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Tort Law and Medical Malpractice Insurance Premiums

This paper estimated the effects of tort law and insurer investment returns on physician malpractice insurance premiums. Data were collected on tort law from 1991 through 2004, and multivariate regression models, including fixed effects for state and year, were used to estimate the effect of changes in tort law on medical malpractice premiums. The premium consequences of national policy changes were simulated. The analysis found that the introduction of a new damage cap lowered malpractice premiums for internal medicine, general surgery, and obstetrics/gynecology by 17.3%, 20.7%, and 25.5%, respectively. Lowering damage caps by $100,000 reduced premiums by 4%. Statutes of repose also resulted in lower premiums. No other tort law changes had the effect of lowering premiums. Simulation results indicate that a national cap of $250,000 on awards for noneconomic damages in all states would imply premium savings of $16.9 billion. Extending a $250,000 cap to all states that do not currently have them would save $1.4 billion annually, or about 8% of the total. A negative effect on malpractice premiums was found for the Dow Jones industrial average, but not for bond prices; effects of the Nasdaq index were not significant for internal medicine, but were marginally significant for surgery and obstetrics premiums.

Physician malpractice insurance is once again a serious concern for health care providers, payers, and consumers. The U.S. Department of Health and Human Services (DHHS 2002b) estimated that malpractice premiums increased by 73% between 1999 and 2002. The *Medical Liability Monitor* (2005) reported that physician liability premiums increased between 10% and 49% in 2003 and between 6.9% and 24.9% in 2004. In 2003 alone, some 34 states debated malpractice reform (Madigan 2003). President Bush has repeatedly asked Congress to enact legislation capping noneconomic damages in malpractice cases at $250,000 (White House 2005) and the House of Representatives has passed such a bill in seven of the last ten years. Physicians and insurers attribute premium increases to more frequent and costly malpractice awards (Palmisano 2005).

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Others blame premium increases on falling asset prices and mismanagement on the part of insurers (Treaster and Brinkley 2005).

The purpose of this paper is twofold. First, it estimates the effects of changes in state tort law on medical malpractice premiums over the 1991–2004 period. Of particular interest, it estimates a "dose-response" effect for inflation-adjusted values of damages caps. Second, it examines the effect of investment returns on malpractice premiums.

Background

The United States appears to be in its third medical malpractice "crisis" since the 1970s. The first, in the 1974–1976 period, was a "crisis of availability." Faced with increasing claims and a recession, many insurers left the malpractice market and others instituted rate increases as high as 500%. In response, physicians formed mutual insurance companies, some states formed joint underwriting associations and/or patient compensation funds, and insurers were allowed to move to claims-made coverage under which insurers were liable only for those claims filed during the coverage period (Danzon 1985). Several states enacted changes in malpractice tort law, such as California's 1975 statute that capped awards for noneconomic damages at $250,000 (California Civil Code 2005).

The second crisis, running from approximately 1984 to 1986, has been characterized as a "crisis of affordability." This crisis involved a general rise in liability claims for variety of insurance types. Physician mutual insurance plans made availability less of an issue, but increasing frequency and magnitude of claims threatened their solvency. Again, insurance products were restructured, but state-level tort reforms were more general rather than targeted at malpractice issues. Legislation was enacted to reduce the frequency of claims, to lower the amounts recoverable, and to reduce the costs of the legal process (see Danzon 1985 and Sloan, Bovbjerg, and Githerns 1991 for in depth discussion of these crises).

In the current "crisis," after years of relative stability, malpractice premiums have risen substantially since 2001. Again, physicians, attorneys, policy-makers, and other interested parties are discussing what to do; further changes in tort law have been proposed. A tort is a civil wrong not involving a breach of contract. Tort law establishes the rules through which judicial institutions assess damages, determine liability, and provide compensation to those harmed by the tortuous acts of others. For example, if a health care provider causes harm to a patient through negligence, the provider has committed a tort.

Despite substantial changes in health care markets with the rise of managed care, there has been little rigorous analysis of how tort law affects malpractice premiums since the late 1980s and early 1990s. Meanwhile, the economy has gone through rapid growth and recession, and states have enacted new malpractice reforms. As Congress and the states debate legislation, it is important to have a rigorous analysis in the current environment to identify any effects that might result from changes in the law.

Nature of Tort Reforms

Since the mid-1970s there have been a number of tort reforms enacted by the states. We focus on 11 major provisions.

Damage caps. Damage caps are the most well-known reforms. Plaintiffs in malpractice cases will typically seek to recover economic damages such as medical costs and the opportunity cost of lost income. In addition, they also typically seek noneconomic damages (e.g., for pain and suffering) and, in some cases, punitive damages. Damage caps limit the magnitude of damages that are recoverable. Some apply only to noneconomic damages, while others apply to both economic and noneconomic compensatory damages. Others apply only to punitive damages. The rationale for damage caps is that they will directly limit the award and thereby lower malpractice premiums. There is also a view that the limitation on awards will reduce the incidence of suits as well.

Usually the cap is stated in nominal terms, such as $250,000 per claim. Over time, such nominal caps become more restrictive as inflation erodes the purchasing power of any given value. For example, the $250,000 limit on noneconomic damages imposed in California in 1975 is the equivalent in purchasing power to an $877,800 limit in 2004 dollars. Thus, the cap is much more restrictive today than when it was enacted. Some states have put in place automatic adjustments to their damage caps, linked to such things as average earnings in the state. Other state legislatures have revisited the caps from time to time and adjusted their magnitude.

Collateral source offset. A plaintiff may have incurred substantial medical costs as a result of negligent medical treatment and may sue to recover these costs. At common law, the plaintiff was entitled to recover the costs incurred even though they were reimbursed by another source such as health insurance. Many states now have modified the common law adopting rules that typically reduce any award for medical expenses by the amount recovered from other sources. Thus if the plaintiff's health insurance plan paid those expenses, then the plaintiff would have any award reduced by the amount of those payments. Some states allow collateral sources to be considered by the jury and some require that the awards to reduced by the judge to reflect collateral offsets. The purpose is to reduce the magnitude of any award, resulting in lower malpractice insurance premiums.

Modification of the rule of joint and several liability. A plaintiff may sue the physician, hospital, and nurse associated with some procedure. Under case law in most states, each of the defendants would be liable for the entire award if the other defendants were unable to pay. Many states have enacted provisions that limit each defendant's liability to only his or her share of the wrongdoing. This again has as its purpose the lowering of the magnitude of the award attributable to any one party. This in turn could lower malpractice premiums.

Periodic payments. Typically, at common law when a plaintiff wins a lawsuit, the defendant is responsible for the payment of the entire award in a lump sum at the time of the entry of judgment including future damages that are reduced to present value. Provisions for periodic payment allow the defendant to spread out payments over some legislative or court- determined schedule. The rationale for this provision is that it allows the defendant to save money by comparing the present value of the payment schedule with the present value of alternative payment or financing arrangements and selecting the least costly. There is some speculation, however, that such provisions may increase net payments if the plaintiff has higher than expected medical expenses down stream.

Statutes of limitation and repose. Statutes of limitation specify a limited time period from occurrence or discovery of an allegedly tortuous act to the filing of a claim in court. With the exception of cases involving children, malpractice statutes of limitations are typically about two years, but the time for filing suit may run from the time of occurrence or discovery in most jurisdictions. Statutes of repose go further and limit the absolute amount of time one has to file a claim regardless of when discovery occurred. These provisions are typically impose a limit of three to four years. The purpose of a statute of repose is to narrow the time window during which a claim may be filed, thereby reducing the number of claims and reducing premiums.

Limits on attorney fees. Most malpractice cases are handled on a contingency basis. The plaintiff is responsible for the costs of the suit and if victorious, the plaintiff's attorney is entitled to a share of the award. Contingency fees in malpractice cases may be as high as 50%. Some states have, however, enacted limits on the percentage of the award that may be paid to the attorney; while others have provided for judicial oversight of the payment with respect to its reasonableness. The rationale is that by limiting the attorney's fee, frivolous lawsuits will be reduced, thereby lowering premiums. There was no change in legislation dealing with attorney fees during our period of analysis, so we were unable to examine its impact.

Limitations on expects. A malpractice case typically requires a medical expert to testify that some event occurred that did not meet the standard of care. Some states have enacted provisions that specify the requisite credentials of clinicians eligible to be qualified as experts in a malpractice case. The laws often require that a physician be board certified in the same specialty as the defendant, and/or that he/she be in active practice deriving some relatively large percentage of income from clinical practice during a specified period of time prior to qualifying as an expert. The intent is to limit the ability of a plaintiff to "doctor shop" for experts willing to testify regardless of their knowledge of the local standard of care or their familiarity with the procedure. The law's intent is to reduce the number of unsubstantiated claims, and raise the costs of bringing a suit with the result that malpractice premiums are reduced.

Res ipsa loquitur. Some iatrogenic injuries have been held to constitute malpractice on their very face under the doctrine of res ipsa loquitur. This allows the plaintiff's claim to go to the jury without specifying the negligent conduct of the

defendant physician. Res ipsa loquitur traditionally has been invoked successfully in cases where a foreign object is left in the body following surgery, or where an injury occurs to a part of the body distant from the intended site of surgery. Courts in some states have broadened the doctrine of res ipsa loquitur beyond these traditional cases. A few states have reacted by adopting statutes limiting the range of results that may be covered by res ipsa loquitur. The rationale is that limiting the application of res ipsa loquitur raises the costs of pursuing a claim, thereby lowering the frequency of claims and reducing premiums. Here, too. there was no change in legislation over our analysis period, so we were unable to judge its impact.

Pre-trial screening. In the 1980s, approximately one-third of the states enacted legislation that required the parties to submit their claim to a panel of experts that would render an opinion on whether the claim was meritorious. In some states this finding could be used in court; in most it could not. The rationale for the process was that the screening would serve as a low-cost means of identifying weak or unsubstantiated claims. A plaintiff with a weak case would be more likely to drop their case. Those claims found to have merit would be more likely to settle without going to court thereby lowering litigation costs. The effect was expected to be fewer claims and more settlements without the costs of trial, with the intent that premiums would be reduced. There was no change in the number of states with pre-trial screening over the 1991–2004 period.

Arbitration. Subscribers purchase health insurance from an insurer. Some health insurers include a clause in their contracts requiring subscribers to accept binding arbitration in the event of an allegedly negligent act. In addition, some health care providers may require a patient to sign an agreement to arbitrate malpractice claims prior to providing treatment. Some states have enacted legislation treating pre-claim agreements to arbitrate as binding. The rationale is that the use of this alternative resolution process is likely to be a less costly means of settlement and, as a consequence, malpractice premiums would be lower.

Studies of Malpractice Premiums

There have been a number of recent studies of the effects of tort reforms on medical malpractice premiums. DHHS (2002a), for example, reported that in 10 states with damage caps of $350,000 or less, premiums increased by 12% between 2000 and 2001, while 10 states without caps had increases of 44%. Weiss, Gannon, and Eakins (2003) reported that the between 1991 and 2002 malpractice premiums increased more in states with damage caps than in states without them. Americans for Insurance Reform (2004) used national data trends to argue that there had been no explosion of malpractice payouts at any time in the past 30 years. It attributes increases in premiums to the state of the economy and declining investment income for insurers. These and similar studies, however, are not reliable guides to understanding the effects of tort reforms on malpractice premiums. They do not control for other factors that may have been going on nationally and they fail to control for systematic differences in the states that may also account for differences in the observed premiums.

In contrast, there have been nearly a dozen studies that have attempted to identify the effects of tort reforms that do control for national and state trends using a variety of different data sets (see Nelson, Kilgore and Morrisey 2006 for a review).

In the earliest work Sloan (1985) used a Health Care Financing Administration Survey of Insurers to examine the effects of damage caps on the average malpractice premiums paid by general practitioners, orthopedic surgeons and ophthalmologists across states; he found no statistically significant effects over the 1974–1978 period. Zuckerman, Bovbjerg, and Sloan (1990) extended this work through 1986, carefully coding the nature and timing of the laws enacted and used lagged premiums, state fixed-effects, and a time trend to control for differences across states and over time. They concluded that damage caps on general surgeons, general practitioners and obstetricians reduced short-run premiums by 13.4%, 14.3% and 16.9%, respectively. Long-run premium decreases ranged from 40.6% to 57.9%. They attributed the lack of findings in the Sloan (1985) work to the short period of analysis.

Blackmon and Zeckhauser (1990) were the first to examine aggregate state malpractice premium data. Unlike Zuckerman, Bovbjerg, and Sloan, who essentially examined the price of coverage as observed by the average physician in a given specialty, this study explored the effects

of reforms on aggregate malpractice premium income received by insurers in the state using a model that included a lagged premium variable. Using data from *Best's Review,* Blackmon and Zeckhauser estimated the change in premium income between 1985 and 1988 as a function of a dummy variable indicating that a state implemented reforms in 1986. They found that states that implemented the four reforms analyzed reduced aggregate short-run premium income by 16.6%. Viscusi et al. (1993) expanded and refined the Balckmon and Zeckhauser study, focusing on reforms in 1985, 1986, and 1987. They concluded that states enacting some sort of "reform" in 1985 or 1986 reduced the increase in premium income by 27.7% and 21.4% respectively, however, an examination of specific reforms found no statistically significant effects of damage caps. Gius (1998) also uses *Best's* state aggregate data, but over the 1976 to 1990 period. With the introduction of a random effects specification, he too found no statistically significant effect of damage caps on aggregate premiums. While aggregate premium income is an important gauge of performance, these analyses were unable to identify whether any effects were driven (or offset) changes in premiums, in the volume of coverage written, in the mix of specialties represented, or in the mix of insurers providing the coverage over the period.

Viscusi and Born (1995) improved on the aforementioned aggregate premium work by using National Association of Insurance Commissioner (NAIC) data to examine the effects of reforms on malpractice premium income by firm by year. These data, available over the 1985–1991 period, allowed them to estimate state and year fixed effects premium income equations. They concluded that states enacting "reforms" reduced firm-specific aggregate premiums by 12.4%. In models that excluded fixed-effects, ceilings on recoveries reduced aggregate premiums by 8%. Viscusi and Born (2004) revisited these data and employed more detailed characterizations of the state malpractice reforms. They concluded that states with caps on noneconomic damages reduced short-run premium income by 6.2% and those that prohibited punitive damages reduced short-run premium income by 8.1%. The long-run effects were 19.7% and 25.8%, respectively.

Thorpe (2004) also used the NAIC data but over a much longer time period 1985 through 2001. He used the Blackmon and Zeckhauser approach of examining state aggregate premium income, but added a new measure—the aggregate premium income per physician in the state. Year fixed effects and a lagged dependent variable were included in the specification. Thorpe found that states with either economic or noneconomic damage caps (or both) had aggregate premium incomes that were 17.1% lower and premium income per physician that was 12.2% lower. There was no statistically significant effect of prohibitions on punitive damages.

Unlike the other studies, Kessler and McClellan (1997) used a survey of physician self-reported malpractice premiums. As such, their work is in the spirit of that of Zuckerman, Bovbjerg, and Sloan (1990) in examining the price of coverage from the physician perspective. They employ a full state and year fixed-effects model to account for differences across time and across states. "Direct reforms," essentially damage caps, were found to reduce premiums by 8.4% three years after enactment.

Finally, Danzon, Epstein, and Johnson (2004) used *Medical Liability Monitor* data to also study the effects of tort reforms on premiums from the physician's perspective. They have 1994–2003 data on average annual premiums paid by internists, general surgeons, and obstetricians by firm and state. Using a state and year fixed-effects model they found that noneconomic damage caps below $500,000 reduced the change in premiums by 5.7%. Damage caps set at a higher level, and total damage caps had no statistically significant effects.

While these carefully conducted studies differ substantially in their findings, much of this has to do with their unit of analysis. The studies that differ the most are those that examine state level aggregate premium income. Gius (1998) found no effects of limits on liability. Blackmon and Zeckhauser (1990) found that damage caps reduced short-run premiums by 13%. Thorpe (2004) found that damage caps reduced premium income by 17.1%. Viscusi et al. (1993) found "reforms" enacted in 1985 or 1986 reduced aggregate premium income by 27.7% and 21.4%, respectively, but damage caps had no statistically significant effects in other specifications. This wide range perhaps may be explained by different measures of tort reform, different time

Table 1. Numbers of states with tort law provisions over time

	1991	1998	2004
Damage cap	24	25	27
Collateral offset	30	29	30
Joint & several liability	25	29	33
Periodic payments	27	27	30
Attorney fee limits	13	13	13
Expert limits	12	14	17
Res ipsa loquitur	6	6	6
Pre-trial screening	19	19	19
Arbitration	10	11	12

frames (Gius and Thorpe) and, in the case of Gius, the use of random effects modeling.

The two Viscusi and Born (1995, 2004) studies use insurer-specific aggregate premiums and are much more consistent. "Reforms" reduced average premium income by 12.4% (Viscusi and Born 1995), and damage caps reduced them by 6.2% (Viscusi and Born 2004). This difference could be attributable to differences in the measures of tort reform used.

Similarly, with the exception of the early Sloan (1985) study that was probably of too short a duration to find meaningful results, the studies that looked at malpractice premiums from a physician's perspective are remarkably consistent. This is particularly so given that they each examined different malpractice "crisis" periods. Zuckerman, Bovbjerg, and Sloan (1990) concluded that damage caps over the 1974–1986 period reduced premiums by 13% to 17% in the short run depending on specialty. Kessler and McClellan (1997) found that "direct reforms" (essentially damage caps) reduced premiums by 8.4% over the 1985–1993 period. And Danzon Epstein, and Johnson(2004) reported that damage caps of $500,000 or less reduced average premiums by 5.7 percent over the 1994–2003 period.

The evidence that other tort reforms have been effective has been spotty at best. Zuckerman et al. (1990) found that shorter discovery periods reduced premiums. Danzon et al. (2004) found that the absence of joint and several liability reduced premiums. The other studies either found no additional reform effects or lumped various reforms together.

Data and Methods

We addressed the specific objectives as follows. First, we took advantage of variations in tort law among the states to estimate the effects of different tort law provisions to affect physician malpractice premiums. We examined these relationships in naïve, state-only, and full fixed-effects models using data from 1991 through 2004. The principal analyses included fixed state and year effects to control for unobserved factors affecting malpractice costs in different states and times that may be unrelated to differences in tort law provisions. We also tested the hypothesis that economic conditions, and returns on investments, affect the costs of malpractice insurance. To do this, it was necessary to relax the year fixed-effects to include national economic conditions.

Data on Malpractice Law

Unfortunately, not all the sources agree about what the state laws are or when they were enacted or in effect (McCullough, Campbell, and Lane 2003; Weiss, Gannon, and Eakins 2003). We undertook an independent study of the statute and case law related to malpractice liability in each of the states from 1975 onward. A team of law students supervised by a law professor prepared historical summaries of tort law in each of the states. Statutes and judicial opinions were read to determine precisely when tort reforms came into, or went out of, effect. For example, Illinois enacted a $500,000 damage cap in March 1995, but it was declared unconstitutional in December 1997.

We examined laws and court actions on all 11 of the tort law provisions described previously. A coding scheme was developed including dichotomous variables for most provisions, number of years for statutes of limitations and repose, and dollar amounts for caps on noneconomic damage awards. The summaries were reviewed and variables coded independently by each of the authors for every state. Where there were discrepancies in coding, legislation and case law were reviewed and the coding revised accordingly until there was a consensus. The result of these efforts was a thoroughly documented and validated set of codes reflecting the tort provisions that were actually in effect in each state for each year from 1975 through 2004. Table 1 shows the numbers of states that had specific tort provisions in place; Table 2 shows the number of states that made substantive changes in tort laws between 1991 and 2004; and Table 3 gives average values for

Table 2. Number of states with tort law changes between 1991 and 2004

Damage cap (dummy)	8
Collateral sources considered	3
Mandatory offset	3
Joint & several liability	9
Statutes of limitation	3
Statutes of repose	7
Periodic payments	6
Attorney fee limits[a]	0
Expert limits	5
Res ipsa loquitur[a]	0
Pre-trial screening[a]	0
arbitration	3

[a] Dropped from analysis due to lack of variation.

Table 3. Mean values for caps (if any) and statutes of limitation or repose

	1991	1998	2004
Mean cap in current dollars	441,561	426,477	565,559
Mean cap in constant (2004) dollars	608,200	490,841	565,559
Statute of limitations (years)	2.1	2.0	2.0
Statute of repose (years)	4.7	4.8	5.5

caps on noneconomic damages and for statutes of limitation and repose.

We use one other characteristic of damage caps to observe the effect of the levels of award limitations. Some states set limits in nominal dollars (e.g. California has had a statutory cap of $250,000 since 1975), other states index the caps to some measure of the rate of inflation. We express all award caps (and malpractice insurance premiums) in real 2004 dollars using the Consumer Price Index (All Items). There were 29 states that had damage caps in place at some point between 1991 and 2004; of these, 27 had caps that were not adjusted for inflation. Six states enacted caps during this period; two had caps that were in place prior to 1991, but were subsequently overturned; and two enacted caps after 1991 that were subsequently overturned. Among the 17 states that had caps in place continuously throughout the time period, the average real value was $514,682, and the average standard deviation was $105,514.

Data on Malpractice Premiums

The principal data source for malpractice premiums was the *Medical Liability Monitor* (MLM 2005) annual survey of physician insurers. Every year, *MLM* identifies the largest malpractice insurance providers in each state and repeatedly contacts them to provide premium data until all selected providers are accounted for. Except in states with a single provider, *MLM* reports premiums for between two and seven firms. Data on the market shares of each firms are not made available per agreement with the firms. These data include 1991–2004 state- and substate-level premiums for three specialties: obstetrics/gynecology, general surgery, and internal medicine. The intra-state regions were determined by the insurance carriers offering coverage in each of the states; 90 such regions were defined in 1991 and 142 in 2004. State law typically specifies a level of minimum coverage and the prevailing level of coverage is reported; thus we can control for the amount of insurance coverage purchased.

Premium rates for other specialties were estimated based on the resource-based relative value scale (RBRVS) computed by the Centers for Medicare and Medicaid Services (CMS 2003) and the frequency of procedure codes billed by each physician specialty from Physician Marketplace Statistics, 1994–2003 (AMA 1998, 2000). Every billable service that physicians provide is associated with a billing code and assigned relative value units (RVUs) for physician work effort, practice expense, and malpractice expense. We combined malpractice RVU data with billing code distributions by specialty to estimate specific premium rates based on weighted averages of malpractice premiums for the most frequently billed procedures.

Other data sources included: the Area Resource File (DHHS 2003), used to identify the numbers of physicians active in patient care for each specialty in each state; the Bureau of Labor Statistics for the CPI (BLS 2005); and online databases for the Dow Jones and Nasdaq indices and bond yields for 10-year treasuries (Financial Forecast Center 2005; Yahoo! Finance 2005).

Analytic Methods

We estimated three types of models. Type I models used naïve ordinary least squares (OLS)

regression with robust standard errors accounting for observations clustered within states; this has been included to demonstrate how a failure to account for unobserved state characteristics can introduce bias into the parameter estimates. Type II models included state-level fixed effects with linear time trend. Measures of investment returns are reliable only as national aggregates, and premiums are set annually, so year-level fixed effects could not be used to test the effects of market changes on premiums. Type III models followed the general approach of Kessler and McClellan (1997) in our analysis of the effects of changes in policy on premium rates and estimate equations of the form:

$$MP_{rst} = L_{st}\gamma + X_{rst}\beta + \theta_t + \alpha_s + \varepsilon_{rst}$$

where *MP* is the natural logarithm of the malpractice premium for specialty r in state-region s in year t. L is the vector of tort laws by state and year, X is a vector of other time-varying market characteristics, θ and α are year- and state-fixed effects, respectively, and ε is an error term. Tort law is defined at the state level and our unit of observation is the malpractice insurance coverage region; all payment regions are areas within states. Regions change as firms enter, exit, or redefine substate markets; in 1991 there were a total of 78 regions, with 16 states having exactly one region; in 2004 there were 309 regions and only six states were defined as single regions. In all models, robust standard errors were computed, adjusting for clustering of observations within states.

State- and year-level fixed-effects regression models effectively controlled for unobserved time-invariant state characteristics and national secular trends that could affect premiums. The regression coefficients on continuous variables can be interpreted as the marginal change in premium rates associated with a within-state change in tort provisions. For the dichotomous tort law changes, we employed the Halverson-Palmquist (1980) correction to obtain the marginal effects.

In addition to presenting the various analytic models described earlier, we offered two different methods for specifying damages caps. The first method included an indicator variable for the presence of a cap in each state and year and a continuous measure of the level on the caps (in $100,000 increments of 2004 dollars). The second method used dichotomous variables indicating the presence of: a cap less than or equal to $250,000; a cap between $250,000 and $500,000; a cap between $500,000 and $750,000; and a cap amount greater than $750,000.

To put estimates of tort reform into a broader context, we simulated the effects of imposing (or removing) a $250,000 nationwide cap on noneconomic damages, and also the incremental effect of adding caps in states that do not have any—the policy recommendation currently under debate. Malpractice insurance effects were estimated directly for obstetrics-gynecology, internal medicine, and general surgery specialties based on observed premiums from the *Medical Liability Monitor*. For 16 other specialties, we estimated expected premiums based on malpractice liability derived from the RBRVS. Expected premiums were calculated using a malpractice index based on the top 25 billed procedures for each specialty. The malpractice index for each specialty is the weighted average of malpractice RVUs generated relative to malpractice RVUs generated by internists or general surgeons.

Expected premiums for each specialty physician were then calculated as the product of malpractice index and the premiums for internists or general surgeons, depending on type of specialty and the area. For example, a thoracic surgeon generates roughly 1.34 times the number of malpractice RVUs as a general surgeon. The average malpractice premium for a general surgeon in Alabama was $31,125 in 2004; thus, we estimated the premium for a thoracic surgeon in Alabama to be $41,716. Finally, we used the distribution of physicians by specialty and state together with our regression estimates of the effects of damage caps to develop simulations of the effect of a national cap on damage awards set at $250,000 and the level of premiums expected if there were no caps.

We tested the validity of these imputed premiums by using RVU weights and premiums for internal medicine to predict general surgery premiums and vice versa. These imputations tend to overestimate medical specialty premiums ($18,311 estimated vs. $13,911 observed) and underestimate surgical specialty premiums ($34,007 estimated vs. $43,217 observed). Thus, approximations made on overall tort reform effects were subject to extensive sensitivity analysis via Monte Carlo simulations.

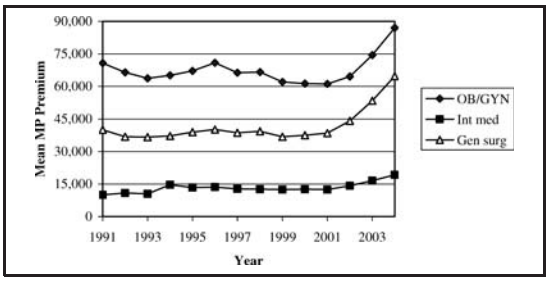

Figure 1. Trends in real value ($2004) of malpractice premiums by specialty (Source: *Medical Liability Monitor*)

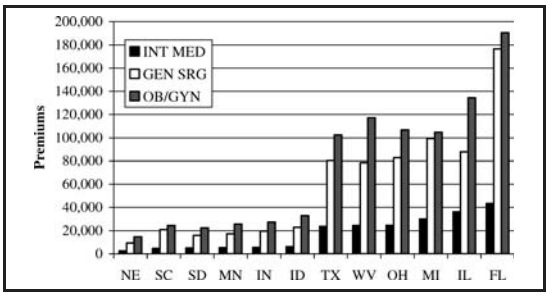

Figure 2. 2004 malpractice premiums by specialty in selected states (Source: *Medical Liability Monitor*)

Results

Figure 1 shows trends in constant (2004) dollar average malpractice premiums for obstetrics/gynecology (OB/GYN), general surgery, and internal medicine. Premiums were flat or declining in inflation-adjusted terms from 1991 to 1999, then rose at an increasing rate through 2004. Figure 2 shows average 2004 premiums for the six lowest- and six highest-cost states. The variability is striking. There is a more than 12-fold difference between the least and most expensive markets. Figure 3 shows 2004 simple average premiums by specialty for states with and without caps on damage awards. States with caps had slightly lower malpractice premiums.

Table 4 shows results for tort provisions with log-transformed internal medicine premiums as the dependent variable under different model specifications. Model I, including neither state nor year fixed-effects, shows the rather implausible result that the adoption of damage caps had no significant effect on premiums, but that higher levels of the cap reduced premiums. The adoption of most of the other tort reforms had no statistically significant effects. Longer statutes of repose (given any in place) were associated with higher premiums, as might be expected; however, provisions for arbitration and restrictions on expert testimony had implausibly large positive coefficients. Similarly, Model Ib, treating damages caps as stepped indicators, suggests that only caps set at very high levels have any significant effect. Further, in using the Halverson-Palmquist (1980) bias correction for dummy variables in a semi-log specification, the model implies that caps in excess of $750,000 would be expected to lower premiums by about 65% ($e^{-1.039} - 1 = .646$). Note that in all text discussions of tort reform dummy variable coefficients, we report the corrected value while leaving the uncorrected coefficients in the tables.

Model II used state fixed-effects and includes the variables for investment returns. The presence of a cap on noneconomic damages reduced premiums, but the effect was not statistically significant. However, given the presence of a damage cap, a higher level of the cap was positively correlated with premiums and was statistically significant. A $100,000 increased in the damage cap increases premiums by 2.8%. The presence of statute of repose, which essentially provides a maximum period during which a suit may be filed, reduced premiums. Given such a statute, its length was associated with a positive, but not significant, increase in premiums. In contrast, all states have statutes of limitations. These laws limit the time period in which a suit may be filed once a potentially negligent act has occurred or been discovered. The Model II results suggest longer liability windows implausibly reduce

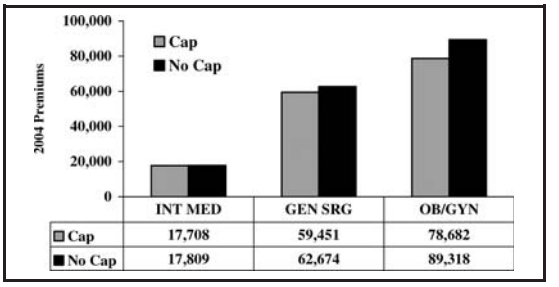

Figure 3. Malpractice premiums by specialty in states with & without caps on awards for noneconomic damages (Source: *Medical Liability Monitor*)

Table 4. Regression results for internal medicine premiums

Dependent variable: ln(premiums)	Ordinary least squares		State fixed effects		State/year fixed effects	
	Ia[a]	Ib[b]	IIa[a]	IIb[b]	IIIa[a]	IIIb[b]
Cap (yes/no)	.081	—	−.1611	—	−.190***	—
	(.162)		(.094)		(.068)	
Cap amount (in $100,000s)	−.062***	−.028**	—	.039***	—	
	(.023)	(.012)		(.010)		
Cap ≤ $250,000	—	−.188	—	−.451*	—	−.292**
		(.181)		(.269)		(.114)
$250,000 < Cap ≤ $500,000	—	−.158	—	−.184**	—	−.122*
		(.159)		(.089)		(.065)
$500,000 < Cap ≤ $750,000	—	−.169	—	.066	—	.076**
		(.119)		(.044)		(.033)
Cap > $750,000	—	−1.039**	—	.370***	—	.391****
		(.413)		(.114)		(.097)
Consider collateral sources	−.138	−.138	−.049	.019	−.025	−.009
	(.154)	(.151)	(.136)	(.163)	(.135)	(.137)
Mandatory collateral source offset	.165	.165	.342**	.326***	.426****	.422****
	(.179)	(.171)	(.140)	(.108)	(.114)	(.102)
Statute of limitations (years)	−.020	−.044	−.151****	−.164****	−.181****	−.200****
	(.092)	(.089)	(.031)	(.023)	(.032)	(.028)
Statute of repose (yes/no)	−.307	−.371*	−.393**	−.513****	−.411***	−.511****
	(.195)	(.192)	(.195)	(.12)	(.141)	(.101)
Length of repose (years)	.057**	.067	.037	.058**	.037	.054**
	(.026)	(.023)	(.036)	(.023)	(.026)	(.021)
Reduced joint & several liability	.193	.190	.018	.034	.051	.029
	(.142)	(.138)	(.047)	(.048)	(.052)	(.050)
Periodic payments	.051	.014	.070	.106**	.062	.096***
	(.131)	(.115)	(.052)	(.045)	(.041)	(.037)
Provision for arbitration	.411**	.483**	.038	.047	−.006	.001
	(.168)	(.187)	(.156)	(.159)	(.175)	(.18)
Restricted expert testimony	.364***	.340***	.136	.141*	.085	.096
	(.111)	(.105)	(.108)	(.084)	(.113)	(.101)
Ln(Bond price)	—	—	−.202	−.189	—	—
			(.119)	(.132)		
Ln(DJIA)	—	—	−.399****	−.405****	—	—
			(.123)	(.126)		
Ln(NASDAQ index)	—	—	−.053	−.047	—	—
			(.056)	(.059)		
Amount of coverage ($ millions)	.1537**	.136**	.063	.056	.061	.053
	(.058)	(.055)	(.04)	(.036)	(.039)	(.036)
Year	—	—	.091****	.090****	—	—
			(.013)	(.013)		
$N = 2{,}756$						
Adjusted R-squared	.307	.325	.741	.744	.748	.749
State fixed effects	No	No	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No	Yes	Yes

Note: Marginal effects for dichotomous variables require Halverson-Palmquist correction: $(e^b - 1)$. Standard errors are in parentheses.
[a] Models with caps as continuous variables.
[b] Models with caps as levels in dichotomous variables.
* $p < .10$.
** $p < .05$.
*** $p < .01$.
**** $p < .001$.

premiums. Similarly, mandatory collateral offsets were positively correlated with malpractice premiums. Finally, there was a strong and highly significant elasticity of −.399 between premiums and the Dow Jones Industrial Average; and a marginally significant −.202 elasticity with respect to Treasury bond prices. There was no statistically significant effect of the NASDAQ

index on malpractice premiums. These findings suggest that malpractice premiums do depend, in part, on investment returns, but apparently not on more risky investments.

Model IIb provides similar results. Caps less than $250,000 were associated with lower premiums (bias corrected 36% reduction; $p < .10$); caps from $250,000 to $500,000 produce less of an effect (bias corrected 16.8% reduction; $p < .05$); caps from $500,000 to $750,000 had no significant effect; and caps greater than $750,000 were associated with higher premiums (bias corrected 44.8% increase; $p < .001$). The effects of other tort reforms were similar to those described, except that the positive association between longer periods for statutes of repose and higher premiums was now statistically significant.

Models III and IIIb reflect our preferred specification, with fixed-effects for both states and years. The introduction of a cap on noneconomic damages reduced medical malpractice premiums by 17.3% ($p < .01$). A more generous cap raised premiums. A $100,000 higher cap increases premiums by 3.9%. Thus a cap of about $440,000 would be expected to have no effect. Model IIIb has a similar interpretation. Caps less than $250,000 were associated with lower premiums (bias corrected 25% reduction; $p < .05$); caps from $250,000 to $500,000 produced less of an effect (bias corrected 11.5% reduction; $p < .10$); caps from $500,000 to $750,000 raised premiums (bias corrected 7.9% increase; $p < .05$); and caps greater than $750,000 were associated with still higher premiums (bias corrected 47.8% increase; $p < .001$).

The other variables remain largely the same as in models II and IIb. The results for the length of the statute of limitations and for mandatory collateral offsets continue to be counter-intuitive. However, the statute of limitations effect can be traced to a single state, Minnesota, where the statute of limitations increased at a time when malpractice premiums had been falling. The mandatory collateral offsets effect can be traced to three states—Pennsylvania, Rhode Island and West Virginia—all of which introduced the provision when malpractice premiums were rising sharply. It is likely that these measures were simply ineffective rather than actually causing a rise in premiums. No other tort reforms had any statistically significant effects in either model II or III.

Results were similar for regressions using full fixed-effects (log) premium models for other specialties (Tables 5 and 6). The introduction of a cap reduced general surgery and obstetrics/gynecology premiums by 20.7% ($p < .01$) and 25.5% ($p < .001$), respectively. An increase in the noneconomic damage cap of $100,000 raised premiums by 3.9% in both specialties ($p < .001$). Similarly, the stepped indicators in model IIIb shows significant decreases in premiums associated with lower cap levels and increases in premiums associated with higher levels. The other reforms behaved in similar ways to those for internal medicine, with some variables losing significance for one specialty or another.

While the use of fixed-effects can control for unobserved state characteristics and period trends, a potential endogeneity problem remains. The primary concern is that states may tend to enact tort reforms in response to increased malpractice premiums. It is important to note, however, that much of the variation in damage caps arose from the effects of inflation, and thus to some extent is exogenous to policy decisions. To test for the presence of endogeneity, we ran a series of regressions with one-, three-, and five-year leads for the presence of caps (Table 7). The coefficients on these lead variables were not significant either individually or in combination.

Simulation results based upon our fixed-effects specification and applied across all 19 specialties available to us indicate that a national cap of $250,000 for noneconomic damages in all states would imply premium savings of $16.9 billion (95% CI, $14.2 billion to $19.6 billion) relative to no state having a cap. Extending a $250,000 cap to all states currently without them or with caps above this level would save $1.4 billion (95% CI, $0.9 billion to $1.75 billion), or about 8% of total premiums.

Discussion

The firmest conclusion that can be drawn from our study is that caps on noneconomic damages can significantly constrain the growth of medical malpractice premiums. First, in our preferred specification, the introduction of a cap lowered internal medicine premiums by over 17.3%, general surgery premiums by 20.7%, and obstetrics/gynecology premiums by 25.5%. Second, an increase of $100,000 in the statutory cap on noneconomic

Table 5. Regression results for general surgery premiums

Dependent variable: ln(premiums)	Naive regression		State fixed effects		State/year fixed effects	
	Ia[a]	Ib[b]	IIa[a]	IIb[b]	IIIa[a]	IIIb[b]
Cap (yes/no)	.128	—	−.172***	—	−.232***	—
	(.149)		(.064)		(.078)	
Cap amount (in $100,000s)	−.056**	—	.027****	—	.039****	—
	(.021)		(.008)		(.010)	
Cap ≤ $250,000	—	−.150	—	−.316	—	−.317***
		(.16)		(.224)		(.107)
$250,000 < Cap ≤ $500,000	—	−.073	—	−.125	—	−.106
		(.144)		(.083)		(.072)
$500,000 < Cap ≤ $750,000	—	−.109	—	.002	—	.030
		(.109)		(.035)		(.044)
Cap > $750,000	—	−.902**	—	.287*	—	.351**
		(.390)		(.155)		(.168)
Consider collateral sources	−.175	−.179	−.046	−.021	−.028	−.029**
	(.133)	(.130)	(.04)	(.061)	(.062)	(.070)
Mandatory collateral source offset	.094	.087	.386**	.400***	.466***	.466****
	(.167)	(.157)	(.163)	(.142)	(.154)	(.125)
Statute of limitations (years)	−.053	−.074	−.106****	−.112****	−.103***	−.120****
	(.099)	(.097)	(.029)	(.024)	(.035)	(.027)
Statute of repose (yes/no)	−.244	−.308*	−.310****	−.358***	−.261*	−.338***
	(.175)	(.173)	(.173)	(.138)	(.142)	(.116)
Length of repose (years)	.057**	.067****	.030	.039	.019	.033
	(.023)	(.019)	(.031)	(.025)	(.024)	(.022)
Reduced joint & several liability	.147	.143	−.086	−.082*	−.028	−.057
	(.135)	(.134)	(.043)	(.042)	(.05)	(.045)
Periodic payments	.050	.014	.059	.070	.025	.040
	(.128)	(.112)	(.046)	(.05)	(.046)	(.046)
Provision for arbitration	.216	.278	.122	.130	.097	.105
	(.158)	(.175)	(.184)	(.188)	(.204)	(.209)
Restricted expert testimony	.374****	.353****	.296	.288***	.240**	.254**
	(.106)	(.102)	(.115)	(.099)	(.117)	(.108)
Ln(Bond price)	—	—	−.148	−.139	—	—
			(.117)	(.12)		
Ln(DJIA)	—	—	−.359**	−.367**	—	—
			(.158)	(.156)		
Ln(NASDAQ index)	—	—	−.142**	−.137**	—	—
			(.066)	(.065)		
Amount of coverage ($ millions)	.133**	.117**	.055**	.050**	.045**	.037
	(.052)	(.049)	(.025)	(.023)	(.023)	(.021)
Year	—	—	.088****	.087****	—	—
			(.014)	(.014)		
$N = 2{,}739$						
Adjusted R-squared	.254	.274	.693	.693	.717	.719
State fixed effects	No	No	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No	Yes	Yes

Note: Marginal effects for dichotomous variables require Halverson-Palmquist correction: $(e^b - 1)$. Standard errors are in parentheses.
[a] Models with caps as continuous variables.
[b] Models with caps as levels in dichotomous variables.
* $p < .10$.
** $p < .05$.
*** $p < .01$.
**** $p < .001$.

damages increased malpractice premiums by 3.9% for all three specialties. By using the constant dollar value of caps we were able to observe the "dose response" both when states introduced or modified caps and when the real value of a cap changed over time as a result of inflation.

Our results also indicate that premium growth is constrained when investment returns are

Table 6. Regression results for OB/GYN premiums

Dependent variable:	Ordinary least squares		State fixed effects		State/year fixed effects	
ln(premiums)	Ia[a]	Ib[b]	IIa[a]	IIb[b]	IIIa[a]	IIIb[b]
Cap (yes/no)	.124	—	−.205***	—	−.295****	—
	(.145)		(.065)		(.077)	
Cap amount (in $100,000s)	−.053***	—	.026****	—	.039****	—
	(.019)		(.006)		(.007)	
Cap ≤ $250,000	—	−.117	—	−.229	—	−.328***
		(.142)		(.146)		(.112)
$250,000 < Cap ≤ $500,000	—	−.075	—	−.177**	—	−.170**
		(.143)		(.087)		(.087)
$500,000 < Cap ≤ $750,000	—	−.089	—	−.033	—	−.027
		(.107)		(.048)		(.059)
Cap > $750,000	—	−.835**	—	.187*	—	.241*
		(.367)		(.111)		(.13)
Consider collateral sources	−.129	−.130	−.123	−.107	−.104	−.124
	(.120)	(.12)	(.114)	(.125)	(.118)	(.109)
Mandatory collateral source offset	.095	.093	.297**	.290***	.409***	.404****
	(.156)	(.144)	(.122)	(.105)	(.126)	(.112)
Statute of limitations (years)	−.013	−.033	−.053	−.061	−.059	−.072
	(.095)	(.093)	(.046)	(.039)	(.056)	(.046)
Statute of repose (yes/no)	−.174	−.230	−.223	−.286	−.189	−.247
	(.162)	(.161)	(.226)	(.187)	(.194)	(.165)
Length of repose (years)	.052**	.060***	.027	.039	.018	.028
	(.021)	(.018)	(.036)	(.030)	(.028)	(.025)
Reduced joint & several liability	.103	.099	.006	.007	.070	.046
	(.125)	(.123)	(.072)	(.071)	(.065)	(.061)
Periodic payments	.071	.038	.127**	.142**	.097**	.111**
	(.118)	(.103)	(.051)	(.049)	(.048)	(.05)
Provision for arbitration	.157	.218	.042	.047	.015	.024
	(.15)	(.164)	(.231)	(.236)	(.26)	(.267)
Restricted expert testimony	.329***	.308***	.245**	.247**	.163	.173*
	(.101)	(.096)	(.108)	(.098)	(.103)	(.099)
Ln(Bond price)	—	—	−.114	−.100		—
			(.096)	(.103)		
Ln(DJIA)	—	—	−.225	−.228*		—
			(.14)	(.138)		
Ln(NASDAQ index)	—	—	.120**	−.115*		—
			(.06)	(.060)		
Amount of coverage ($ millions)	.20646****	.136****	.066*	.064*	.056	.049
	(.050)	(.055)	(.036)	(.036)	(.036)	(.036)
Year	—	—	.054****	.054****	—	—
			(.013)	(.013)		
$N = 2{,}713$						
Adjusted R-squared	.295	.313	.708	.708	.714	.714
State fixed effects	No	No	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No	Yes	Yes

Note: Marginal effects for dichotomous variables require Halverson-Palmquist correction: $(e^b - 1)$. Standard errors are in parentheses.
[a] Models with caps as continuous variables.
[b] Models with caps as levels in dichotomous variables.
* $p < .10$.
** $p < .05$.
*** $p < .01$.
**** $p < .001$.

higher, particularly for the high quality stocks represented in the Dow Jones industrial average. The effects are less robust for the Nasdaq index and are never significant for bond prices. This makes sense intuitively; when investment returns are high, firms have income over and above collected premiums and would be expected to keep premiums low in a competitive market.

Table 7. Endogeneity test (dependent variable: log of OB/GYN premiums)

Damage caps	Coef.	Std. Err.	t	$P > t$
1 year lead	.010	.051	.19	.846
2 year lead	−.034	.055	−.63	.532
3 year lead	−.055	.054	−1.00	.315
4 year lead	.014	.054	.26	.794
5 year lead	.048	.041	1.17	.243

However, relaxing the year-level fixed-effects, as was necessary for this analysis, means that unobserved factors could be influencing both equity returns and malpractice premiums.

The findings with respect to other tort provisions are less convincing. Imposing a firm statute of repose—a firm time limit for bringing a claim—can reduce premiums by as much as 25%, assuming the period is approximately the 5-year average among states with such statutes. In some states, however, statutes of repose have been found unconstitutional. Other attempts at tort reform appear to have no effect on premiums, and some may even be counterproductive. The findings that increasing the length of the statute of limitations decreases premiums and that mandatory collateral source offsets increase premiums appear to be artifacts of the timing of these laws in a small handful of states. It is likely that these measures were simply ineffective rather than causing a rise in premiums. No other tort reforms had any significant effect.

An important limitation of this study directly concerns the findings on tort reforms other than damage caps. Because there were no changes in law during our time frame for limits on attorney fees, res ipsa loquitor, and pre-trial screening procedures, each of these factors had to be dropped from the analysis. The few changes made in other reforms was also problematic, particularly for collateral source rules, statutes of limitations, limits on expert testimony, and provisions for arbitration of malpractice claims. We attempted to aggregate tort reforms as has been done in other studies (creating an indicator any indirect reforms in effect), but this aggregate indicator exhibited less change than did many of the individual laws we used in our analyses. It should be noted that studies of time periods where there was greater variation in the laws, due to legislative activity, no significant effects were found for most indirect changes in the law compared with directly capping awards.

Another limitation is that the fixed-effects specification only controls for unobserved state-level characteristics that do not vary over time. Unobserved factors within states that vary over time these could bias our estimates. To some extent, this is ameliorated by the year-level fixed effects, which control for unobserved secular characteristics. Therefore, the concern is greater when evaluating the findings for the investment returns that required relaxing the year fixed effects. Some of the null findings with respect to changes in tort law can be attributed to a lack of observed change over time—no states changed their laws with regard to pretrial screening or limits on attorneys' fees during the period studied.

Policymakers must determine whether the savings in premiums justify imposing those costs. The $1.4 billion annual savings that could be obtained from imposing additional or stricter caps represents 8% of total premiums paid. Those savings would come at the expense of plaintiffs. There is, however, evidence that malpractice suits do not correlate well with negligently inflicted harm (Brennan, Sox, and Burstin 1996). Further research is also needed to determine whether tort reforms can affect other health care costs through the practice of "defensive" medicine—where clinically inappropriate tests and procedures are used because of concerns over liability.

References

Americans for Insurance Reform (AIR). (2004). *Insurers Continue to Price-Gouge Doctors Despite Dropping Medical Malpractice Payouts.* (October 12). Available at: www.centerjd.org/air/pr/stablelosses2004rel.pdf. accessed June 16, 2005.

American Medical Association (AMA). (1998). *Socioeconomic Characteristics of Medical Practice. 1983–1997/98.* Chicago: AMA, Center for Health Policy Research.

——— (AMA). (2000). *Physician Socioeconomic Statistics,* 1999–2000 ed. Chicago: AMA, Center for Health Policy Research.

Blackmon, G. and R. Zeckhauser. (1990). The Effect of State Tort Reform Legislation on Liability Insurance Losses and Premiums. Working paper,

Cambridge, Mass: Harvard University, Kennedy School of Government.

Brennan, T.A., C.M. Sox, and H.R. Burstin. 1996. Relation Between Negligent Adverse Events and the Outcomes of Medical Malpractice Litigation. *New England Journal of Medicine* 335(26): 1963–1967.

Bureau of Labor Statistics (BLS). (2005). *Consumer Price Indices,* available at: www.bls.gov/cpi/home.html; accessed April 21, 2005.

California Civil Code. (2005). Article Two: Damages for Wrongs. §3333.2.

Centers for Medicare and Medicaid Services (CMS). (2003). *CMS Data Users Reference Guide (DURG)*, available at: http://cms.hhs.gov/data/durg/glossary.pdf, accessed August 11, 2003. Also, RBRVS.com, available at: http://www.rbrvs.com/History.htm, accessed August 11, 2003.

Danzon, P.M. (1985). *Medical Malpractice: Theory, Evidence and Public Policy*. Cambridge, Mass: Harvard University Press.

———. (2000). Liability for Medical Malpractice, A.J. Culyer and J.P. Newhouse, eds. In *Handbook of Health Economics*, vol. 1B, Amsterdam: Elsevier.

Danzon, P.M., A.J. Epstein, and S.J. Johnson. (2004). The "crisis" in medical malpractice insurance. Working paper, Philadelphia: University of Pennsylvania, Wharton School.

Financial Forecast Center. (2005). *10-Year Treasury Constant Maturity Rate*. Available at: http://forecasts.org/data/data/GS10.htm. accessed March 2, 2005.

General Accounting Office (GAO). (2003). *Medical Malpractice Insurance: Multiple Factors Have Contributed to Increased Premium Rates*, Report GAO-03-702. Washington, D.C.: GAO.

Gius, M.P. (1998). Using Panel Data to Estimate the Determinants of Medical Malpractice Insurance Premiums. *Applied Economics Letters* 5:37–39.

Halvorsen, R. and R. Palmquist. (1980). The Interpretation of Dummy Variables in Semilogarithmic Equations, *American Economic Review* 70: 474–475.

Kessler, D.P. and M. McClellan. (1997). The Effects of Malpractice Pressure and Liability Reforms on Physicians' Perceptions of Medical Care, *Law and Contemporary Problems* 60:81–106.

Localio, A.R., A.G. Lawthers, T.A. Brennan, N.M. Laird, L.E. Hebert, L.M. Peterson, J.P. Newhouse, P.C. Weiler, and H.H. Hiatt. (1991). Relation between Malpractice Claims and Adverse Events Due to Negligence. Results of the Harvard Medical Practice Study. *New England Journal of Medicine* 325:245–251.

Madigan, E. (2003). Medical Malpractice Reform High on States' Agenda, Stateline.org. available at: www.stateline.org/live/viewpage.action?sitenodeid=136&languageid=1&contentid=15331. accessed June 16, 2005.

McCullough, Campbell & Lane (2003). *Summary of Medical Malpractice Law*. Available at: http://www.mcandl.com/introduction.html. accessed June 16, 2005.

Medical Liability Monitor (MLM). (2005). Rate Survey Issues 1991–2004. Chicago: MLM. Available at: www.medicalliabilitymonitor.com. accessed June 16, 2005.

Nelson, L.J., M.L. Kilgore, and M.A. Morrisey. (2006). Damage Caps in Medical Malpractice Cases. Working paper: University of Alabama at Birmingham, Lister Hill Center for Health Policy.

Palmisano, D.J. (2005). *The Medical Liability Crisis: How It Affects Patient Care and Health Care Costs*. Available at: www.ama-assn.org/ama/pub/category/14841.html. Accessed June 16, 2005.

Sloan, F.A. (1985). State Responses to the Malpractice Insurance "Crisis" of the 1970s: An Empirical Assessment. *Journal of Health Politics, Policy and Law* 9(4): 629–646.

Sloan, F.A., R.R. Bovbjerg, and P.B. Githerns. (1991). *Insuring Medical Malpractice*. New York: Oxford University Press.

Thorpe, K.E. (2004). The Medical Malpractice "Crisis": Recent Trends and the Impact of State Tort Reforms, *Health Affairs* – Web Exclusive W4:20–30.

Treaster, J.B. and J. Brinkley. (2005). Behind those Medical Malpractice Rates, *New York Times* (February 22). Available at: http://www.nytimes.com/2005/02/22/business/22insure.html?ex=1153540800&en=ea8b99f2e25cf114&ei=5070. Accessed July 20, 2006.

U.S. Department of Health and Human Services (DHHS). (2002a). *Confronting the New Health Care Crisis: Improving Health Care Quality and Lowering Costs by Fixing Our Medical Liability System.* (July 24). Washington, D.C.: DHHS.

———. (2002b). *Special Update on Medical Liability Crisis*. (September 25). Washington, D.C.: DHHS.

———. (2003). *Area Resource File (ARF)*. (February) Rockville, Md: Health Resources and Services Administration, Bureau of Health Professions. Washington, D.C.: DHHS.

Viscusi, W.K. and P.H. Born. (1995). Medical Malpractice Insurance in the Wake of Liability Reform. *Journal of Legal Studies* 24:463–490.

———. (2004). Damages Caps, Insurability, and the Performance of Medical Malpractice Insurance. Working paper: Cambridge, Mass.: Harvard University, John M. Olin Center for Law, Economics and Business.

Viscusi, W.K., R.J. Zeckhauser, P. Born, and G. Blackmon. (1993). The Effects of 1980s Tort Reform Legislation on General Liability and Medical Malpractice Insurance. *Journal of Risk and Uncertainty* 6:165–186.

Weiss, M.D., M. Gannon and S. Eakins. (2003). *Medical Malpractice Caps: The Impact of Non-Economic Damage Caps on Physician Premiums, Claims Payout Levels, and Availability of*

Coverage. (June 3). Palm Beach Gardens, FL: Weiss Ratings, Inc. Available at: http://www.weissratings.com/MedicalMalpractice.pdf. Accessed June 16, 2005.

White House. (2005). *Medical Liability: A Framework for Addressing the Medical Liability Crisis*. Available at: www.whitehouse.gov/infocus/medical/biability/. accessed June 16, 2005.

Yahoo! Finance. (2005). *Dow Jones Industrial Average and NASDAQ Index Trends*. Available at: http://finance.yahoo.com. Accessed March 2, 2005.

Zuckerman, S., R.R. Bovbjerg, and R. Sloan. (1990). Effects of Tort Reforms and Other Factors on Medical Malpractice Insurance Premiums, *Inquiry* 27(Summer): 167–82.