WORKING P A P E R

The Impact of Liability on the Physician Labor Market

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THE IMPACT OF LIABILITY ON THE PHYSICIAN LABOR MARKET

Abstract

This study examines the impact of malpractice reforms on physician behavior using a new measure of liability risk and a nationally representative, individual-level dataset on physician behavior. We first develop a theoretic model in which physicians are unable to fully insure against liability risk. We then match our liability measure to data on physician behavior from the Physician Practice Costs and Income Survey (PPCIS). Data from the PPCIS bracket a period of substantial state-level legal reform between 1983 and 1988, which provides identifying variation in our liability measure. We estimate the impact of liability reform on hours worked. We find an estimated elasticity of hours worked to liability exposure of -0.285 for the full sample of physicians. The interpretation is that a 10 percent increase in expected liability costs (not necessarily malpractice premiums) is associated with a 2.85 percent decrease in hours worked. The effect for physicians age 55 or older is much larger: We find an elasticity of -1.224 for this category. We also examine the link between our 'pure' liability measure and malpractice premiums. We find that an increase in \$1 of expected liability is associated with a \$0.699 to \$1.05 increase in malpractice premiums, although there remains substantial unexplained variation in premiums after accounting for expected liability and observable demographic characteristics of physicians.

Preface

In this paper, we estimate the impact of medical malpractice liability on physician labor supply. We add to the theoretical literature on the topic by developing a model of physician labor supply that accounts for risk-avoidance behavior in the presence of insurance contracts. We then test the implications of the model with data formed by combining two unique data sources: 1) We develop a new measure of liability risk based on actual liability award data in Florida, combined with aggregate award data from other states. Our measure of liability risk varies by specialty, state, and the details of existing medical-malpractice award caps (instead of the typical approach of using dummy variables to indicate the existence of a cap). 2) We use individual-level data from two nationally representative cross sections of physicians: the Physician Practice Costs and Income Surveys (PPCIS) from 1984 and 1988. These two surveys contain detailed information on physicians and practice behavior. Additionally, these surveys bracket a period of significant state-level activity in instituting liability caps, providing the primary econometric identification for our liability measure.

We find that increases in liability decrease the number of hours a physician works. The effect is strongest for physicians who are age 55 or older, and the effect increases modestly with age. The fact that the impact on hours worked is largest among physicians over 55 is consistent with previous research, which finds the largest impact of liability on retirements (Kessler et al., 2005). Sole proprietors also exhibit a relatively strong reaction to variation in liability risk.

This observed sensitivity of hours worked to liability risk is potentially important in the context of the current political debate over whether to have a nationwide cap on malpractice awards. There are many anecdotes and some firm empirical work concerning the impact of liability risk on physician exit from high-risk specialties such as obstetrics and surgery. What our results show is that there are also labor effect on the *intensive* margin—physician behavior other than the participation decision—thereby suggesting a larger effect of medical malpractice liability than previously thought. In particular, access to health care can be affected not only by physician exit, but also by physicians cutting back on their hours worked.

Table of Contents

The RAND Institute for Justice	i
The Impact of Liability on the Physician Labor Market	ii
Abstract	ii
Preface	iii
Table of Contents	v
1. Introduction	1
2. Labor Supply and Liability Exposure	5
3. Data Description	7
3.1: Data on Physician Behavior – The Physician Practice Costs and Income Surveys	7
3.2: The Florida Closed Claim File	8
3.3: The National Association of Insurance Commissioners Data on State Malpractice Claims	8
3.4: Description of Liability Index	9
3.4.1: Theoretical Justification	9
3.4.2: Estimation of γ^S	10
3.4.3: Estimation of Liability Measure	10
4. Estimation Results	13
4.1 Impact of Changes in Liability on Hours Worked	13
4.2 Alternative Specifications and Robustness Checks	14
4.3 Liability Measure And Malpractice Premiums	16
4.4 Selection Issues	16
5. Conclusion	18
Data Appendix	21
References	25

1. Introduction

Medical malpractice reform is the subject of ongoing debate among academics and policy makers. Critics of the current system point to several flaws. First, it does a poor job of identifying and compensating victims of negligent injury (Harvard Medical Practice Study, 1990; and Studdert and Brennan, 2000). Second, its high administrative costs are not justified by estimates of deterrence (Kessler and McClellan, 1996, 2002a). Third, it creates inefficiencies in the practice of medicine. One aspect of the potential inefficiency is commonly referred to as ‘defensive medicine’: actions taken by physicians (or other health-care providers) meant to reduce the probability of a malpractice lawsuit. Examples would include ordering an excessive number of diagnostic tests, or performing medical procedures of dubious value to a patient. By engaging in such behavior, physicians plausibly reduce the risk of a litigation claim, at the cost of an inefficient use of resources.

Perhaps the most well-known empirical economic papers on this topic are by Kessler and McClellan (1996, 2002a) who examine how health expenditures for Medicare recipients vary with changes in state liability reforms. They find that up to 9 percent of expenditures on treatment for heart disease and heart attacks can be attributed to excessive care due to physicians practicing defensive medicine.¹ Other researchers tend to find smaller effects. Dubay et al. (1999, 2001) examine data on cesarean section procedures and also find an effect attributable to liability reform. In contrast, work by Sloan et al. (1995) and the Congressional Budget Office (2003) find little effect of liability reform on expenditures.

Although not typically thought of as ‘defensive’ medicine, there is a related literature that examines how malpractice liability affects physician labor market participation. For example, Klick and Stratman (2005) examine the impact of liability reform on the number of physicians practicing in a given state. In a similar vein, Kessler et al. (2005) and Encinosa and Hellinger (2005) find that physician labor supply increases when states adopt caps (direct reforms in Kessler et al.) limiting liability.² Additionally, there is substantial anecdotal evidence of physicians leaving particular specialties due to liability concerns which has fueled political attempts to institute malpractice litigation reform.³

Our paper explores the link between liability risk and physician labor hours. This is a particularly interesting margin for analysis for at least two reasons. First, it seems likely that it will be related to the standard notion of defensive medicine because additional tests and procedures would probably require at least some additional hours of physician labor. Therefore,

¹ Kessler and McClellan find around a 5 percent impact on costs when they account for managed care.

² Mello et al. take a different approach estimating malpractice liability premiums on physician labor supply and find some evidence of an effect. Thornton (1997) using the 1983 version of the PPCIS finds a positive impact of medical malpractice premiums on labor supply.

³ For example see AMA President Donald J. Palmisano, 2003 Congressional Testimony. Available at <http://energycommerce.house.gov/108/Hearings/02102003hearing780/Palmisano1279.htm>

observing the extent that labor hours are affected by litigation risk would provide an auxiliary check on the extent of defensive medicine. Second, it also seems plausible that if we observe physicians changing their behavior on the extensive margin by choosing not to participate in some specialties, or by leaving the practice of medicine altogether, it is possible that we might observe some action on the intensive margin as well. This could have implications for access to health care beyond the widely publicized physician exits observed in some specialties: a large number of physicians working shorter hours could have equilibrium effects of the same magnitude of physician exits on a smaller scale.

A key innovation of our paper is a new measure of liability, which allows us to exploit variation in liability risk across states and physician specialties, and its responsiveness to medical malpractice caps on liability awards. The measure is based on a combination of the Florida closed claim file, which contains all malpractice awards in the state of Florida, including 31 physician specialty categories, and the National Association of Insurance Commissioners data on malpractice claims for all states from 1980 to 1988. Most previous work has used dummy variables to measure the impact of malpractice reform, but dummy variables mask considerable statutory variation across states.⁴ For example, Table 1 lists the levels and types of state-level caps on damages. On one extreme, Nebraska instituted a cap of \$1.25 million on total damages, economic and noneconomic. On the other tail, neighboring state Kansas instituted a cap of \$250,000 on noneconomic awards only. The dummy variable approach often treats both states the same, which seems likely to miss important differences in outcomes. As discussed below, states vary widely in their underlying liability risk so that the same nominal cap on malpractice awards may represent very different experiments in different states. Finally, as is well-known, different specialties vary greatly in their exposure to liability and hence different specialties undergo very different policy changes when a cap is implemented.

We begin the paper by outlining a theoretic model in which physicians are unable to fully insure against liability risk. We then develop the theoretical justification and empirical implementation of our measure of liability risk. Next, we match our liability measure with a nationally representative, individual-level dataset of physicians, the Physician Practice Costs and Income Survey (PPCIS, 1983 and 1988). This data includes physician work hours and income, among other variables. These surveys bracket a period of substantial state-level reform, which provides the major source of identification in our empirical strategy.⁵

We find an estimated elasticity of hours worked to liability exposure of -0.285 for the full sample of physicians. The interpretation is that a 10 percent increase in expected liability costs (not necessarily malpractice premiums) is associated with a 2.85 percent decrease in hours worked per week. The effect for physicians age 55 or older is much larger: We find an elasticity of -1.224 for this category. We also examine the link between our 'pure' liability measure and malpractice

⁴ Two important exceptions are Kessler and McClellan (2002b), which uses closed claim data to capture liability exposure, and Bhattacharya (2005) who estimates the impact of the probability of a lawsuit on specialty choice and income.

⁵ Of the 34 states that have enacted caps by 2002, 14 did so between 1983 and 1988.

premiums. We find that an increase in \$1 of expected liability is associated with a \$0.699 to \$1.05 increase in malpractice premiums.

The outline of the paper is as follows: Section 2 presents the theoretic model and its implications; Section 3 describes the data and the creation of the liability measure; Section 4 presents and discusses the empirical results; and Section 5 concludes.

2. Labor Supply and Liability Exposure

We model a physician as choosing an optimal number of patients subject to an uncertain loss from malpractice liability, $L(Q, \alpha)$.⁶ The loss depends upon both the number of patients treated, Q , and an exogenous scaling parameter, α . For expositional purposes, we assume that the support of the random variable L does not depend on Q or α .⁷ L is assumed to be strictly increasing in Q and α — $L_Q > 0$, $L_\alpha > 0$ —and that $L_{Q\alpha} > 0$ which implies that the marginal loss with respect to Q is increasing in α . The physician is risk-averse, has some market power, and chooses Q to maximize expected utility of profits where $U_\pi > 0$ and $U_{\pi\pi} < 0$. The physician has a cost function $c(Q)$, $c_Q > 0$ and $c_{QQ} > 0$, and faces an inverse demand curve, $P(Q)$, $P_Q < 0$. We assume the physician purchases malpractice insurance at price p , but it does not cover all costs. $L(Q, \alpha)$ then is to be interpreted as net liability costs, after insurance payment. The maximization problem, along with first and second order conditions, is given by:

$$\text{Max}_Q E \{U(\pi)\} = E \{U(P(Q)Q - c(Q) - L(Q, \alpha) - p)\}$$

FOC:

$$\frac{\partial E \{U(Q)\}}{\partial Q} = E \{U_\pi(\pi)(P_Q Q + P - c_Q - L_Q)\} = 0 \quad (1)$$

SOC:

$$\frac{\partial^2 E \{U(Q)\}}{\partial Q^2} = E \{U_{\pi\pi}(\pi)(P_Q Q + P - c_Q - L_Q)^2 + U_\pi(\pi)(P_{QQ} Q + 2P_Q - c_{QQ} - L_{QQ})\} < 0$$

We would like to know how optimal Q changes as the liability risk changes, $\frac{\partial Q^*}{\partial \alpha}$. The comparative statics using the first order condition are

$$\frac{\partial Q^*}{\partial \alpha} = - \frac{\frac{\partial E U_Q}{\partial \alpha}}{\frac{\partial E U_Q}{\partial Q}} \quad (2)$$

Where EU_Q represents the first order condition. The denominator is the second order condition and is therefore negative, which implies that the sign of the derivative will be the sign of the numerator. The equation for the numerator is given by

⁶ For an alternative perspective focusing just on malpractice premiums, see the model in Thornton (1997).

⁷ For example, $L(Q, \alpha) = QP(\alpha)$ where P is a lognormal random variable with mean α .

$$\frac{\partial EU_Q}{\partial \alpha} = E \left\{ U_{\pi\pi} (P_Q Q + P - c_Q - L_Q) (-L_\alpha) + U_\pi (-L_{Q\alpha}) \right\} \quad (3)$$

Perhaps surprisingly, the sign is ambiguous. The second term will be negative, implying that an exogenous increase in the expected liability would decrease the number of patients. However, the sign on the first term will depend on the sign of marginal profits, which can be either positive or negative depending on the weighting of marginal utility of profits in the first order condition.

Upon reflection, the intuition of this ambiguous result is straightforward: the risk of liability has two effects. First, it increases the marginal cost of treating a patient, thereby reducing the incentive to take on additional patients. This is the effect measured by the 2nd, negative term. Second, it imposes a negative shock to income, reducing income and thereby making the treatment of an additional patient more valuable in expected utility terms. Which of these effects dominates is theoretically uncertain.⁸ It is important to note that this model contrasts sharply with the view that malpractice premiums fully insure all potential losses from malpractice litigation. With this framework, physicians have an incentive to avoid actions that will increase potential liability costs even when paying malpractice premiums.

⁸ Note that if the physician cannot avoid liability by avoiding treatment, the sign is unambiguously positive. For evidence of this affect, see Nicholson and Souleles (2005) who find that physicians respond to an increase in HMO penetration, which reduced their income below their expectations, by increasing the number of hours worked.

3. Data Description

We use three primary data sources: two are combined to construct our liability measure. We describe each of the data sources, and then turn to the creation of the liability measure.

3.1: Data on Physician Behavior – The Physician Practice Costs and Income Surveys

We use two cross-sectional surveys: the 1983 and 1988 Physicians Practice Costs and Income Survey (1983 and 1988 PPCIS). The 1983 PPCIS is a cross-sectional survey of physicians conducted by NORC under contract to the Health Care Financing Administration. The survey includes responses from 4,729 physicians (out of 6,847 eligible) drawn from a stratified random sample of physicians from the American Medical Association's 1984 Physician Master File. The physicians were asked numerous detailed questions regarding practice costs, pricing policies and work schedules. The data set also contains a set of variables concerning the physicians' personal characteristics (age, sex, specialty, etc.) obtained from the AMA Physician Master file. The survey took place over a period of 9 months running from October 1984 to June 1985. The 1988 PPCIS is a similar cross-sectional study with 3,505 participating physicians (61 percent response rate) conducted between July 1989 and March 1990.⁹

The PPCIS cross-sections have two primary strengths for our research purposes: First, the timing of the surveys is very useful because they bracket many of the important state-level medical liability reform measures made by states during the 1980s. Second, the data contain a rich set of behavioral and practice characteristics. We have information on both income and work hours, as well as information on case mix and practice costs.

The PPCIS has a key advantage over the previous estimates of liability on physician labor supply but also an important limitation. Previous estimates of liability's impact on physician labor supply have used the American Medical Association's Physician Master File (see Klick and Stratmann, 2005, and Kessler et al., 2005). Because the Master File does not contain data on hours worked or income, the authors estimate exit, entry and relocation but not changes in hours worked.

By contrast the PPCIS does not include retired physicians, part-time physicians (under 20 hours a week) or those doctors employed only by an HMO, hospital, clinic or medical school (including clinical or research fellows). Thus we are able to estimate hours worked but not retirement.¹⁰ We focus on physicians likely to be working "full-time" by restricting the age range to physicians

⁹ The survey asks questions retrospectively: The first survey asks about 1983 and the second about 1988.

¹⁰ A related point is that the PPCIS restricts its sample to those physicians Kessler et al. (2005) identify as mostly exposed to the cost of liability, specifically those in non-group practice settings (i.e., those not employed solely by an HMO, hospital or government employees. We do not view this as a limitation since, as Kessler et al. point out, this is the population of interest when evaluating the impact of liability on physician labor supply.

older than age 30 and younger than age 75 and have had an income of at least \$35,000 in the previous year.

3.2: The Florida Closed Claim File

Florida has maintained a database of all medical-malpractice claims from 1975 to the present. In 1980, insurance companies began reporting more comprehensive information to the Florida Department of Insurance, and data on physician specialty was added.¹¹ These data are unique in providing specialty-specific distribution of medical malpractice claims over an extended period of time. As outlined below, we use claims filed before 1987 as a baseline for the distribution of state-level malpractice claims. These cases predate any limitation on noneconomic damages in Florida and, regardless of the period of resolution, will not be covered by subsequent restrictions. We treat these as the distribution of potential payments resulting from actions taken by the doctor in the sample period. One feature of this approach is that we are capturing claims resolved years after the sample period. The three most recent claims in the data are resolved in 1999. One concern is that this long tail might be driving the results. For this reason we also estimate the model using only claims paid before 1987 and find similar results (see below).

Our technique of simply truncating the sample for payments that are over the cap accords well with the reality of trial. With few exceptions, juries are not instructed of the existence of caps, and the award is reduced to the cap after the verdict is entered. More problematic is how to treat settlements. Over 93 percent of the cases that are not unilaterally dropped by the plaintiff end in settlement. Moreover plaintiffs win around 30 percent of the trials. Given the small number of cases that go to trial and receive a payment, we are unable to estimate the liability measure for each specialty using only cases that end in a trial. Our solution is to truncate all payments at the cap as described below.¹²

3.3: The National Association of Insurance Commissioners Data on State Malpractice Claims

To account for variation across states in the level of malpractice claims, we use the National Association of Insurance data on malpractice claims by insurer in each state, by year. This data does not include specialty information so it does not provide the level of detail of the Florida closed claim file. But it does allow us to scale the Florida data to account for differences in litigation costs across states. The data include both incurred losses for the year and actual losses paid. We use incurred losses to construct the liability measure.¹³

¹¹ See Helland et al (2005) for a more detailed discussion of this data.

¹² There are models of settlement negotiation that would accord well with this approach. For example, Priest and Klein (1984) model litigation as a game in which the value of the case is known to both parties, but litigants diverge in their assessment of the likelihood of victory at trial. In their model, trials are errors but the value of the case is unaffected by trial or settlement.

¹³ See Born and Viscusi (1998) for a more extensive discussion of this data.

3.4: Description of Liability Index

A key aspect of our analysis is the construction and use of a measure of liability. Ideally, we would like to have a measure of all liability awards by specialty, state, and year. With such a measure, we could directly evaluate the change in liability risk as various state-level regulations are modified. However, such data are not available and so, as an alternative, we outline a methodology that allows us to create an index across all states and specialties, using the Florida closed claim data and the NAIC data.

3.4.1: Theoretical Justification

Our key assumption is that the unrestricted distribution of claims within a given specialty is similar across all states, up to a factor of proportionality, γ^S . Specifically, let $f(x|c)$ be the PDF of liability awards, x , conditional on specialty, c , in a given state where γ^S is normalized to 1. Assuming a continuous distribution, the conditional mean for specialty c is represented by

$$E[x|c] = \int_0^{\infty} xf(x|c)dx \quad (4)$$

Suppose that liability awards by specialty are proportional across states. Let y be the claims in state S . Using the change-of-variables technique we have the following:

$$\begin{aligned} y &= \gamma^S x, \gamma^S > 0 \\ \text{so} \\ x &= (1/\gamma^S)y \\ dx &= (1/\gamma^S)dy \\ f(y) &= f_x(y/\gamma^S)(1/\gamma^S) \\ \text{so} \\ E[y|c] &= \int_0^{\infty} yf(y|c)dy = \int_0^{\infty} \gamma^S xf_x(x|c)dx = \gamma^S E[x|c] \end{aligned} \quad (5)$$

Therefore the expected liability for specialty c in state S is proportional to the mean in the reference state. For our analysis, we want to examine how liability changes with a cap on liability awards. To compute the mean with a cap in state S we have

$$\begin{aligned} E[y|c, \text{cap} = \bar{Y}] &= \int_0^{\bar{Y}} yf(y|c)dy + \bar{Y} \int_{\bar{Y}}^{\infty} f(y|c)dy \\ &= \int_0^{\bar{Y}/\gamma^S} \gamma^S xf(x|c)dx + \bar{Y} \int_{\bar{Y}/\gamma^S}^{\infty} f(x|c)dx \end{aligned} \quad (6)$$

If we had a measure of γ^S we could estimate this mean with data from the reference state, as well as the mean without the cap.

3.4.2: Estimation of γ^S

NAIC gathers data on all claims paid by insurance in each state. Let $y_{s,i,t}$ be the average claim per doctor, and $p_{s,i,t}$ be the number of physicians in specialty s , state i , and year t . Then total claims in state i and year t can be written as:

$$c_{i,t} = \sum_s p_{s,i,t} y_{s,i,t} \quad (7)$$

In the NAIC data, we only observe $c_{i,t}$, not the individual components. However, suppose claims are proportional to claims in Florida, our reference state: $y_{s,i,t} = \gamma^S y_{s,FL,t}$. Then we would have

$$c_{i,t} = \gamma^S \sum_s p_{s,i,t} y_{s,FL,t} \quad (8)$$

γ^S could then be estimated as

$$\gamma^S = \frac{c_{i,t}}{\sum_s p_{s,i,t} y_{s,FL,t}} \quad (9)$$

where the numerator is the NAIC state estimate for liability claims in state i and year t , and the denominator is the weighted average of the Florida specialty claims where the weighting is the state and year specific measure of doctors in each specialty. We estimate γ for each state using all years from 1980 to 1986 where a state does not have a cap in place. Table 2 gives estimates of γ where Florida has been normalized to 1.¹⁴ The estimates range from a high of 3.40 in New York to 0.17 in South Carolina.

3.4.3: Estimation of Liability Measure

Full details of our estimation are given in the appendix. We give a brief overview here. We assume that the distribution of awards in Florida is stable over the relevant time period implying that each year is drawn from the same underlying distribution. This allows us to reduce the noise from year-to-year variation in malpractice claims. The choice of 1980 to 1986 is driven by two factors: 1) 1980 was the first year that specialty designations were included with each claim; and 2) Florida began instituting malpractice reforms in 1986, including a cap on malpractice awards in 1988.¹⁵ Thus we take the distribution of claims in the intervening period to be

¹⁴ The unnormalized measure of γ for Florida is 1.28. This implies that the NAIC measure of claims is somewhat larger than the Florida closed claim file. Given that the collection mechanisms and purposes of the two surveys are different, such a difference is not surprising.

¹⁵ In 1986, Florida abolished the collateral sources rule, limited joint and several liability, and restricted contingent fees. In 1988, Florida imposed a cap of \$350,000 on noneconomic damages (see Klick and Stratman (2005) and Helland and Tabarrok (2003a)). From 1980 until 1985 Florida did have the English Rule (the "loser pays" provision). See Hughes and Snyder (1995) for the details of this liability change. The effects of this rule are potentially significant; however, it is unclear why this would systematically bias the results. Although the English Rule does appear to have moderately improved "case quality", this would seem to affect all specialties equally and hence is captured in Florida overall liability risk.

representative of an unrestricted claim environment. One concern is that Florida's ranking of liability risk differs from other states in a systematic way. For example, it is possible that given the large number of retirees living in Florida, liability risk might be relatively higher (or lower) for some specialties than in other states. We cannot address this concern directly. There is no publicly available data on liability payments that also contains detailed information on specialty.¹⁶ In Appendix Table A1, we provide a comparison of Florida and the rest of the US. The table confirms the conventional wisdom that Florida has a higher percentage of its population who are Hispanic, foreign born and over 65. On all other dimensions it is quite similar to the rest of the country. It is also worth noting that the demographic characteristics that have been associated with higher awards — proportion of African Americans and proportion in poverty — are quite similar to the rest of the US (see Helland and Tabarrok 2003b). We address the ability of our measure to capture specialty risk using data on medical malpractice premiums in the results section.

We first adjust all awards to be measured in 1980 dollars. Then we compute an average award by specialty where the specialty designations are set by the Florida Department of Insurance (Table 3). To compute the estimated liability for specialty s in state i when there is no cap, we multiply the state-specific γ by the average award by specialty. For example, the estimated γ for Ohio is 1.12 and the estimated average annual liability of a general surgeon in Florida is \$4,961. Therefore we estimate the liability of an Ohio general surgeon to be \$5,556. One potential issue is the small number of cases in certain specialties. For example, public health has only 7 claims in the sample period. Clearly such small samples make estimating the liability for these specialties quite noisy. Not surprisingly, specialties with small cell sizes in the Florida data are also those with small cell sizes in the PPCIS and hence they are unlikely to be driving the results.

To compute the effect of a cap, we truncate actual awards observed in Florida to the CPI adjusted award level in the particular state and then compute the sample mean implied by Equation (6), adjusting for the state γ . For example, Virginia instituted a \$1 million cap in 1983. We put this cap in 1980 dollars, multiply all observed Florida awards by Virginia's γ (0.92), truncate observed awards that exceed the cap, and then we compute the average award per doctor.

One issue in computing relative liability exposure is how to calculate caps on noneconomic damages. As can be seen from Table 1, states often cap only noneconomic damages. The Florida closed claim data does contain information on noneconomic damages for some cases. One solution is to apply the relevant state cap to these damages. This is problematic because the breakdown is often not reported for settlements constituting 93 percent of closed claims not dropped by the plaintiff. Our solution is to take the average breakdown across all cases and reduce awards only in those cases where the fraction of the award that is typically noneconomic damages exceeds the cap. During the period 1980-1986, 58 percent of awards in Florida are for

¹⁶ The one exception, the NPDB contains information on a few specialties but researchers are instructed not to use this information because of reliability issues. The NPDB also covers only cases after 1990.

economic damages (lost wages, medical expenses, etc.) and 42 percent noneconomic damages.¹⁷ We therefore apply this average rate to all awards in computing the effect of caps on noneconomic claims.

Table 4 provides an example of the importance of cross-state differences in determining which doctors have actually been exposed to a policy change. Table 4 compares two states, Kansas and Nebraska. In 1988, Kansas imposed a \$250,000 cap on noneconomic damages while in 1986 Nebraska imposed a \$1,250,000 overall cap. By our estimate, Kansas's liability payments are 85 percent of Florida and Nebraska's are much lower at 46 percent.

As Table 4 shows, the Kansas cap affects specialties very differently depending on their underlying liability risk. OB/GYNs find their liability risk reduced by 10 percent while an allergist has no change in his liability exposure. Contrast this with Nebraska. Given Nebraska's lower underlying liability risk, our estimate is that no change in liability risk occurred for any specialty as a result of the cap. In effect no policy experiment occurred in Nebraska despite the law change. Although Nebraska is admittedly an extreme example, there is considerable variation in the size of the changes faced by doctors. The last 3 columns of the table show our estimate of the average changes in liability due to caps during this period.

¹⁷ This number is similar to the estimates of Tillinghast (2003), who finds that noneconomic damages constitute 52 percent of liability payments in 2003.

4. Estimation Results

We examine the impact of liability on the physician labor market with two outcome variables: hours worked per year and hours worked per week. The surveys asked two questions: 1) how many hours did the physician work in the last full workweek?; and 2) how many vacation weeks did the physician take in the previous year? We expect that weekly hours will be relatively well measured by the survey. To construct an estimate of annual hours, we combine the two survey questions. We expect this measure to be relatively noisy due to the combined measurement error.

Our estimation strategy is to treat the PPCIS as a stacked cross-section for 1983 and 1988. Thus observation i is a physician, k is physician specialty, s is state, and t is year. The basic regression model is

$$\ln(y_i) = \beta_0 + \gamma \ln(liability_{s,k,t}) + \lambda_t + \alpha_k + \delta_s + \beta x_i + v_i$$

where y_i is either hours worked or net income, λ_t is a dummy for 1988, α_k is a set of dummies for physician specialty, δ_s is a set of state dummies, $liability_{s,k,t}$ is the liability index and x_i are the control variables, including a set of county-level variables to account for local labor market conditions. We cluster the standard errors on state, specialty, and year. Descriptive statistics are given in Table 5.

4.1 Impact of Changes in Liability on Hours Worked

The first empirical results are outlined in Table 6. Column 1 gives the results of the regression of log of annual hours worked on the liability measure and a set of controls. Specialty, state, and year dummies, and county-level variables are included but are not reported due to space considerations.

The coefficient of interest is the liability measure. It is estimated to be -0.151, implying that a 10 percent increase in the malpractice premium is associated with a 1.51 percent decrease in hours worked, but this variable is statistically insignificant. There are no surprises with the control variables, and R-squared is 0.15 with 6,940 observations. This regression hints at an effect of liability on hours worked, but the evidence is not strong.

Column 2 reports on a similar regression that uses weekly hours rather than annual hours. In this specification the coefficient is indeed larger (in absolute value) at -0.285 than using annual hours, and it is statistically significant with a (asymptotic) t-statistic of 1.82. This estimate implies a relatively high sensitivity of labor hours to liability. Column 3 tests a subset of the data using just those physicians organized as sole proprietorships. The idea with this specification is that sole proprietors might be more sensitive to liability concerns because of potentially less risk-sharing that can occur in large, multi-physician practices. Indeed, with this specification

(Column 3), the estimated coefficient is substantially larger in absolute value at -0.660, and it is also statistically significant.

Column 4 modifies the Column 2 regression to add in an interaction term with liability and age. The motivation is as follows: anecdotal evidence suggests that a high expected liability will often induce exit from high-risk specialties. While our data do not allow us to measure entry or exit decisions directly, it allows us to test for an indirect effect. Rather than a dichotomous choice to simply work or not work in response to a change in liability risk, it is possible that liability risk accelerates the standard retirement pattern of working fewer hours near the end of the life cycle: If physicians face higher risk they will exit the profession gradually rather than simply stopping work abruptly.

To test this, we interact the liability measure with a counter variable that takes a value of 0 for ages less than 55, 1 at age 55, 2 at age 56, 3 at age 57, and so on.¹⁸ The results are given in Column 4. The coefficient on liability, -0.278, is similar to the initial regression (Column 2) and it also remains statistically significant. The estimated coefficient for the interaction term is -0.00176 and is highly statistically significant with a t-statistic of -2.23. The magnitude is relatively small, though. The estimated elasticity for a 65-year-old physician is -0.297, or 0.019 points lower than physician age 55 or younger. Although small, these results do imply that liability has an increasing effect as physicians get older, which is consistent with the anecdotal evidence of early retirement behavior in high-risk specialties.

To examine this age effect more directly, we restrict the sample to physicians who are age 55 or older and rerun the regression. The results are reported in Column 5. In this specification, the liability measure is very large relative to previous estimates, -1.224 and a t-statistic of 3.12. This estimate implies that a 10 percent increase in the malpractice liability risk is associated with a 12 percent decrease in hours worked. This result is consistent with the specification using the full sample implying that older physicians respond strongly to liability risk.

4.2 Alternative Specifications and Robustness Checks

Next we estimate a set of regressions using alternative specifications to check the implications and robustness of our results. First, we estimate a set of specifications with alternative measures of liability reform. Column 1 reports the results using a dummy variable for whether a state has any cap on malpractice awards. This dummy variable specification is similar to previous empirical work investigating the impact of liability reform. As our baseline specification, we use the log (weekly hours) regression reported from Table 6, Column 2, but we replace our continuous liability measure with a dummy variable. The estimated coefficient is -0.001 with a standard error of 0.014. We next estimate the model with two dummy variables, one for whether there is a cap on the total award, and one for whether there is a cap on noneconomic awards.

¹⁸ We experiment with other specification, using younger and older ages. There was not much of an effect below 55 and specification starting after 55 tended to show larger coefficients on the interaction.

Again the estimated coefficients are small and statistically insignificant, -0.005 for both parameters.

It is often the case that when states reform their legal system, they do so with a host of other changes so it is possible that our liability measure is picking up the marginal effects of these other changes. In Column 3, we add in a set of dummy variables for other state laws affecting medical-malpractice liability, and we also include our liability measure. Caps on total awards are still statistically insignificant, and the liability measure is actually larger and more statistically significant than in the baseline regression from Table 6: -0.399 with a t-statistic of -2.07. We see that abolishing joint-and-several liability (allows plaintiffs to recover damages from any defendant in the case regardless of their degree of culpability) has a positive and statistically significant impact on hours worked, 0.031, but the other measures of liability reform do not have a statistically significant impact. Interestingly, we tested the joint significance of the five liability reforms other than liability awards /caps and found that as a group they are statistically insignificant. From this set of results, though, it seems that other liability reforms do not overturn our initial results.

In Column 4 of Table 7 we address another issue. In our discussion of the creation of the liability measure, we noted that many of cases in the Florida data are filed before 1987 but take many years to resolve. To avoid this long tail we estimate the model truncating the sample to cases decided before 1987. We find a very similar effect as before, with an estimated elasticity of labor supply of -0.268 and a t-statistic of -2.20.

Column 5 reports the results of an instrumental variables regression accounting for taxes. Thurston and Showalter (1997) using the 1983 cross section of the PPCIS find that marginal tax rates have a significant effect on physician labor supply for some segments of the physician populations (e.g., sole proprietors). Given the relatively large tax change from the 1986 federal tax reform, it is possible that the change in labor hours is reflective of changes in the marginal tax rates rather than the change in the liability risk. Column 5 reports the results when the Thurston/Showalter specification with endogenous taxes is run, including our liability measure. We find that the coefficient is even larger than when taxes are not accounted for, -0.441, and statistically significant ($t = -2.58$).

Finally, in Column 6 we report the results using log (income) as the dependent variable. Income is reported as a gross measure, but it has several problems. For one, it is measured categories and so actual income is not observed.¹⁹ We also do not observe the details of contracts with hospitals or physician working groups to account for who is paying malpractice premium. But income offers a potentially interesting check on our labor-hour regressions because if physicians are cutting back on hours, it would probably show up in lower income as well. This regression has fewer observations in this specification, 6,240 versus 7,104 in the weekly hours regression, due to a lower response rate for the income questions. The liability effect is again negative and

¹⁹ A few observations in 1988 have actual income (if they were above a certain threshold).

significant at the 10 percent level with a t-statistic of -1.95. This is consistent with what we find in the labor hours regressions.

4.3 Liability Measure And Malpractice Premiums

We next test the link between our liability measure and self-reported malpractice premiums. Our liability measure is admittedly imperfect, but if it is capturing anything of interest it ought to be correlated with observed malpractice premiums. The PPCIS asked physicians for the dollar amount of their malpractice premiums. This measure is also quite noisy: a given physician's malpractice premium can be complicated by joint arrangements in multi-physician practices and by arrangements through other parties such as hospitals. In Table 8, we report the results of regressing the self-reported measure of malpractice premiums on our liability measure. Column 1 uses only a constant and the liability measure. In this regression the coefficient on liability is 0.699 with a t-statistic of 11.1. Note that this estimate is without control variables. Our liability measure is highly correlated with observed premiums and alone can explain 18 percent of the variance. Given the measurement problems with both variables, this result is surprisingly strong. It is also heartening that the number implies that a \$1 increase in liability is associated with a nearly equal increase in the observed malpractice premium.

Column 2 adds in some physician-specific control variables and the county-level variables. The estimated coefficient is almost the same, 0.684, with a t-statistic of 12.9. Column 3 adds in state, specialty, and year controls. These additional variables decrease the estimated coefficient substantially to 0.225, but it is still highly statistically significant. Taken together, these results indicate a strong, positive relationship between actual liability and observed malpractice premiums although we are hesitant to place a great deal of faith in the exact coefficient estimates because we know little about the actual underlying insurance contracts.

Because of the ambiguity over how malpractice premiums are actually set (Baicker and Chandra, 2006), we reestimate using only claims adjudicated through 1986, rather than claims that were adjudicated up through then end of the 1990s. This might be a better approximation to the information that insurers used in setting malpractice premiums during this period. The results are found in Columns 4 through 6. The results are similar to those found previously, although the coefficient estimates are closer to 1, suggesting a dollar-for-dollar link between expected liability and malpractice premiums.

4.4 Selection Issues

The results indicate that physicians decrease their labor supplied in the face of rising liability costs. Further, this impact is particularly important among physicians over age 55. However, these estimates likely represent a lower bound on the impact of liability on physician labor supply. First, because we are not estimating specialty choice, we cannot control for any selection that might occur due to liability considerations. Although Bhattacharya (2005) finds no evidence that specialty choice is influenced by liability exposure, it is possible that those doctors least

responsive to changes in liability self select into high-liability specialties and are the least responsive to changes in liability. A second reason that our estimates represent lower bounds is that our sample contains only physicians who work more than 20 hours a week. Thus complete retirement and part-time work would not be captured in our estimates.

5. Conclusion

In this paper we estimate the impact of medical malpractice liability on physician labor supply. We add to the theoretical literature on the topic by developing a model of physician labor supply that accounts for risk-avoidance behavior in the presence of insurance contracts. We then test the implications of the model with data formed by combining two unique data sources: 1) First, we develop a new measure of liability risk based on actual liability award data in Florida, combined with aggregate award data from other states. Our measure of liability risk varies by specialty, state, and the details of existing medical-malpractice award caps. The measure contrasts with the more typical approach of using dummy variables to indicate the existence of a cap. 2) Second, we use individual-level data from two nationally representative cross sections of physicians: the Physician Practice Costs and Income Surveys (PPCIS) from 1984 and 1988. These two surveys contain detailed information on physicians and practice behavior. Additionally, these surveys bracket a period of significant state-level activity in instituting liability caps, providing the primary econometric identification for our liability measure.

We find that increases in liability decrease the number of hours a physician works. The effect is strongest for physicians who are age 55 or older, and the effect increases modestly with age. The fact that the impact on hours worked is largest among physicians over 55 is consistent with previous research, which finds the largest impact of liability on retirements (Kessler et al., 2005). Sole proprietors also exhibit a relatively strong reaction to variation in liability risk.

This observed sensitivity of hours worked to liability risk is potentially important in the context of the current political debate over whether to have a nationwide cap on malpractice awards. There are many anecdotes and some firm empirical work concerning the impact of liability risk on physician exit from high-risk specialties such as obstetrics and surgery. What our results show is that there are also labor effect on the *intensive* margin—physician behavior other than the participation decision—thereby suggesting a larger effect of medical malpractice liability than previously thought. In particular, access to health care can be affected not only by physician exit, but also by physicians cutting back on their hours worked.

We also find that our liability measure is highly correlated with a self-reported measure of malpractice premiums. Although this result is to be expected by economists, the previous empirical work is ambiguous on the link between liability claims and malpractice premiums. As discussed in Baicker and Chandra (2004), malpractice premiums are influenced by several mechanisms including multiple years worth of liability exposure, investment returns, and the competitive climate.

Finally, the relatively simple exercise of comparing the effect of a given dollar-level cap in malpractice awards suggests that the impact of a cap can vary widely from state to state. This variation comes from two sources: the legal environment in a given state and its propensity to generate large malpractice awards, and the health care environment and its general level of cost. This observed variation would seem to suggest that having a uniform nationwide standard on

malpractice awards might not be optimal. But this point is worthy of additional research that would account for the various tradeoffs involved.

Data Appendix

Estimated factors of proportionality (γ s) were computed as follows:

- 1) NAIC collects firm-level data on medical malpractice claims by state and year. We aggregated this data to estimate a total claims incurred for each state and year from 1980 to 1986. The resulting variable we will refer to as NAIC (year, state).
- 2) Using doctor counts by specialty from the AMA Masterfile of physicians, we constructed a count of the number of doctors for each year, 1980-1986, in each of the 36 specialties coded in the Florida claims data. 1984 data was missing so we averaged the 1983 and 1985 values to impute the 1984 counts. The resulting variable we will refer to as DOCCOUNT(specialty,year,state).
- 3) Using the Florida closed claim file, we computed a total dollar value of claims filed in each year for each specialty. We then divided these numbers by the number of Florida doctors in that specialty for that year using the results from step 2. This gives an average claim per doctor, by specialty and year which we refer to below as AVGCLAIM(specialty,year,FL).
- 4) Following Equation 9 in the text, we then compute an estimate of the total claims filed in each state-year combination by multiplying AVGCLAIM*DOCCOUNT and summing over specialty. The resulting variable we refer to as TOTCLAIM (year, state).
- 5) We then compute a 'raw' factor of proportionality, γ , by dividing NAIC (year, state) by TOTCLAIM(year, state). Then the average value for the 7 years is computed for each state, except for states that imposed a cap on liability awards between 1983 and 1988. For those states we only average over the non-capped years. We then normalize the γ s by the value for Florida and use the result to adjust claims to compute the liability measure as outlined below.

Estimating the liability measure for each state, year, and specialty

The liability measure was computed using the following algorithm:

- 1) For state i , in year t , specialty s : all awards (i, t, s) from the Florida data are adjusted to be in 1980 dollars.
- 2) For states with no caps, the liability index is computed as AVGCLAIM(specialty, year, FL) multiplied by the estimated γ in the respective state. Therefore, states with no caps between 1983 and 1988 have the same value for the liability index for both years.
- 3) For states with a cap, each award from the Florida data is first multiplied by the state's estimated γ , and is then segmented into an economic (ECON) and noneconomic (NECON) component. $ECON = 0.58 * \text{award}$ and $NECON = 0.42 * \text{award}$. Then the particulars of the states rules are then applied to ECON and NECON.

Example: Suppose there is a \$1,000,000 award (1980 dollars) for thoracic surgery in the Florida data. We want to adjust this to compute an index value for thoracic surgeons in New Hampshire,

which instituted a \$250,000 cap on noneconomic damages in 1986. First, we adjust the award by New Hampshire's estimated γ , 0.84, to obtain a value of \$840,000. Then this value is split into an economic and noneconomic component, \$487,200 and \$352,800, respectively. We compute an adjusted award under conditions of the cap: $487,200 + 187,956 = 675,156$, where the 187,956 is the \$250,000 cap in 1980 \$. So, the cap has reduced the award from \$840,000 to \$675,156. Every award against a thoracic surgeon in the Florida data would be similarly adjusted and a mean value of the adjusted awards would then be computed to construct the index value.

Table A1--Comparison of Florida and U.S. Demographics

	Florida	U.S.
Population, 2000	15,982,378	281,421,906
Population, percent change, 1990 to 2000	23.50%	13.10%
Persons under 18 years old, 2000	22.80%	25.70%
Persons 65 years old and over, 2000	17.60%	12.40%
Female persons, 2000	51.20%	50.90%
White persons, 2000	78.00%	75.10%
Black or African American persons, 2000	14.60%	12.30%
Persons of Hispanic or Latino origin, 2000	16.80%	12.50%
Foreign born persons, 2000	16.70%	11.10%
Language other than English spoken at home, 2000	23.10%	17.90%
High school graduates, persons age 25+, 2000	79.90%	80.40%
Bachelor's degree or higher, persons age 25+, 2000	22.30%	24.40%
Persons per household, 2000	2.46	2.59
Homeownership rate, 2000	70.10%	66.20%
Median value of owner-occupied housing units, 2000	\$105,500	\$119,600
Median household income, 1999	\$38,819	\$41,994
Per capita money income, 1999	\$21,557	\$21,587
Persons below poverty, percent, 1999	12.50%	12.40%

References

- Baicker, Katherine and Amitabh Chandra (2006) "The Effect of Malpractice Liability on the Delivery of Health Care", Forum for Health Economics & Policy, Forum: Frontiers in Health Policy Research, Volume 8: Article 4. <http://www.bepress.com/fhep/8/4>
- Bhattacharya, Jayanta (2005) "Specialty Selection and Lifetime Returns to Specialization within Medicine," *Journal of Human Resources* 40(1):115-43
- Black, Bernard, Charles Silver, David Hyman and William Sage, 2005, "Stability, Not Crisis: Medical Malpractice Claim Outcomes in Texas, 1988-2002" SSRN working paper #678601
- Born, Patricia H. and W. Kip Viscusi, (1998) "The Distribution of the Insurance Market Effects of Tort Liability Reforms" *Brookings Papers on Economic Activity*. 55-100
- Congressional Budget Office, 2004, "Limiting Tort Liability for Medical Malpractice," January.
- Dubay, L, R. Kaestner, and T. Waidmann, 1999, "The Impact of Malpractice Fears on Cesarean Section Rates," *Journal of Health Economics*, August, 18: 491-522.
- Dubay, L., R. Kaestner, and Timothy A. Waidmann. (2001) "Medical Malpractice Liability and Its Effect on Prenatal Care Utilization and Infant Health." *Journal of Health Economics*, 20 (4): 591-611.
- Encinosa, William and Fred Hellinger (2005) "Have State Caps on Malpractice Awards Increased the Supply of Physicians?" *Health Affairs* 24:250-259.
- Helland, Eric and Jonathan Klick and Alexander Tabarrok 2005, "Data Watch: Tort-uring the Data," *Journal of Economic Perspectives*," 19(2):207-220
- Helland, Eric and Alex Tabarrok (2003a) "Contingency Fees, Settlement Delay and Low-Quality Litigation: Empirical Evidence from Two Datasets," *Journal of Law, Economics and Organization*. 19(2):517-542.
- Helland, Eric and Alex Tabarrok (2003b) "Race, Poverty and American Tort Awards," *Journal of Legal Studies*. 32(1):27-58, 2003
- Hughes, James and Edward Snyder (1995) "Litigation under the English and American Rules: Theory and Evidence," *Journal of Law and Economics*, 38:227-250.
- Kessler, Daniel P and Mark B. McClellan, 1996, "Do Doctors Practice Defensive Medicine?" *Quarterly Journal of Economics*, 111(2):353-390.
- Kessler, Daniel and Mark McClellan, 2002a, "Malpractice law and health care reform: optimal liability policy in an era of managed care" *Journal of Public Economics*, 84:175-197
- Kessler, Daniel P and Mark B. McClellan, 2002b, "How Liability Law Affects Medical Productivity" *Journal of Health Economics*, 21: 931-955.
- Kessler, Daniel, William M. Sage, David J. Becker (2005) "Impact of Malpractice Reforms on the Supply of Physician Services" *Journal of the American Medical Association*. 293(21):2618-2625.
- Klick, Jonathan and Stratmann, Thomas, (2005) "Does Medical Malpractice Reform Help States Retain Physicians and Does it Matter?" <http://ssrn.com/abstract=870492>

- Mello, Michelle M., David M. Studdert, Jennifer Schumi, Troyen A. Brennan, and William M. Sage (2006) "Changes in Physician Supply and Scope of Practice during a Malpractice Crisis: Evidence from Pennsylvania," Harvard School of Public Health working paper.
- Nicholson, Sean and Nicholas S. Souleles (2005), "Income Prediction Errors: Sources and Implications for Physician Behavior," University of Pennsylvania working paper, March.
- Sloan, F and RR Bovbjerg, 1991, Insuring Medical Malpractice, New York, NY: Oxford University Press.
- Studdert, David and Brennan, Troyen. (2000) "Beyond Dead Reckoning: Measures of Medical Injury Burden, Malpractice Litigation, and Alternative Compensation Models from Utah and Colorado." *Indiana Law Review*, 33:1643-86.
- Priest, George and Benjamin Klein (1984) "The Selection of Disputes for Litigation" *Journal of Legal Studies* 13(1): 1-55.
- Thornton, J, 1997, "Are Malpractice Insurance Premiums A Tort Signal That Influence Physician Hours Worked?" *Economic Letters*, 55(3):403-407.
- Showalter, Mark H. and Norman K. Thurston, (1997) "Taxes and Labor Supply of High-Income Physicians" *Journal of Public Economics* 66(1): 73-97
- Tillinghast-Tower Perrin (2003) U.S. Tort Costs 2003 Update: Trends and Findings in the Cost of the U.S. Tort System.

Table 1: Malpractice Reforms Before 1989

State	Non-Economic Damages Cap	Total Damages Cap	Collateral Sources Rule Abolished	Joint and Several Liability Abolished	Contingent Fee Restriction	Periodic Payment	Victims Fund
AK			1976	1988		1986	
AL	\$400,000 (1987)	\$1,000,000 (1987)	1987			1987	
AZ			1984	1987	1976		
CA	\$250,000 (1975)		1975	1986	1987	1975	
CO			1986	1986		1988	
CT			1985		1986		
DE			1976		1976		
FL	\$350,000 (1988)		1986	1986	1986	1986	
GA			1987				
HI	\$375,000 (1986)		1986		1986		
IA			1975				
ID				1987	1981		
IL			1985		1985	1985	
IN			1975				
KS	\$250,000 (1988)				1988		
KY			1988	1988			
LA		\$500,000 (1975)				1984	
MA	\$500,000 (1986)		1986		1986		
MD	\$350,000 (1986)				1986		
ME					1987	1985	
MI			1986	1986	1986	1986	
MN			1986				
MO	\$500,000 (1988)		1987			1986	
ND	\$500,000 (1987)		1987	1987			
NE		\$1,250,000 (1986)			1976		
NH	\$250,000 (1986)				1986		
NJ			1987		1976		
NM		\$600,000 (1976)		1987		1976	
NY			1986		1985	1985	
NV				1987			
OH				1987		1987	
OK			1975		1953		
OR			1987	1987	1975-1987	1987	
PA					1975		
RI						1987	
SD				1987		1988	
TN			1980		1975		
TX				1987			
UT				1986	1985	1986	
VA		\$1,000,000 (1983)					1987
VT				1985			
WA	Formula (1988)			1986	1976	1986	
WI					1986	1975	
WV	\$1,000,000 (1986)						
WY				1986	1977		

Table 2 -- Estimated Factors of Proportionality

<u>State</u>	<u>gamma</u>	<u>State</u>	<u>gamma</u>
AK	1.33	MS	0.63
AL	0.92	MT	1.36
AR	0.52	NC	0.61
AZ	1.63	ND	1.81
CA	1.11	NE	0.46
CO	1.36	NH	0.84
CT	2.26	NJ	1.85
DC	1.57	NM	0.37
DE	2.43	NV	1.51
FL	1.00	NY	3.40
GA	1.03	OH	1.12
HI	0.71	OK	0.99
IA	1.49	OR	1.29
ID	1.35	PA	1.23
IL	2.43	RI	0.47
IN	0.66	SC	0.17
KS	0.85	SD	0.82
KY	1.02	TN	2.14
LA	0.77	TX	0.62
MA	0.26	UT	0.99
MD	1.43	VA	0.92
ME	1.19	VT	1.10
MI	2.38	WA	1.77
MN	0.95	WI	0.52
MO	1.53	WV	2.23
		WY	1.51

Table 3 -- Estimated Annual Liability

Specialty	Florida Data Pre-1987 Filings			PPCIS
	Number of Claims Filed	Average Number of Physicians per Year	Average Annual Liability Award Per Physician	Number of Physicians
Allergy	13	92	332	35
Anesthesiology	737	913	6,807	514
Cardiovascular Diseases	612	702	4,045	267
Dermatology	247	325	972	79
Emergency Room	1,077	587	6,564	221
Endocrinology	20	61	3,794	15
Gastroenterology	177	270	2,729	190
General Practice	2,016	2,993	2,658	926
General Surgery	1,748	1,505	4,961	586
Hematology	36	52	1,153	14
Internal Medicine	1,833	2,086	3,016	706
Nephrology	48	128	1,154	34
Neurology	711	451	12,864	127
Obstetrics/Gynecology	2,268	1,260	12,373	506
Oncology	6	138	20	53
Ophthalmology	571	725	1,620	298
Orthopedics	1,606	777	11,788	273
Otorhinolaryngology	380	322	5,088	151
Pathology	209	528	1,666	310
Pediatrics	775	1,143	5,062	366
Physical Medicine	11	96	397	45
Plastic Surgery	497	230	7,113	75
Psychiatry	131	1,018	174	467
Public Health	7	42	136	1
Radiology	956	972	3,644	447
Rheumatology	13	93	129	24
Thoracic Surgery	238	110	13,580	72
Urology	511	478	2,915	337

Florida closed claim data, filed prior to 1987. 1980 \$. Average number of physicians from AMA physician masterfile, 1980-1986. Awards include all claims adjudicated through 1998. Count of PPCIS physicians is from regression Column 2, Table 6. Florida data also includes a category "undesigned" which has been excluded from the analysis. Seven other Florida specialties either had no claims, or no counterpart in the PPCIS and are thus excluded.

Table 4 -- Examples of the Variation in the Effects of Capping Malpractice Awards

	Kansas			Nebraska			Average of States Imposing Some Cap Between 1983 and 1988		
	Without Cap	With Cap	% Change	Without Cap	With Cap	% Change	Without Cap	With Cap	% Change
Allergy	281	281	0.0	154	154	0.0	377	377	0.0
Anesthesiology	5,759	4,998	-13.2	3,153	3,153	0.0	7,714	6,970	-9.6
Cardiovascular Diseases	3,422	3,175	-7.2	1,874	1,874	0.0	4,584	4,358	-4.9
Dermatology	822	822	0.0	450	450	0.0	1,101	1,101	0.0
Emergency Room	5,554	5,234	-5.8	3,041	3,041	0.0	7,439	7,163	-3.7
Endocrinology	3,210	3,210	0.0	1,757	1,757	0.0	4,300	4,297	-0.1
Gastroenterology	2,309	1,995	-13.6	1,264	1,264	0.0	3,093	2,765	-10.6
General Practice	2,249	2,106	-6.4	1,231	1,231	0.0	3,012	2,874	-4.6
General Surgery	4,197	3,988	-5.0	2,298	2,298	0.0	5,622	5,426	-3.5
Hematology	976	976	0.0	534	534	0.0	1,307	1,307	0.0
Internal Medicine	2,552	2,409	-5.6	1,397	1,397	0.0	3,418	3,291	-3.7
Nephrology	977	977	0.0	535	535	0.0	1,308	1,308	0.0
Neurology	10,884	9,775	-10.2	5,958	5,958	0.0	14,579	13,524	-7.2
Obstetrics/Gynecology	10,468	9,420	-10.0	5,731	5,731	0.0	14,022	13,022	-7.1
Oncology	17	17	0.0	9	9	0.0	22	22	0.0
Ophthalmology	1,371	1,368	-0.2	750	750	0.0	1,836	1,834	-0.1
Orthopedics	9,973	9,337	-6.4	5,460	5,460	0.0	13,359	12,799	-4.2
Otorhinolaryngology	4,305	4,165	-3.3	2,357	2,357	0.0	5,766	5,650	-2.0
Pathology	1,410	1,320	-6.4	772	772	0.0	1,888	1,815	-3.9
Pediatrics	4,283	3,698	-13.7	2,345	2,345	0.0	5,737	5,153	-10.2
Physical Medicine	336	336	0.0	184	184	0.0	450	450	0.0
Plastic Surgery	6,018	5,677	-5.7	3,295	3,295	0.0	8,061	7,730	-4.1
Psychiatry	148	146	-1.4	81	81	0.0	198	197	-0.5
Public Health	115	115	0.0	63	63	0.0	154	154	0.0
Radiology	3,083	2,853	-7.5	1,688	1,688	0.0	4,130	3,927	-4.9
Rheumatology	109	109	0.0	60	60	0.0	146	146	0.0
Thoracic Surgery	11,490	10,777	-6.2	6,290	6,290	0.0	15,390	14,820	-3.7
Urology	2,467	2,256	-8.6	1,350	1,350	0.0	3,304	3,096	-6.3

Table 5 -- Descriptive Statistics

	Full Sample		1983 Only		1988 Only	
Observations	7,247		3,950		3,297	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Annual Hours	2,765	743	2,709	746	2,829	734
Weekly Hours	58	15	57	15	59	15
Annual Income	126,085	101,545	108,067	68,567	145,456	124,985
Medical Malpractice Premium	12,157	13,072	7,475	7,747	16,914	15,448
Liability Measure	7,639	8,146	7,418	7,977	7,903	8,336
Age	47.0	10.3	47.7	10.6	46.2	10.0
Male	0.92	0.27	0.92	0.28	0.93	0.26
Solo-Practice	0.34	0.47	0.23	0.42	0.47	0.50
Board Certified	0.73	0.45	0.69	0.46	0.77	0.42
Foreign Medical School	0.23	0.42	0.24	0.43	0.21	0.41
Hispanic	0.03	0.16	0.02	0.16	0.03	0.16
Asian	0.11	0.32	0.12	0.32	0.11	0.31
Black	0.02	0.15	0.02	0.14	0.02	0.15
County-Level Controls						
Physicians per 1000	2.0	1.2	2.0	1.1	2.1	1.2
Hospitals per 1000	0.03	0.02	0.03	0.02	0.03	0.02
Hospital Beds per 1000	6.2	3.7	6.7	4.0	5.6	3.2
% Population in HMO	8.8	7.5	5.6	6.0	12.6	7.4
% Population age 14 or under	21.7	2.9	22.0	2.8	21.4	3.0
% Population age 65 or over	11.5	3.4	11.2	3.4	11.9	3.5
% Population Black	11.7	12.3	11.8	12.1	11.6	12.5
% Urban	78.4	24.3	79.8	23.5	76.8	25.2
% Population Below Poverty Line	12.0	5.1	11.8	5.0	12.1	5.2
Median Income (1980 \$s)	20,498	3,816	20,677	3,792	20,282	3,833

Note: Some variables have missing values. The statistics are computed on the available data in those cases.

Table 6 -- Regression Results of Various Physician Behavioral Variables on the Liability Measure

	(1)	(2)	(3)	(4)	(5)
	Ln(Annual Hours)	Ln(Weekly Hours)	Ln(Weekly Hours) Sole Proprietors Only	Ln(Weekly Hours)	Ln(Weekly Hours) Age 55 or Older
Ln(Liability)	-0.151 (0.180)	-0.285* (0.157)	-0.660** (0.279)	-0.278* (0.156)	-1.224*** (0.392)
Ln(Liability)*(Age-54)				-0.00176** (0.00079)	
Age	0.016889*** (0.003234)	0.012742*** (0.003010)	0.003714 (0.005064)	-0.006640 (0.006944)	-0.011771 (0.035481)
Age Squared	-0.0002196*** (0.0000328)	-0.0001835*** (0.0000310)	-0.0000988* (0.0000505)	0.0000466 (0.0000806)	-0.0000071 (0.0002823)
(Age-54)				0.00364 (0.00726)	
Male	0.104*** (0.014)	0.098*** (0.014)	0.103*** (0.024)	0.099*** (0.014)	0.112** (0.050)
Solo-Practice	0.015** (0.008)	0.001 (0.007)		0.002 (0.007)	-0.003 (0.016)
Board Certified	0.024*** (0.009)	0.020** (0.008)	0.011 (0.013)	0.022*** (0.008)	0.044** (0.019)
Foreign Medical School Graduate	-0.005 (0.011)	-0.013 (0.011)	-0.023 (0.018)	-0.013 (0.011)	-0.016 (0.024)
Race of Physician					
Asian	-0.021 (0.013)	-0.031** (0.013)	0.003 (0.022)	-0.030** (0.013)	0.076** (0.036)
Black	0.027 (0.023)	0.033 (0.022)	0.055** (0.027)	0.034 (0.022)	0.034 (0.045)
Hispanic	0.000 (0.022)	0.004 (0.020)	-0.002 (0.032)	0.003 (0.020)	-0.014 (0.063)
Observations	6940	7104	2404	7104	1749
R-squared	0.15	0.15	0.18	0.16	0.16
F test:				4.20	
Prob > F				0.02	

Notes: Clustered standard errors in parentheses: by year, state and specialty. All regressions contain the following control variables: a constant and dummy variables for year, state, physician specialty, and county-level controls for doctors per 1000 residents, hospitals per 1000 residents, hospital beds per 1000 residents, percent population enrolled in HMO, median income, percent urban, percent black, percent below poverty line, percent age 0-14, percent age 65 or older.

F-tests in Columns (4) and (6) test joint significance of liability and the interaction term. The interaction term, "Ln(Liability)*(Age-54)," takes a value of 0 for physicians under age 55.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7 -- Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var: Ln(Weekly Hours)--Columns (1)-(5)				Index Measured Using Only 1980- 1986 Adjudications	IV for Taxes	Ln(Income) as Dependent Variable
Any Cap on Malpractice Awards	-0.001 (0.014)					
Cap on Non Economic Awards		-0.005 (0.015)	-0.028 (0.019)			
Cap on Total Award		-0.005 (0.025)	-0.002 (0.036)			
Joint and Several Liability Abolished			0.031** (0.014)			
Collateral Sources Rule Abolished			-0.015 (0.013)			
Contingent Fee Restriction			-0.019 (0.014)			
Periodic Payment			0.021 (0.013)			
Victims Fund			0.014 (0.049)			
Ln(Liability)			-0.399** (0.193)	-0.268** (0.122)	-0.441** (0.171)	-0.597* (0.306)
Observations	7,104	7,104	7,104	7,104	5,987	6,240
R-squared	0.15	0.15	0.16	0.15	0.14	0.30
F test:		0.07	1.69			
Prob > F		0.93	0.13			

Notes: Clustered standard errors in parentheses: by year, state and specialty. All regressions contain the following control variables: a constant and dummy variables for year, state, physician specialty, and county-level controls for doctors per 1000 residents, hospitals per 1000 residents, hospital beds per 1000 residents, percent population enrolled in HMO, median income, percent urban, percent black, percent below poverty line, percent age 0-14, percent age 65 or older, age, age squared male, solo practice (0/1), board certified (0/1), foreign medical school graduate (0/1), racial categories: asian, black, hispanic.

Column (5) includes Ln(1-marginal tax rate) as an explanatory variable. It is instrumented with Ln(1-MSTR) where MSTR is the highest marginal state tax rate in the state of residence. F-tests in Columns (4) and (6) test joint significance of liability and the interaction term. The interaction term, "Ln(Liability)*(Age-54)," takes a value of 0 for physicians under age 55.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8--Regression of Self-Reported Medical Malpractice Premium on Liability Measure

	All Claims			Only Claims Adjudicated by 1986		
	(1)	(2)	(3)	(4)	(5)	(6)
Liability	0.699*** (0.063)	0.684*** (0.053)	0.225** (0.108)	1.053*** (0.100)	1.042*** (0.083)	0.350** (0.174)
Age		702.2*** (121.6)	437.2*** (107.6)		711.4*** (122.6)	435.1*** (107.9)
Age Squared		-6.9*** (1.2)	-4.4*** (1.1)		-6.9*** (1.2)	-4.3*** (1.1)
Male		1127.6* (615.6)	-136.9 (515.8)		1365.8** (617.3)	-122.8 (515.9)
Solo-Practice		-1049.0*** (331.9)	-711.6*** (267.7)		-931.0*** (337.4)	-700.4*** (267.1)
Board Certified		1536.6*** (300.3)	1113.1*** (269.2)		1613.2*** (305.8)	1113.9*** (269.6)
Foreign Medical School Graduate		563.0 (474.1)	656.6 (409.4)		599.0 (480.2)	656.8 (409.1)
Race of Physician						
Asian		-1177.9** (541.4)	-1114.8** (483.3)		-1186.3** (540.7)	-1108.4** (482.4)
Black		-42.1 (974.2)	-967.0 (800.8)		44.5 (980.8)	-998.6 (799.1)
Hispanic		509.2 (946.4)	-730.5 (851.5)		431.9 (952.4)	-752.5 (847.6)
County-level Demographic Controls	No	Yes	Yes	No	Yes	Yes
State, Year & Specialty Controls	No	Year Only	Yes	No	Year Only	Yes
Observations	6,346	6,310	6,310	6,346	6,310	6,310
R-squared	0.18	0.33	0.49	0.17	0.31	0.49

Notes: Clustered standard errors in parentheses: by year, state and specialty. All regressions contain a constant. Columns (2), (3), (5), and (6) contain county-level controls for doctors per 1000 residents, hospitals per 1000 residents, hospital beds per 1000 residents, percent population enrolled in HMO, median income, percent urban, percent black, percent below poverty line, percent age 0-14, and percent age 65 or older.

* significant at 10%; ** significant at 5%; *** significant at 1%