some of the same predictions (e.g., physicians who are sued may not see an overall decrease in workload) but would not generate the nuanced predictions of our model vis-a-vis physician quality and the composition of the physician's caseload.

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Figure 1a depicts the profit maximizing choices of P_φ and Q_γ for a seller whose demand from type φ customers is sufficiently high that $Q_\gamma < Q_{\gamma max}$. We say that such a seller has "high quality." This high quality may reflect the physician's technical or personal skills or even the perceived quality of the hospital where the physician practices. In any event, the implication of high quality for our model is that the resulting marginal revenue curve crosses the marginal cost curve at a point where the physician rations access to type γ patients, as depicted in the figure. In this scenario, the seller is treating Q_φ type φ customers and Q_γ type γ customers. Figure 1b shows what happens if the seller suffers a decline in demand from both customer types. The demand curve from type φ customers rotates in whereas the demand from type γ remains along the P_γ price line as $Q_{\gamma max}$ shrinks. In this particular example, we assume it is still the case that $Q_\gamma < Q_{\gamma max}$. In this case, Q_φ decreases but Q_γ increases by an exactly offsetting amount. If the demand decline is large enough (not shown), the seller will reach $Q_{\gamma max}$ and end up selling less to both customer types.

Figure 2a depicts the choices of a seller whose demand from type φ customers is not sufficiently high and, as a result, profit maximization entails choosing $Q_\gamma = Q_{\gamma max}$. Figure 2b shows what happens if the seller suffers a decline in demand; to simplify the picture, we consider only a decline in Q_γ to Q'_γ, the decline of the type γ customers. Afterwards, we consider the additional implications of a decline in the demand from type φ. In this case, the seller experiences a reduction in type γ customers from Q_γ to Q'_γ. If private demand does not change, the seller reduces P_φ and increases the quantity to $Q_\varphi + Q'_\varphi$. This must be the case because if P_φ is unchanged, the marginal cost of treating an additional type φ customer will be below the marginal revenue (due to upward sloping marginal cost.) The overall impact on P_φ and Q_φ

therefore depends on the relative decline in demand from type φ customers and the slope of the marginal cost curve.

Note that a similar analysis can be made in case if there were two different downward sloping private demand schedules, such as with PPO and HMO patients. The change in the number of patients for each type of private insurance is generally ambiguous, as it depends in part on the magnitude of the demand shift (e.g., an insurer may not strongly object to lower quality) as well as on the relative changes in elasticity.[9]

III. Data

We focus on the market for obstetrics in the state of Florida. The high volume of cases in this specialty and the high volume of malpractice-related litigation facilitate our empirical analysis.[10] Three features of obstetrics suggest that there might be a market response to negligence: childbirth is important, the patients have substantial time to shop around to find an obstetrics provider, and many patients rely on word of mouth from other patients when selecting a provider. We restrict attention to Florida for two reasons. First, it has some of the highest premium levels as well as the highest rates of litigation in the entire country. Second, and more importantly, Florida's Agency for Health Care Administration (AHCA) provides detailed patient level hospital utilization data that identifies the operating physician; in the case of obstetrics, the data identify the license number of the physician who performed the delivery.

We use AHCA hospital discharge data from 1994 - 2003. AHCA data include all deliveries that took place in hospitals in Florida and includes information about the treatment

[9] An alternative hypothesis for why physicians see changes in volume after negligence is that physicians who are in groups are assigned fewer cases by their partners. They may also be assigned less remunerative cases such as Medicaid. But this hypothesis still cannot explain the interaction between these effects and physician quality that we see in the data and present in the next section.

[10] Malpractice premiums for ob/gyns are as high as $200,000 per year in some states. See MacLennan et al (2005)

(diagnosis related group codes), patient characteristics (age, race, zip code, type of insurance, risk factors such as multiple gestation and whether the patient has had a previous cesarean section), physician license numbers, a unique hospital identifier, and the year and quarter of the hospitalization based on the date of discharge. The main insurance categories that we consider are PPO, which tends to pay generous rates, HMO, which is less generous, and Medicaid, which pays a low fixed rate.[11] The physician identifiers (Florida State License Numbers) are unique and consistent over time, allowing us to track each physician's practice volume for all the years in our data.

We match physician license numbers in the AHCA data to a dataset of closed medical malpractice claims collected by Florida's Department of Financial Services from January 1979-July 2003. This data covers every malpractice claim made in Florida that is resolved as of July 2003. The data include most of the important events in the "history" of the claim, including the date of occurrence of the incident that led to the litigation, date of claim, date of filing of the lawsuit, and date of resolution.[12]

A patient may not be aware that something has gone wrong at the time of the medical procedure. This is especially common in obstetrics, where problems that arise during a delivery may not manifest themselves for months or even years. In Florida, the statute of limitations requires patients to file suit within two years of the date when they "knew or should have known"

[11] The data contain other categories of payer such as self-pay, uninsured, Medicare (for disabled mothers), Veteran's Administration etc. Each of these categories is individually very small making up less than 1% of the observations on average. Hence we do not consider their effects separately.

[12] Due to the time required to resolve a negligence claim, some incidents of negligence in the last few years of the data will not be associated with a closed claim. Those claims that are closed are likely to involve lesser degrees of negligence and some deliveries that are included in the control group (no identified litigation) may have involved negligence. In addition, not every negligent act results in a lawsuit. Thus, the "control" deliveries include some observations for which there may be a negative market reaction. All of these factors tend to bias against finding demand responses to litigation, thereby making our estimates conservative. Moreover, we address the close claim issue by examining only those claims where the negligent event occurs prior to 2000. Our results are largely unchanged.

of the potential negligence. Our data do not report this date. The important implication for our research is that we are unable to identify the window of time between the date when the patient "knew or should have known" of potential negligence and the date when litigation is filed. As a result, we cannot investigate whether there is a demand response to the knowledge of negligence independent of the demand response to the lawsuit.

Each claim contains the license number of the physician involved in the claim. We arrange this dataset to construct an individual history of claims for each physician dating back to 1979. The history includes the date of occurrence (of an alleged medical malpractice incident), claim (date the physician was contacted by patient), and filing of a lawsuit (date a lawsuit is filed if it is filed at all).[13] We restrict attention to lawsuits related to obstetrics, which represents nearly 20 percent of all lawsuits.

In the analyses that we present herein, we restrict attention to physicians who perform a minimum of 50 deliveries annually on average over the ten year timeframe of the data. We also try other thresholds and obtain similar results. We impose this quantity threshold to exclude physicians who may perform the occasional delivery (e.g. an emergency delivery when no obstetrician is available). We will refer to these physicians as obstetricians, although we do not know their specialty certification. Based on the 50 delivery threshold, there are 1418 physicians in our sample, responsible for 91% of all deliveries in the data.

Our unit of observation is a physician-year-quarter with our analysis sample consisting of 38,469 such observations. Table 1 provides summary statistics of some key variables. On average, a physician in our data treats over 35 patients per quarter, with Medicaid patients making up the largest fraction. The number of physicians present in the data each year is

[13] In separate unreported regressions, we exclude from the sample all physicians who were sued between 1979 and 1994. Our results are not materially affected by this restriction.

relatively stable, with the incidence of lawsuits being slightly greater in the earlier years of the sample. We address this issue in our empirical specifications detailed below.

IV. Estimating the Effects of Litigation on Demand

We first present some patterns in the raw data. Figure 3 shows the quarterly trend in patients for physicians who have been sued, for a period of three years before and three years after the lawsuit. The overall pattern suggests that doctors who are sued experience no pronounced overall trend in patients prior to litigation, except for a slight decline in HMO patients prior to litigation. Shortly following litigation, there is a decline among all patients and particularly among PPO patients, while there is a slight increase in HMO and Medicaid patients. This suggests that the change in patient mix is due to the adverse event, rather than the continuation of a trend caused by some other, unobserved factor.[14]

Table 2 presents the quarterly trend in patients for a representative year in our sample, 1999. The top panel contains information on patient volumes for physicians that were subject to a lawsuit in 1999 while the bottom panel presents averages for all other physicians active in that year. The main disparity in trends across these two sets of physicians seems to be in the first two categories, i.e. all patients and PPO patients. Physicians not subject to a lawsuit experience a steady increase in total patient volume as well as PPO patient volume. In contrast, physicians sued in 1999 seem to see declines in patient volume in these categories by the end of the year. These patterns are purely descriptive, of course, and do not exploit the richness of our panel dataset. We now provide more details on our empirical approach.

[14] For example, physicians might suddenly take on a higher caseload which increases their risk of negligence.

We estimate the effect of litigation on demand using linear and Negative Binomial regressions which include fixed effects for each physician, year and quarter.[15] Since we are interested in the effect of litigation on the total volume as well as the composition of patients treated, we estimate multiple specifications with different dependent variables. Our base regression examines the total number of patients treated by the physician in a quarter. We estimate separate models for the number of PPO, HMO, and Medicaid patients seen by the physician. We report results from both linear and Negative Binomial regressions.

Table 3 presents results from specifications that take the following form:

$$(1) \quad Phys\ Vol_{pqy} = \alpha + \beta_0 * post_{pqy} + \lambda_p + \tau_y + \psi_q + \theta_{py} + \varepsilon_{pqy}$$

The subscripts *p, q* and *y* refer to the physician, quarter and year respectively. The dependent variable $Phys\ Vol_{pqy}$ measures the number of patients treated by physician *p* in quarter *q* of year *y*. The primary predictor $post_{pqy}$ is an indicator that takes the value 1 for physician *p* in quarter *q* of year *y* if a lawsuit has been filed against physician *p* prior to or in the quarter *q*. We use the date of filing of the lawsuit while constructing the litigation measure because it is the earliest time that an alleged medical malpractice case officially becomes public information. As discussed earlier, the patient may know of the negligent event as much as two years before filing a lawsuit and word of mouth may adversely affect the physician's reputation. In these cases the litigation might serve only as a (potentially delayed) marker of the timing of the incident. Such timing would work against our results because we occasionally misassign some "post negligence" data to the "pre" period.[16]

[15] We do not estimate regressions with logged dependent variables because of the large number of zero observations for specific insurance categories.

[16] Many acts of negligence may not result in a lawsuit. By including physician fixed effects, we control for the possibility that physicians who are sued have more negligent acts that might be unobservable. Our results may be

The vectors denoted by λ_p, τ_y and ψ_q represent a full set of fixed effects for each physician, year and quarter, respectively. In addition, we include a set of fixed effects for the year in which the lawsuit was filed (denoted by θ_{py}) in order to account for the fact that lawsuits filed in earlier years have a greater chance of being resolved by 2003 which in turn may lead to the characteristics of lawsuits observed in our data varying by year.

Column 1 of Table 3 presents results using a linear regression specification. The coefficient on the *post* variable is negative and significant, implying that physicians experience a decline in the total number of patients treated after they have been sued. The point estimate suggests that physicians lose 1.9 patients each quarter (i.e., nearly 8 patients per year). In column 2 we replace *post* with separate dummies for the number of years after the lawsuit. We find that the demand shock does not fully kick in until the second year after the lawsuit. This suggests either that information travels slowly, or that women who have already chosen their obstetrician (which usually occurs at least six months prior to delivery) do not respond. It also suggests that bias due to not knowing when the patient learned of the negligence is minimal. The demand shock persists for several years, possibly reflecting the importance of word of mouth when women choose their obstetricians. Similar timing patterns emerge in all subsequent analyses, and we omit further year-by-year results for brevity.

Columns 3 and 4 of Table 3 present similar results using a negative binomial specification, where the implied relationship between litigation and demand is multiplicative; that is, the impact increases with the baseline number of patients seen by the physician.[17] The results from this specification are qualitatively similar to the results produced by the linear model.

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biased if there is an *increase* in unobservable (to us) negligent acts subsequent to litigation and if patients respond to them.

[17] Goodness-of-fit tests suggest that the conditional errors in Poisson specifications are overdispersed.

To compute magnitudes we consider the median physician who performs 32 procedures in a quarter. The coefficient on the *post* (-.0474) indicator implies that physicians lose around 1.5 patients per quarter as a result of the lawsuit.

Table 4 decomposes the results by patient insurance type. Columns 1-4 present results from the linear model while columns 5-8 present results from the negative binomial regression. Across both models, the filing of a lawsuit has a negative and significant impact on the number of PPO patients seen by the physician. Given that the median physician treats 5 PPO patients in a quarter, the implied loss of PPO patients (about 0.4 patients per quarter) subsequent to a lawsuit is economically significant. The number of HMO and Medicaid patients seen by the physician also decrease as a result of the lawsuit although these effects are not statistically significant. These results represent averages across physicians of all quality levels. As we show in the next section, interactions with physician quality reveal more substantial effects.

V. How is the Impact of a Lawsuit Moderated by Physician Quality?

The theoretical model outlined in Section 2 implies that the effect of litigation might vary by insurance type as well as the initial quality of the physician. We modify our empirical model to take this into account. As discussed in Section 2, quality manifests itself observationally as the fraction of PPO patients seen by a physician.[18] For physicians that are never subject to a lawsuit from 1994-2003, we compute quality as the average fraction of PPO patients seen by the physician over the ten year timeframe of the data. For physicians that are sued, we use the

[18] We note that individual physician PPO share may reflect unobservable physician level characteristics that are outside of the model and that may be correlated with litigation; we believe our empirical strategy of using an instrumental variable for PPO share addresses this concern somewhat. That being said, PPO share ought to reflect tangible measures of quality such as clinical skill. Unfortunately, any objective clinical measures are hard to come by (for example, publicly available physician level report cards did not exist for most of our study period and those that are currently available tend to based on models with low R-squared and would therefore be unreliable measures of quality). Moreover, they would fail to capture other dimensions of quality such as bedside manner that might be tied to high PPO share.

average fraction of PPO patients treated by the physician in the years prior to the lawsuit.[19] As before, in the base specifications we estimate models of the following form for each patient type:

$$(2) \quad Phys\ Vol_{pqy} = \alpha + \beta_0 * post_{pqy} + \beta_1 * post_{pqy} * Quality_p + \lambda_p + \tau_y + \psi_q + \theta_{py} + \varepsilon_{pqy}$$

Table 5 reports results of OLS and Negative Binomial regression estimates of equation (2) where we again show the effects of litigation overall as well as a breakdown by patient type. The results in column 1 indicate that low quality physicians lose about 2 patients per quarter after litigation while high quality physicians experience a smaller decrease. This masks considerable variation across payers. Specifically, high quality physicians treat fewer PPO patients in the wake of a lawsuit but treat more Medicaid and HMO patients. This finding is consistent across both the linear and the Negative Binomial models. Before we read too much into the magnitudes of these effects, it is necessary to address the possibility that our findings are subject to endogeneity bias resulting from mean reversion.

Our model incorporates physician fixed effects and therefore focuses on how litigation affects changes in physician caseload. In these fixed effects models, there is no obvious bias in the coefficient on *post*. However, our interactions of *post* with physician quality are potentially problematic because our measure of physician quality incorporates the lagged value of the dependent variable. This may introduce bias if there is mean reversion in the number of PPO patients. Specifically, note that a "high quality" physician is defined as having a high PPO ratio prior to being sued. The number of PPO patients might regress to the mean, so that unobserved

[19] One potential concern with measuring physician quality based on PPO shares is that physicians who are sued later in the data or who are never sued will be mechanically designated as having higher levels of quality if PPO shares increase in the dataset over time. In order to address this concern, we constructed a quality measured based on relative PPO shares through use of a z-score that compares each physician's PPO share to the PPO share of other physicians practicing in the relevant time frame (e.g. if a physician were sued in 1997, we compare that physician's PPO share in 1994-1996 to the PPO share of physicians practicing in the same time period). The pattern of coefficients is similar to the one obtained using the quality measure we use in the current version of the paper (the full set of results is available from the authors upon request). We thank an anonymous referee for this suggestion.

demand from PPO patients declines post-litigation. This would appear in our regressions as a negative coefficient on the post-litigation indicator.

To determine whether our findings suffer from mean regression, we perform a falsification test by replicating our empirical strategy on a set of "pseudo lawsuits." That is, we drop from our data all physicians who were subject to an actual lawsuit and then randomly assign fictitious lawsuits to physicians in a manner such that the total proportion of lawsuits to observations in the data (1.75 percent) remains the same as before. As in our prior analyses, we define quality for these physicians based on their proportion of PPO patients treated prior to the pseudo lawsuit. Because the Negative Binomial and linear regression results are always qualitatively similar, we report only the latter in this and future tables.[20] Table 6 presents results from this falsification exercise. The key interaction coefficients are somewhat smaller than in Table 5 but the pattern is quite similar and the coefficients remain statistically significant; this confirms our suspicions about mean reversion.

To eliminate concerns about endogeneity induced by mean reversion, we instrument for quality using the average fraction of non-maternity PPO patients at the primary practice hospital of the physician.[21] We expect this measure to be correlated with our measure of physician quality because both may be driven by the number of PPO plans that contract with the hospital as well as by the demographics of the population that favors that hospital. Because we average this measure over the duration of the data set we should effectively eliminate the potential for mean reversion.

Results from the first-stage regression, in which we regress the quality of each physician on the instrument along with all of the fixed effects (for each year, year of lawsuit and physician)

[20] Results from Negative Binomial specifications are available from the authors upon request.
[21] Since some of the physicians in our data perform procedures at multiple hospitals, we designate the hospital where the physician performed more procedures as the primary practice hospital of the physician

indicate that the instrument is able to explain a good amount of variation in physician quality. The coefficient on the instrument is positive (0.306), strongly significant ($p<.001$), and the F-statistic for the instrument is 42.6.

Table 7 presents results from the linear regression specification where we instrument for the *quality*post* interaction using the fraction of non-maternity PPO patients at the hospital as an instrument for physician quality. The pattern is similar to the one seen in Table 5. In the wake of a lawsuit, high quality physicians see fewer PPO patients but offset this decline by treating greater numbers of HMO and Medicaid patients, while low quality physicians lose HMO and Medicaid patients.

In order to better interpret the coefficients, we compute the magnitudes of these effects for a representative high quality and a low quality physician and report these in Table 8. A high (low) quality physician is defined as one who is at the 80th (20th) percentile of the distribution of physicians, in terms of quality. This translates into roughly 40% PPO patients for a physician designated as high quality, and 2.5% PPO patients for a physician designated as low quality.

High quality physicians do not experience any significant change in patient load overall subsequent to a lawsuit. However, the filing of a lawsuit does lead to a significant reshuffling of patient types treated. High quality physicians treat two fewer PPO patients per quarter after a lawsuit but treat more HMO and Medicaid patients (around 1 and 1.5 patients per quarter, respectively). Low quality physicians on the other hand experience a general decline in the overall number of patients seen post the filing of a lawsuit, especially in the HMO and Medicaid segments where they lose 2.2 and 2.9 patients per quarter, respectively.

Low quality physicians who are sued partially offset the decline in Medicaid and HMO patients with an increase of 1.65 PPO patients. The model predicts an increase in PPO patients

provided that the Medicaid demand is exhausted and demand from PPO does not fall substantially after a lawsuit. The intuition is as follows: If the physician loses many Medicaid patients, marginal cost falls. This physician is therefore willing to take on more PPO patients, through a price reduction. This can be offset by a decline in PPO patients if the PPO demand falls. Our results suggest that the latter effect is small, perhaps because the news of a lawsuit against a doctor who treats a lot of Medicaid patients does not circulate among PPO patients; this is consistent with the theory if PPO patients do not view the litigation as news or are not aware of the litigation.

Finally, we confirm that the instrumental variables approach accounts for mean reversion by estimating specifications on the sample containing pseudo lawsuits where we instrument for physician quality. Table 9 presents results from this set of specifications. There is no pattern evident in the results and the coefficients are all statistically indistinguishable from zero. This reassures us that our instrumental variables estimates are free from bias caused by mean reversion.

VI. Extensions and Robustness Checks

The results in the previous sections clearly establish a market response to negligence. One might expect the strength of this response to vary based on the degree of negligence. Although we cannot measure the extent of negligence, we treat the size of the award (whether a settlement or jury award) as a proxy for the extent of negligence. Overall, approximately 60% of claims against obstetricians result in a positive award. We re-estimate the models presented in Table 7 with the addition of interaction terms between *post* and *post*quality* with the log of the

award payment and present the coefficients in Table 10. [22] In order to ease interpretation, we compute magnitudes corresponding to high and low quality physicians for awards at the 20th and the 80th percentile of the distribution of non-zero award payments in the data ($50,000 and $500,000 respectively) and present these in Table 11. While the pattern of the demand response across patient segments remains similar across both award amounts, lawsuits that relate to incidents with greater degrees of negligence (as measured by the size of the award) clearly evoke a stronger demand response from patients although the difference is not substantial.

We also tested for other potential responses to litigation. Physicians subject to a lawsuit might end up losing their practicing privileges at their primary practice hospital, and/or might choose to relocate to a different market. In order to test this hypothesis, we re-estimate equation (1) where the dependent variable is an indicator for whether the physician switched hospitals or exited the market as dependent variables. The key coefficient was statistically insignificant in all such specifications implying that the filing of a lawsuit had no significant impact on physician switching or exit.[23]

Physicians who are sued may change their patient mix to avoid complicated cases. By the same token, patients with complicated cases may avoid physicians who are sued. In order to test this hypothesis, we re-estimate equation (1) where the dependent variable is the percentage of deliveries with complications, as determined by the patient's diagnosis related group, and report results in columns 1 and 2 (OLS and Negative Binomial model, respectively) of Table 12. The coefficients are small in magnitude and imprecisely estimated.

Finally, we determined whether physicians who are sued see a change in the volume of non-pregnancy procedures they may perform (which would include procedures like

[22] Our measure – log(award) – is set to zero for awards with zero payment
[23] These results are not reported here but are available from the authors upon request.

hysterectomies, for example). We re-estimate equation (1) with the new dependent variable as the number of non-pregnancy procedures performed by the physician and report these results in columns 3 and 4 (OLS and Negative Binomial model, respectively) of Table 12. The coefficients on *post* are negative but again imprecisely estimated.

We test the robustness of our results using alternate sample restrictions. Since lawsuits filed in earlier years have a greater chance of being resolved within the timeframe of the data (and therefore of being present in the data), we run all our models on a sample that only contains lawsuits that are filed before 1999 but tracks the physicians all the way until 2003. Physicians that are subject to a lawsuit in the later years (post-1999) are excluded. The resulting sample consists of 1214 physicians and 334 instances of a lawsuit being filed against 220 physicians. The results from our specifications yield very similar conclusions.[24] Our results are also robust to alternate sample definitions where the annual volume threshold for a physician to be included in the sample was changed to 25 deliveries a year and 100 deliveries a year, respectively.

VII. Discussion

The answer to the question "what happens to a physician's practice after that physician is sued?" is complex. Focusing on obstetricians in Florida, we find that on average, physicians lose about 2 patients per quarter. But this average effect masks important subtleties. Breaking down results by patient insurance type, we find that PPO patients shy away from doctors who have been sued, to be replaced by Medicaid and HMO patients.

These results are consistent with the theoretical model that we posit in section 2. Namely, PPO patients form beliefs about the quality of their providers and lawsuits shake up the beliefs about high quality doctors. As PPO patients withdraw demand from high quality doctors,

[24] These results are available from the authors upon request.

the doctors alter their patient mix by accepting more Medicaid and HMO patients. Thus, patients whose insurers are stingy with provider payments may get to see high quality physicians only after these physicians are sued.

The financial impact of this change in patient mix can be significant. Consider a high quality physician who sees 100 PPO patients, 50 HMO patients, and 50 Medicaid patients annually. Using the estimates in Table 8, these numbers would be approximately 92, 54, and 56 in the wake of a lawsuit. Although the total caseload is largely unchanged, reimbursements for HMO and Medicaid patients tend to be much less generous than PPO payments. For example, the *Physician Compensation Report* for July 2000 suggests that the global fee for all obstetrics services for a privately insured patient range from $1700-$2500. Medicaid fees are usually below the low end of the range of private fees. If we suppose that the global fees for PPO, HMO, and Medicaid are $2500, $1700, and $1300 respectively, then the physician's annual gross earnings drops from $400,000 to $394,600, and the loss is felt for at least five years after the lawsuit. Low quality physicians also lose. Take a low quality physician who sees 20 PPO patients, 90 HMO patients, and 90 Medicaid patients annually. After a lawsuit, the caseload would be 26, 81, and 79. Annual gross earnings would drop from $320,000 to roughly $305,000 and again is felt for 5 years or more.

To put these effects in perspective, a typical lawsuit costs a physician about 1-2 days of time spent preparing the defense, which represents less than 1 percent of revenues in a single year.[25] There are no other documented tangible costs to the physician, who is typically community rated by the malpractice insurance carrier.[26]

[25] See, e.g., "Ob/Gyn Groups Push Cooperation Through Equal Shares and Salary" *Physician Compensation Report,* July 26, 2000.
[26] See, e.g., Fournier and McInnes (2001).

Our analysis shows that the market provides substantial incentives for physicians to provide due care. But we are not able to state whether the negligence system should be weakened. In particular, it is unclear whether litigation serves as a marker without which patients might not learn about the negligent event. Nor have we done the kind of benefit/cost analysis to determine whether marginal increases in physician effort would justify the cost.

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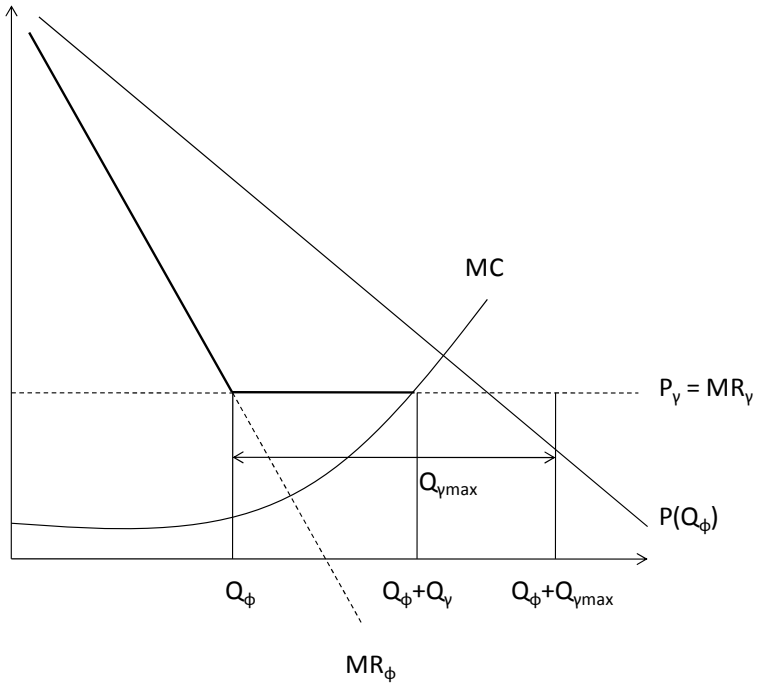


Figure 1a. Initial Demand for High-Quality Seller

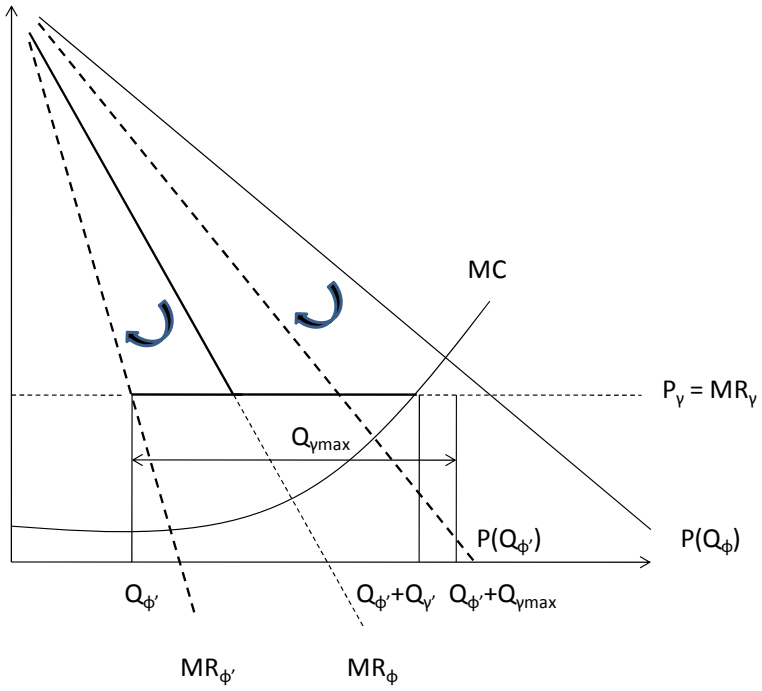


Figure 1b. Demand for High-Quality Seller Post Lawsuit

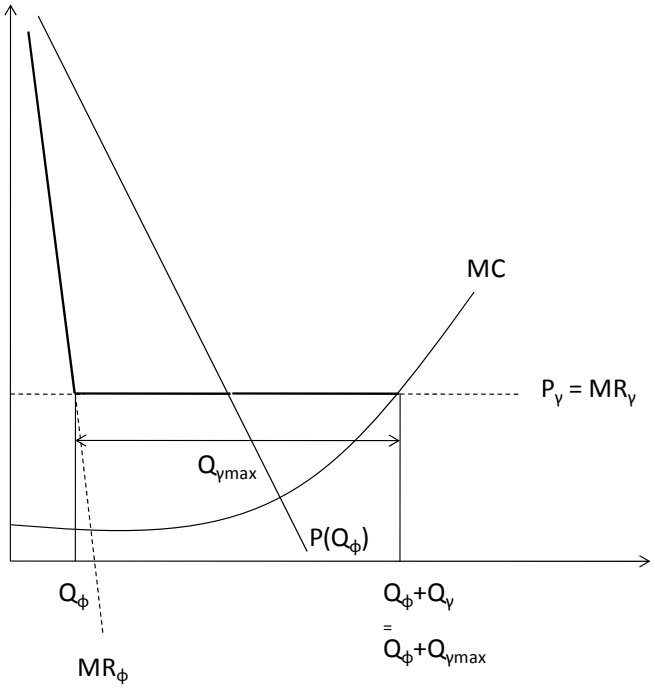


Figure 2a. Initial Demand for Low-Quality Seller

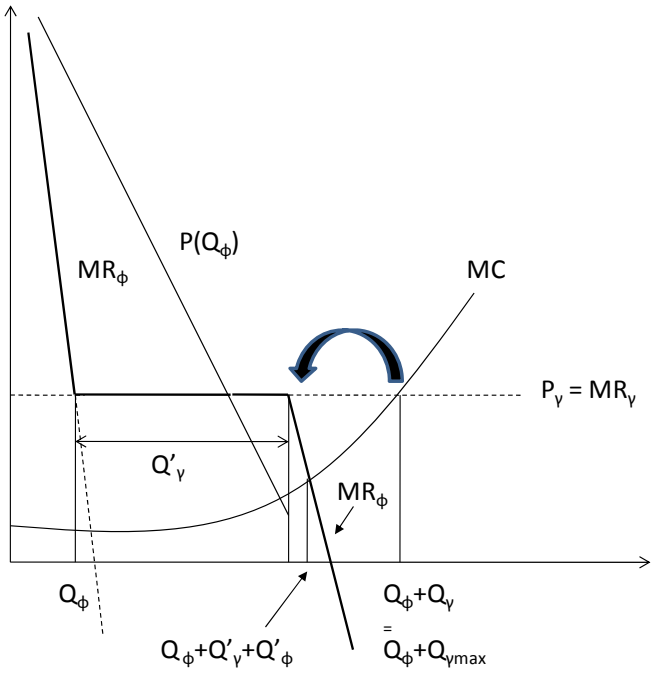
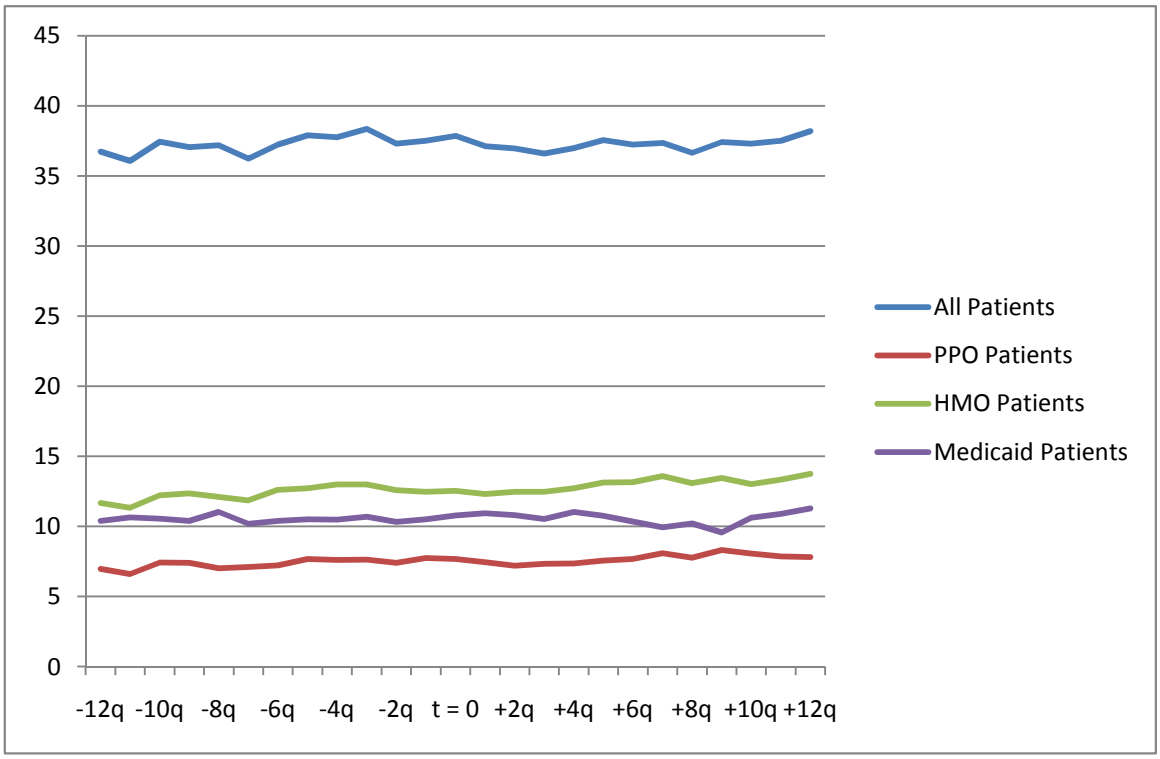


Figure 2b. Demand for Low-Quality Seller Post Lawsuit

Figure 3. Quarterly Trend in Number of Patients 3 Years Before and After a Lawsuit



Note: t = 0 represents quarter of lawsuit. Figures shown in table are averages computed across all physicians that were subject to a lawsuit

Table 1. Summary Statistics for Key Variables; 1994-2003

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	*Total*
Patient Breakdown											
Number of Patients	31.59	31.56	30.92	34.51	35.12	35.61	37.09	37.59	37.86	40.13	*35.38*
	(19.93)	*(19.88)*	*(20.41)*	*(19.58)*	*(19.61)*	*(19.78)*	*(21.59)*	*(21.86)*	*(22.40)*	*(23.12)*	*(21.09)*
Number of PPO Patients	5.95	6.24	5.86	6.73	6.75	6.99	7.47	7.71	7.64	6.20	*6.79*
	(6.20)	*(6.26)*	*(6.02)*	*(6.58)*	*(6.70)*	*(6.35)*	*(6.65)*	*(6.76)*	*(6.60)*	*(6.95)*	*(6.56)*
Number of HMO Patients	6.23	7.48	8.51	10.90	11.93	12.79	13.04	13.10	13.11	9.77	*10.87*
	(7.77)	*(8.14)*	*(8.59)*	*(9.31)*	*(10.04)*	*(10.31)*	*(10.62)*	*(10.62)*	*(10.49)*	*(10.47)*	*(10.05)*
Number of Medicaid Patients	11.46	10.70	10.26	10.77	10.29	10.19	11.19	11.77	12.47	20.62	*12.01*
	(14.97)	*(13.47)*	*(13.34)*	*(13.24)*	*(12.41)*	*(12.22)*	*(13.65)*	*(13.87)*	*(14.25)*	*(12.09)*	*(14.88)*
Lawsuits											
Number of times lawsuit is filed	98	64	70	73	71	80	71	60	54	36	*677*
Number of Physicians	855	919	926	1033	1058	1059	1061	1064	1061	1017	*1418*
Number of physicians facing lawsuit	92	61	69	67	69	78	67	60	53	36	*394*
Number of Observations	3270	3451	3489	3958	4051	4065	4089	4068	4080	3948	*38469*

Note *: Unit of observation is a physician-year-quarter. Sample includes all Ob/Gyns in the state of Florida that performed at least 50 procedures annually on average.*

Table 2. Quarterly Trend in Number of Patients in 1999

	Panel A: Physicians subject to lawsuit in 1999 (No. of physicians = 78)			
	Qtr 1	**Qtr 2**	**Qtr 3**	**Qtr 4**
All Patients	37.87	37.77	41.14	38.65
PPO Patients	8.18	8.17	8.49	7.79
HMO Patients	14.79	15.14	15.90	15.38
Medicaid Patients	8.96	8.43	9.76	10.14

	Panel B: Physicians not subject to lawsuit in 1999 (No. of physicians = 981)			
	Qtr 1	**Qtr 2**	**Qtr 3**	**Qtr 4**
All Patients	34.00	33.75	36.36	37.22
PPO Patients	6.64	6.66	7.02	7.25
HMO Patients	12.07	12.30	13.00	12.86
Medicaid Patients	10.04	9.54	10.30	11.17

Note: 1999 is chosen as a representative year. Figures in Panel A represent averages across all physicians that were subject to a lawsuit in 1999. Figures in Panel B represent averages across all physicians not subject to a lawsuit in 1999.

Table 3. Effect of Lawsuits on Volume of Patients Treated

	OLS Model		Negative Binomial Model	
	(1)	**(2)**	**(3)**	**(4)**
Post Lawsuit Indicator	-1.905**		-0.0474**	
	(0.7755)		*(0.0219)*	
Indicator for Number of Years Post Lawsuit				
Year 1		-0.7262		-0.0206
		(0.4586)		*(0.0130)*
Year 2		-1.9563***		-0.0541***
		(0.5296)		*(0.0151)*
Year 3		-2.1230***		-0.0565***
		(0.6099)		*(0.0171)*
Year 4		-2.4882***		-0.0639***
		(0.7008)		*(0.0196)*
Year 5		-1.3052		-0.0396*
		(0.8129)		*(0.0224)*
Year 5+		-1.9359***		-0.0668***
		(0.7366)		*(0.0203)*
Number of Observations	38469	38469	38468	38468

Note: *Sample includes all Ob/Gyns in the state of Florida that perform at least 50 procedures annually, on average. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician*

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

Table 4. Effect of Lawsuits on Volume and Composition of Patients

	OLS Model				Negative Binomial Model			
	All Patients	**PPO Patients**	**HMO Patients**	**Medicaid Patients**	**All Patients**	**PPO Patients**	**HMO Patients**	**Medicaid Patients**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Post Lawsuit Indicator	-1.905**	-0.389*	-0.389	-0.403	-0.047**	-.067*	-.017	-.008
	(0.776)	*(0.2271)*	*(0.345)*	*(0.503)*	*(0.022)*	*(.035)*	*(.034)*	*(.041)*
Number of Observations	38469	38469	38469	38469	38468	38156	38283	38412

Note: *Sample includes all Ob/Gyns in the state of Florida that perform at least 50 procedures annually, on average. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician*

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

Table 5. Effect of Lawsuits on Volume and Composition of Patients: Quality Interactions

	OLS Model				Negative Binomial Model			
	All Patients	**PPO Patients**	**HMO Patients**	**Medicaid Patients**	**All Patients**	**PPO Patients**	**HMO Patients**	**Medicaid Patients**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Post Lawsuit Indicator	-2.214**	2.357***	-2.438***	-1.848***	-0.094***	0.158***	-0.228***	0.098**
	(0.9045)	*(0.275)*	*(0.401)*	*(0.587)*	*(0.025)*	*(0.041)*	*(0.039)*	*(0.045)*
Physician Quality * Post	1.322	-11.768***	8.789***	6.199***	0.204***	-0.844***	0.919***	-.528***
	(1.997)	*(0.6074)*	*(0.886)*	*(1.396)*	*(0.054)*	*(0.084)*	*(0.089)*	*(0.096)*
Number of Observations	38469	38469	38469	38469	38468	38156	38283	38412

Note: *Sample includes all Ob/Gyns in the state of Florida that perform at least 50 procedures annually, on average. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician*

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

Table 6. A Falsification Exercise: Estimate of Lawsuits on Demand with Randomly Generated Lawsuits

	OLS Estimates			
	All Patients	**PPO Patients**	**HMO Patients**	**Medicaid Patients**
Post Lawsuit Indicator	-0.763	1.583***	-1.137***	-1.062*
	(.951)	*(.272)*	*(.396)*	*(.633)*
Physician Quality * Post	7.804***	-6.069***	5.765***	7.402***
	(2.083)	*(.595)*	*(.867)*	*(1.387)*
Number of Obs	25432	25432	25432	25432

Note: *Sample excludes all physicians that were subject to a lawsuit in the original data. "Pseudo lawsuits" are randomly assigned to physicians such that the total proportion of lawsuits to observations remains the same as in the original data. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician*

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

Table 7. Instrumental Variables Estimate of Lawsuits on Demand (Linear Model)

	IV = Fraction of non-maternity PPO patients at Hospital			
	All Patients	**PPO Patients**	**HMO Patients**	**Medicaid Patients**
Post Lawsuit Indicator	-3.08**	1.88**	-2.37***	-3.16***
	(1.249)	*(0.379)*	*(0.554)*	*(0.811)*
Physician Quality * Post	5.04	-9.72***	8.50***	11.82***
	(4.198)	*(1.28)*	*(1.863)*	*(2.724)*
Number of Obs	38469	38469	38469	38469

Note: *Sample includes all Ob/Gyns in the state of Florida that perform at least 50 procedures annually, on average. The average fraction of non-maternity PPO patients at the primary practice hospital of the physician is used as an instrumental variable for physician quality. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician*

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

Table 8. Instrumental Variables Estimate of Lawsuits on Demand: Magnitudes

	Effects for High Quality Physician (Quality = 0.4)				Effects for Low Quality Physician (Quality = 0.025)			
	All Patients	*PPO Patients*	*HMO Patients*	*Medicaid Patients*	*All Patients*	*PPO Patients*	*HMO Patients*	*Medicaid Patients*
Post Litigation	-1.06	-2.01***	1.03**	1.57**	-2.95**	1.65**	-2.16***	-2.86**
	(1.04)	*(39.89)*	*(4.94)*	*(5.36)*	*(6.39)*	*(6.18)*	*(17.35)*	*(7.14)*

Note: *Sample includes all Ob/Gyns in the state of Florida that perform at least 50 procedures annually, on average. The average fraction of non-maternity PPO patients at the primary practice hospital of the physician is used as an instrumental variable for physician quality. A high (low) quality physician is defined as one who is at the 80th (20th) percentile of the distribution of physicians, in terms of quality. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician. Chi-squared statistics presented in parentheses.*

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

Table 9. A Falsification Exercise: IV Estimate of Lawsuits on Demand with Randomly Generated Lawsuits

	IV Estimates; IV = Fraction of non-maternity PPO patients at Hospital			
	All Patients	**PPO Patients**	**HMO Patients**	**Medicaid Patients**
Post Lawsuit Indicator	0.547	0.652*	0.732	0.448
	(.532)	*(.382)*	*(.515)*	*(.821)*
Physician Quality * Post	-1.118	-1.89	-1.014	1.642
	(1.357)	*(1.64)*	*(.867)*	*(2.908)*
Number of Obs	25432	25432	25432	25432

Note: *Sample excludes all physicians that were subject to a lawsuit in the original data. "Pseudo lawsuits" are randomly assigned to physicians such that the total proportion of lawsuits to observations remains the same as in the original data. The average fraction of non-maternity PPO patients at the primary practice hospital of the physician is used as an instrumental variable for physician quality. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician*

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

Table 10. Instrumental Variables Estimate of Lawsuits and Award Payments on Demand (Linear Model)

	IV = Fraction of non-maternity PPO patients at Hospital			
	All Patients	**PPO Patients**	**HMO Patients**	**Medicaid Patients**
Post Lawsuit Indicator	1.0871 *(2.516)*	-0.4383 *(.765)*	-0.3582 *(1.116)*	-0.8240 *(1.632)*
Physician Quality * Post	-12.4477 *(9.953)*	1.5375 *(3.026)*	-3.7654 *(4.415)*	2.4096 *(6.456)*
Post Lawsuit * ln(Award amt)	-0.4275* *(.223)*	0.2365*** *(.068)*	-0.2051** *(.099)*	-0.2395* *(.1446)*
Post Lawsuit * ln(Award amt) * Physician Quality	1.8015* *(.919)*	-1.1735*** *(.279)*	1.3059*** *(.408)*	0.9649 *(.5963)*
Number of Obs	38469	38469	38469	38469

Note: *Sample includes all Ob/Gyns in the state of Florida that perform at least 50 procedures annually, on average. The average fraction of non-maternity PPO patients at the primary practice hospital of the physician is used as an instrumental variable for physician quality. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician*

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

Table 11. Instrumental Variables Estimate of Lawsuits on Demand: Magnitudes

	Effects for High Quality Physician (Quality = 0.4)				Low Quality Physician (Quality = 0.025)			
	All Patients	*PPO Patients*	*HMO Patients*	*Medicaid Patients*	*All Patients*	*PPO Patients*	*HMO Patients*	*Medicaid Patients*
Award amt = $50,000 (20th percentile)								
Post Lawsuit Indicator	-0.752	-2.291***	1.529***	1.702**	-3.379***	1.8746***	-2.369***	-3.093***
	(0.47)	*(52.34)*	*(10.97)*	*(6.23)*	*(7.99)*	*(25.93)*	*(19.33)*	*(16.12)*
Award amt = $500,000 (80th percentile)								
Post Lawsuit Indicator	-0.085	-2.816***	2.252***	2.034***	-4.273***	2.364***	-2.780***	-3.594***
	(0.28)	*(63.14)*	*(18.85)*	*(7.12)*	*(9.90)*	*(31.99)*	*(20.64)*	*(16.88)*

Note: *Sample includes all Ob/Gyns in the state of Florida that perform at least 50 procedures annually, on average. The average fraction of non-maternity PPO patients at the primary practice hospital of the physician is used as an instrumental variable for physician quality. A high (low) quality physician is defined as one who is at the 80th (20th) percentile of the distribution of physicians, in terms of quality. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician. Chi-squared statistics presented in parentheses.*

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

Table 12. Effect of Lawsuits on Number of complications and non-pregnancy procedures

	Dep Var = Number of Patients with complications in delivery		Dep Var = Number of non-pregnancy procedures performed by physician	
	OLS Model	***Negative Binomial Model***	***OLS Model***	***Negative Binomial Model***
Post Lawsuit Indicator	0.0077 *(0.0051)*	0.0456 *(0.1311)*	-0.5005 *(0.5436)*	-0.0118 *(0.0233)*
Number of Observations	38469	38469	38468	38468

Note: *Sample includes all Ob/Gyns in the state of Florida that perform at least 50 procedures annually, on average. All specifications include fixed effects for each Year, Quarter, Year of Lawsuit and Physician*

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