Do Tort Liability Reforms Affect Trends in Medical Malpractice Insurance Market Conditions?

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Abstract

In this paper, we examine the extent to which reforms to the tort liability system alter trends in medical malpractice insurance market conditions. Our research is motivated by the fact that, while policy discussions and academic research pertaining to the merits of tort reforms often center on *ex post* effects, it is unclear whether deteriorating medical malpractice insurance markets conditions are, in fact, turned around by the enactment of a tort reform. Our analysis of tort reforms in the mid-2000s finds little evidence that state-level medical malpractice insurance losses incurred, premiums earned, or incurred loss ratios were increasing in the years prior to the enactment of various tort reforms, casting doubt on policy makers claims that tort reforms were needed to mitigate a crisis in the medical malpractice insurance market. Further, we find little evidence that tort reforms led to improvements in otherwise deteriorating medical malpractice insurance market conditions. Our conclusion is that, while the most recent round of tort reforms may have lowered levels of medical malpractice insurance losses incurred and improved insurer profitability, these reforms were generally not responsible for mitigating a medical malpractice insurance "crisis."

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1. Introduction

Medical malpractice insurance markets have experienced several hard markets over the past 40 years characterized by rapid declines in insurer profits, increases in the cost of medical malpractice insurance premiums, and decreases in the availability of professional liability coverage for medical providers. During this same time period medical malpractice markets experienced significant amounts of regulatory intervention, the most notable of which were the several "rounds" of tort liability reform measures enacted between the mid-1970s through the mid-2000s. Policymakers argued that these reforms were necessary to reverse deteriorating conditions in the medical malpractice insurance market and avert a "crisis." For example, Texas Governor Risk Perry stated that the tort reforms he helped enact in 2004 were necessary because physicians needed "relief from spiraling malpractice insurance premiums as soon as possible" (Texas Medical Association, 2003).

In support of their assertion that tort reforming activities avert crises in the medical malpractice insurance market, policymakers in favor of tort reforms often point to *ex post* effects of the reforms. Governor Perry, for example, stated that as a result of the Texas reform efforts "doctors are getting immediate relief because the Texas Medical Liability Trust has already announced a 12-percent rate reduction" (Texas Medical Association, 2003). Governor Perry's and other tort reform proponents' assertion that medical malpractice insurance market conditions become more favorable following the enactment of tort reforms is also consistent with many academic studies. In particular, these studies find that, following the enactment of tort reforms, medical malpractice insurers incur fewer losses and charge lower premiums (e.g. Viscusi and Born, 2005; Born, Viscusi, and Baker, 2009; Grace and Leverty, 2013).

It is important to note, however, that observing improved conditions in the medical malpractice insurance marketplace following tort reforms does not necessarily indicate that reforms caused a deteriorating marketplace to start improving. This is a subtle but important point that is often overlooked in policy debates on the merits of tort reform. For example, finding evidence that mean levels of losses

incurred by medical malpractice insurance firms decreased following the enactment of reforms does not indicate that losses incurred were increasing before the reform. Losses could have been stagnant or, alternatively, losses incurred could have been declining before the reform and the rate of decline in losses may have simply increased due to the reform. Thus, *ex post* improvements in the marketplace don't necessarily justify certain policymakers' assertions that tort reforms avert a crisis and reverse a deteriorating trend in marketplace conditions. Rather, *ex ante* evidence is necessary to provide a complete picture on the merits of tort reforming activities.

Our paper therefore explores trends in marketplace conditions before and after tort reforms in order to understand whether reforms averted a crisis by reversing deteriorating marketplace conditions. The particular sample for our study is the subset of "hold out" states that enacted tort liability reforms during the most recent round of reform activity that occurred in the mid-2000s. These states are particularly interesting because they would have had the opportunity to reflect on the experience of states that had enacted reforms in prior years, beginning with California in 1975 and a host of states in the mid-1980s. For whatever reason, these states chose not to "jump on the bandwagon" until more recently, suggesting perhaps that market conditions had finally warranted consideration of reform.

Using state-level data from the National Association of Insurance Commissioners (NAIC) from 1997 – 2010, we examine the extent to which trends in medical malpractice losses incurred, premiums earned, and incurred loss ratios changed in these hold out states following the enactment of tort reforms. Our most robust finding is that medical malpractice insurance market conditions were not deteriorating in the years leading up to the enactment of caps on noneconomic damages. That is, prior to the enactment of the reform, there did not appear to be a crisis characterized by rapid increases in losses incurred and the cost of insurance. We do find that state-wide losses incurred (incurred loss ratios) declined by an average of 7.6 percent (4.4 percent) in each year following the enactment of caps on noneconomic damages. However, this downward trend in loss levels following noneconomic damage reforms is not statistically different from the trend that existed before the reforms. Our findings therefore cast doubt on claims that caps on noneconomic damages pull markets out of medical malpractice insurance "crises."

Our analysis does find weaker evidence that joint and several liability reforms were helpful in controlling premium levels, which increased at a rate of approximately 8.1 percent per year before the reform and stopped increasing after the reform. These reforms also led to average annual reductions in state-wide losses incurred (incurred loss ratios) in the magnitude of approximately 6.2 percent (4.3 percent). However, we find no evidence that joint and several liability reforms led an otherwise deteriorating medical malpractice insurance market to start improving. Further, we find little evidence that medical malpractice insurance markets were deteriorating prior to states enacting caps on punitive damages and reforming collateral source rules. We also find no evidence that these two reforms provided relief to a crisis that occurred in the market.

Acknowledging that tort reforms may be warranted by, or reverse trends in, market conditions outside of medical malpractice insurance markets, we examine how trends in court cases, physician supply, and healthcare expenditures changed before and after reforms. We do find weak evidence that tort reforms had a positive impact on these marketplace trends, though the magnitude of the impact is negligible. The most economically and statistically significant is that civil caseloads appear to have increased by approximately 3.8 percent per year in the years prior to states placing caps on punitive damages and then decreased at a rate of approximately 3.4 percent per year following the reform. However, we find no other evidence that any crises in physician supply, civil caseloads, and healthcare expenditures was averted by tort reforms.

The importance of our research is highlighted by the fact that many policy debates on the merits of tort reforms are based on theoretical and empirical evidence regarding the *ex post* effects of these reforms. Far fewer of these policy debates, however, address whether the markets that enacted reforms were in need of stabilizing in the first place. Our results suggest that, in the hold out states we studied, market conditions in medical malpractice insurance markets were not deteriorating and did not appear to need stabilizing. Furthermore, tort reforms do not appear to significantly change trends in medical malpractice market conditions. Thus our study casts doubt on the claims that tort reforms are an effective method of addressing crises in the medical malpractice insurance market. We therefore hope that the

evidence presented in this study helps inform policymakers and shape future public policies related to reforming medical malpractice insurance markets.

We organize the remainder of the paper as follows. The next section provides background on tort reforms and the studies that examine their influence on insurance markets. We then discuss our sample and methods in section 3. In the ensuing section, we discuss our results and in section 5, we provide concluding remarks.

2. Background

Since the early 1970s, the medical malpractice market has experienced several "hard" markets or "crises" characterized by dramatic increases in the price of medical malpractice insurance and dramatic reductions in the availability of coverage. Market conditions during these times are thought to have a variety of negative economic consequences, especially as it relates to the costs associated with healthcare delivery. As a result, policymakers responded by instituting measures designed to stabilize medical malpractice insurance markets, the most notable of which were reforms to the tort liability system. The intended purpose of these tort reforms measures is to reduce the cost of tort litigation and damages by, for example, placing limits on the amount of non-economic damages recoverable, limiting attorneys' contingency fees, modifying the joint and several liability doctrines, or restricting the amount of punitive damages recoverable. States enacted these reforms in four "rounds" which occurred in the mid-1970s, the mid-1980s, the late 1990s and the mid-2000s.

While the majority of states instituted some measure of reform in the past 40 years, there is considerable heterogeneity in reforming activity in terms of when states elected to reform and what particular reforms were enacted. This observation motivated researchers to consider the factors that lead states to enact tort reform measures. While there does not appear to be a general consensus in the literature on the subject, one theory is that special interest groups, such as lawyers, physicians, or insurance firms, influence the legislative process in ways that result in the enactment of regulations and reforms (e.g. Stigler, 1971; Peltzman, 1989). Another theory posits that compassionate legislatures identify failures in the marketplace and enact reforms that improve the social welfare of constituents (e.g.

Joskow and Noll, 1981). Still others (e.g. Dixit, 1996; Berry, 1998) suggest that political factors, such as the actions of partisan politicians or the political ideology of citizens, influence the legislative process in ways that drive tort reform. As noted earlier, empirical research on this subject is sparse. One recent study by Deng and Zanjani (2014) suggests that the level of litigation activity in the state is a strong driver, as is the party in control of the legislature. However, the influence of interest groups does not seem to be a significant driver of tort reform.

Though less is known regarding what motivated states to enacted tort liability reforms, there is considerable evidence pertaining to the ultimate effects of tort reforms on various participants in the medical malpractice market. A subset of literature provides evidence that tort liability reforms have non-trivial consequences for the dispensation of medical malpractice claims by, for example, speeding up the litigation process (e.g. Friedson and Kniesner, 2012). Another particularly well developed area of this literature also considers the influence of tort reform measures on physician behavior and healthcare costs, though evidence on the subject is mixed. For example, some studies find that tort reforms influence physician behavior in ways that reduce healthcare costs (e.g. Kessler and McClellan, 1996), increase healthcare costs (e.g. Born, Karl, and Viscusi, 2015), or have no influence on healthcare costs (e.g. Sloan and Shadle, 2009). Of note is that many of these studies focus their analysis on the effects of reforms that cap non-economic damage.

As it relates specifically to medical malpractice insurers, there is considerable evidence in the literature that tort reforms have the effect of reducing incurred losses. For example, many studies find that tort reforms reduce the level of incurred medical malpractice losses and loss ratios (e.g. Barker, 1992; Born and Viscusi, 1998; Viscusi and Born, 2005). Similarly, Born, Viscusi, and Baker (2009) find that tort reforms reduce the levels of developed medical malpractice losses incurred by insurers. Born and Neale (2013) find evidence that non-economic damage caps set under $250,000 are more effective at reducing medical malpractice losses incurred by insurers than caps above that amount. In addition, the analysis of Grace and Leverty (2013) indicates that reforms that were eventually declared unconstitutional had little effect on insurer losses but reforms that were unchallenged or upheld in court served to reduce

the level of losses incurred by medical malpractice insurers. These and similar studies also suggests that

caps on non-economic damages have the most influential effect on levels of medical malpractice

insurance losses incurred.

The post-reform economic consequences of tort reform that are detailed in the literature represent

a valuable resource for public policy discussion pertaining to the merits of tort reform legislation.

However, it is important to note that *ex ante* motivations of special interest groups, benevolent legislators,

or other parties responsible for driving tort reform are not necessarily required to be consistent with *ex*

post effects on the market. For example, a political party may gain control of a legislature in a state with a

healthy medical malpractice market but may still enact tort reforms due to the political agenda of the

party. Even if the reforms in this example had the desirable effect of, for example, improving the

profitability of medical malpractice insurers, it would be difficult to argue that the reforms had a

stabilizing effect on the market or averted a crisis. The distinction becomes more important when one

considers that there are costs associated with tort liability reforms.[1] To the extent that the expected

benefits of reforms are associated with potential costs, understanding whether trends in the marketplace

warranted reforms in the first place becomes an important component of policy discussions.

Another drawback of gleaning policy inferences on the effects of tort reform from *ex post*

evidence is that it does not shed light on whether tort reforms actually "turn the market around" and

improve deteriorating conditions. Frequently, reforms to the tort liability system are proposed by

policymakers as a way to mitigate a crisis in the medical malpractice insurance market. However, it is not

clear from the evidence in the literature that the impact of tort reforms is substantial enough to mitigate a

crisis. Rather, prior studies (e.g. Grace and Leverty, 2013; Born and Neale, 2013; Born et al., 2009,

Viscusi and Born, 2005) merely suggest that mean levels of medical malpractice insurance losses incurred

and incurred loss ratios decline following the enactment of reforms. Since these studies do not specifically

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[1] For example, Friedson and Kneiesner (2012) find evidence that the economic cost of tort reforms to injured parties is large and that claimants would prefer the medical malpractice tort system in place before the enactment of reforms. In particular, they find evidence that damage caps act as a 25% tax on settlements.

examine whether market conditions before the reforms were deteriorating, it is not clear that tort reforms averted any crises. As such, juxtaposing *ex ante* evidence with *ex post* on the effects of reforms on market trends provides a clearer picture of whether tort reforms are responsible for mitigating crises in medical malpractice insurance markets, as is often asserted in policy discussions of tort reforms.

3. Discussion of Sample and Methods

Similar to prior studies (e.g. Viscusi, 1990; Viscusi et al. 1993; Grace and Leverty, 2013), we perform our analysis of medical malpractice insurance markets at the state-level and we utilize data from various sources to compile a dataset of state-year observations from 1997 through 2010. Data pertaining to the tort reform liability activities of a given state are obtained from Ronen Avraham's database and confirmed with information available on the website of the American Tort Reform Association (ATRA). From this database, we identify the years that states enacted caps on noneconomic damages (*NE*), enacted caps on punitive damages (*PD*), reformed collateral source rules (*CSR*), and modified joint and several liability rules (*JS*).[2] Our econometric analysis focuses on the effects of these four reforms because they are the ones most frequently considered in prior studies of medical malpractice insurance markets (e.g. Grace and Leverty, 2013; Born and Neale, 2013; Born, Viscusi, and Baker, 2009; Viscusi and Born, 2005).

The specific medical malpractice insurance market conditions of interest in this study are the medical malpractice losses incurred and premiums earned by insurers. We obtain these data from the state pages (Schedule T) of insurer filings with the National Association of Insurance Commissioners (NAIC). After applying filters to remove non-logical values (e.g. negative or missing values for premiums and

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[2] Caps on noneconomic damages place limits on amounts awarded to injured parties for pain and suffering, emotional distress, loss of consortium, and similar non-pecuniary losses. Punitive damage caps limit the amount that defendants are required to pay as a result of intentional or malicious conduct. Collateral source reforms place restrictions on the sources from which plaintiffs can collect awards. Joint and several liability reforms place restrictions on the assignment of liability to two or more parties that are potentially liable for a tort and require each guilty party to pay damages commensurate with their level of responsibility for the tort. For more detailed discussion of specific tort liability reforms in insurance markets, see, for example, Grace and Leverty (2013) and Viscusi and Born (2005).

losses), we collapse the firm-state-year observations by state to arrive at a state-level value of medical malpractice insurance losses incurred (*Losses*) by all insurers in a given state during a given year. We perform the same collapse to arrive at a state-level value for medical malpractice insurance premiums earned (*Premiums*).

We also follow a growing literature that specifically accounts for the long-tailed nature of medical malpractice liability claims (e.g. Grace and Leverty, 2013; Born, et al., 2009) and calculate the present value of losses incurred in a given state during a given year.[3] Specifically, we apply the Taylor separation method (Taylor, 2000) to data from Schedule P of the NAIC annual statements to estimate the payout proportions of medical malpractice insurance. This allows us to discount the estimated future medical malpractice insurance loss payments using U.S. Treasury yields and arrive at the present value of medical malpractice insurance losses incurred (*Present Value of Losses*) in a given state, during a given year. Our method for calculating the present value of medical malpractice losses incurred is analogous to Grace and Leverty (2013) and is similar to a method approved by the Internal Revenue Service (IRS) for tax purposes (Cummins, 1990). Utilizing *Present Value of Losses* also allows us to follow prior studies (e.g. Grace and Leverty, 2013) and calculate the *Economic Loss Ratio*, which is defined as *Present Value of Losses* divided by *Premiums*.

Our econometric models also include several additional state-level demographic variables that serve as controls. First, we collect data pertaining to the population, income, educational attainment, the number of females, and the number of physicians in a given state during a given year from the *U.S. Census Bureau*. With these data, we calculate *Income Per Capita*, *Educational Attainment*, *Females Per Capita*, and *Physicians Per Capita*. We then gather the number of lawyers from the *American Bar Association* and calculate *Lawyers Per Capita*. We also obtain the *Citizen Ideology Index*, developed by Berry et al. (1998), to capture the political ideology of a given state's population in a given year. The

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[3] In unreported analysis, we find that the use of undiscounted losses incurred does not qualitatively change the analysis presented in this paper.

index, which is the same as that used in Grace and Leverty (2013), is a continuous variable, bounded by 0 and 1, where a value of 0 (1) indicates the states representatives are conservative (liberal).

Finally, we combine all the data from the various sources to create a panel dataset that consists of 700 state-year observations. Our sample includes data pertaining to all 50 states for the years 1997 – 2010. Summary statistics are provide in Table 1. More detail on the sources, construction, and definitions of all variables used in our analysis is found in Appendix 1.

Our sample period is similar to those examined in prior studies of tort reforms in medical malpractice insurance markets (e.g. Born and Neale, 2013). The period is characterized by significant amounts of reforming activity during the most recent "round" of tort reforms. As given in Table 2, 15 states enacted at least one of the four categories of reforms considered in this paper. The most frequent reforms enacted by states during our sample period are caps on noneconomic damages and nine states enacted a cap between 1997 and 2010. Four states enacted caps on punitive damages and four additional states reformed collateral sources rules. We also observe that five states enacted reforms to joint and several liability rules during our sample period. As it is characterized by numerous reforms to the tort liability system, our sample period therefore provides an excellent opportunity to examine tort reform proponents' claims' that tort reforms mitigate adverse or deteriorating conditions in the medical malpractice insurance.

Figure 1 provides additional information on malpractice insurance market trends during our sample period. It plots the average *Economic Loss Ratio*, across all states, over each year of our sample period, and helps to provide preliminary perspective on medical malpractice market conditions. Consistent with prior studies (e.g. Neal, Eastman, and Drake, 2009), Figure 1 indicates that the county-wide *Economic Loss Ratio* was increasing in the first part of our sample, suggesting that insurance marketplace conditions were deteriorating from 1997 – 2001. These conditions then improved in the later part of our sample period and we find that the country-wide *Economic Loss Ratio* generally declined from 2002 – 2010.

In Figure 1, we also include information regarding the number of states that enacted a reform in a given year. Interestingly, these figure suggests that the majority of reforming activity undertaken by states

did not occur until after market conditions began to improve. The most striking evidence is gleaned from the plot of noneconomic damage reforms against *Economic Loss Ratio*. None of the nine states that placed caps on noneconomic damages during our sample period did so before the market began to soften. In fact, the first noneconomic damage cap reforming activity began in 2003, which is two years after the market trends appear to have changed. The plots of other types of reforming activities provide a similar picture and, as a whole, do not lend support to the notion that tort reforming activities are responsible for mitigating malpractice insurance crises by reversing trends in the marketplace.

Our econometric models explore the trends given in Figure 1 in more detail. We are particularly interested in assessing the extent to which tort reforms alter *trends* in the medical malpractice marketplace relating to premiums, losses, and insurer profitability. Our research interest represents a significant departure from prior studies (e.g. Grace and Leverty, 2013; Born and Neale, 2013; Born et al., 2009, Viscusi and Born, 2005) that generally examine the average effect of tort reforms on malpractice market conditions after the reform is in existence. While the distinction between our research interest and that of prior studies may appear subtle, it is important because methods used in prior studies are unable to shed light on the extent to which reforms were responsible for improving deteriorating market conditions. Rather, they can only conclude that the average medical malpractice insurer incurs fewer losses and has lower incurred loss ratios following tort reforms, particularly as it pertains to caps on noneconomic damages.

We therefore follow a method used in the regulatory economic literature (e.g. Hoyt, Powell, and Mustard, 2006; Plassman and Whitely, 2003; Mustard, 2001) that specifically estimates the before and after trends in market conditions surrounding a given law. The models we estimate take the general form of:

$$Y_{it} = \alpha + \sum_{j=1}^{4} \beta_j \, REFORMSBEFORE_{ijt} + \sum_{j=1}^{4} \gamma_j \, REFORMSAFTER_{ijt} \qquad 1)$$

$$+ \eta' F_{it} + \sum_{t=1997}^{2010} \tau_t \, T_t + \sum_{i=1}^{50} \delta_i \, S_i + \varepsilon_{it}$$

The variable *Y* is a measure of medical malpractice insurance market conditions in state *i* in year *t* and the specific measure differs depending on the chosen specification. Since most of the relevant prior studies (e.g. Grace and Leverty, 2013; Born and Neale, 2013; Born et al., 2009, Viscusi and Born, 2005) examine loss levels, premium levels, and insurer profitability (i.e. loss ratios), we follow suit. Our measure of loss levels is the natural logarithm of *Present Value of Losses*. Our measure of premium levels is the natural logarithm of *Premiums*. Finally, our measure of insurer profitability is the natural logarithm of *Economic Loss Ratio*.

 REFORMSBEFORE and *REFORMSAFTER* are the variables of interest in our analysis. For each of the four tort reforms we consider, *REFORMSBEFORE* is a time trend that tracks the years preceding the enactment of reform *j* in state *i*. Similarly, *REFORMSAFTER* is a time trend that tracks the years following the enactment reform *j* in state *i*. For illustration purposes, Table 3 depicts the two variables as it specifically relates to the enactment of caps on noneconomic damages in Texas in 2004. For comparison purposes, the table also depicts the variable traditionally used in prior studies to evaluate the influence of caps on noneconomic damages. The coefficient estimates on *REFORMSBEFORE* (*REFORMSAFTER*) are interpreted as the rate of change in medical malpractice insurance premiums/losses/profitability before (after) a given reform is enacted in state *i*. As such, examining these coefficients allows us to comment on the extent to which market conditions were deteriorating before a reform and then improved after a reform

 Specifying our model with *REFORMSBEFORE* and *REFORMSAFTER* included also allows us to directly test whether the enactment of a reform actually changed a trend in the medical malpractice insurance market. This is accomplished by performing an F-test of the coefficients on *REFORMSBEFORE* and *REFORMSAFTER* for a given reform. If, for example, the enactment of a cap on noneconomic damages reversed a trend of increasing *Present Value of Losses*, the F-test would indicate that the positive coefficient on *REFORMSBEFORE* for noneconomic damage caps is significantly different than the negative coefficient on *REFORMSAFTER* for noneconomic damage caps. This method is analogous to that used in prior studies of the effects of law changes (e.g. Hoyt, et al., 2006)

As denoted by *F* in equation 1, our model also includes a vector of additional covariates that serve as controls. The specific variables included in *F* are *Income Per Capita*, *Educational Attainment*, *Females Per Capita*, *Physicians Per Capita*, *Lawyers Per Capita*, and *Citizen Ideology Index*. These variables were chosen with the aid of relevant, prior studies (e.g. Born, Karl, and Viscusi, 2015; Grace and Leverty, 2013; Born et al., 2009, Viscusi and Born, 2005; Danzon, 1982) and more information regarding their construction can be found in Appendix A. For all variables except *Lawyers Per Capita* and *Citizen Ideology Index*, we expect a positive relation with *Present Value of Losses, Premiums*, and *Economic Loss Ratio*. [4] While we expect *Lawyers Per Capita* and *Citizen Ideology Index* to have a non-trivial influence on *Present Value of Losses, Premiums*, and *Economic Loss Ratio*, the direction of the effect is ambiguous.

We also estimate the model with state effects (δ_i) and year fixed effects (τ_t), which control for unobserved factors, unrelated to tort reforming activities, that could affect *Present Value of Losses*, *Premiums*, and *Economic Loss Ratio*. More specifically, state (year) effects absorb differences across states (time) and imply that within state (year) variation is examined. Finally, ε is an error term and the model is estimated with robust standard error and clustering at the state-level.

4. Results

4.1 Present Value of Losses

Table 4 displays the results of estimating equation 1 when the dependent variable is the natural logarithm of *Present Value of Losses*. To avoid multicolinearity concerns, we estimate four models where

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[4] Since malpractice awards partially reflect lost income potential, we expect *Income Per Capita* and *Educational Attainment* to be positively related to premium and loss levels in medical malpractice insurance markets. *Females Per Capita* will also likely be positively associated with medical malpractice premiums and losses due to the fact that large awards are associated with malpractice incidents involving child delivery. We expect a positive relation between *Physicians Per Capita* because as the number of physicians in a state increases, so would the frequency of medical malpractice filings. As the number of lawyers in a state increases, the number of lawsuits likely increase but the cost of legal services likely decrease. As such, the predicted relationship of *Lawyers Per Capita* and medical malpractice premium and loss levels is ambiguous. Finally, *Citizen Ideology Index* controls for the fact that the political ideology of a state likely influences a variety of regulatory and/or judicial processes related to the frequency/size of medical malpractice awards. However, the net effect of political ideology on medical malpractice premiums and losses is unclear and we are unable to formulate an expectation regarding *Citizen Ideology Index*.

trends from a single reform are included (columns 1 – 4). We also estimate a model that includes before

and after trends of all four reform types (column 5). Discussions of results in most prior studies center on

models estimated with all reforms types in a single model. Similarly, we focus our discussion on the

results given in column 5 of the table and, where relevant, comment on the results of the single reform

models.

Turning first to the results of the noneconomic damage cap trends, we find evidence that state-

wide loss levels were decreasing both before and after states enacted caps on noneconomic damages. The

statistically significant before trend coefficient estimate on noneconomic damage caps indicates that

Present Value of Losses in reforming states was decreasing by approximately 4.6 percent, on average, in

each year leading up to the reform. This finding is not consistent with the notion that market conditions

were deteriorating in the years prior to states' enactments of noneconomic damage caps. Rather, it

suggests that market conditions were improving in that insurers were incurring fewer losses in each of the

years leading up to the reform. However, this result appears to be contingent on controlling for trends of

other reform types, as the coefficient is not statistically significant in the single reform model (column 1).

When we examine the after trend coefficient on noneconomic damages, we find that it is also

negative and statistically significant, suggesting that losses continued to decline in each year following

the enactment of the reform. The magnitude of the coefficient indicates that *Present Value of Losses*

declined, on average, by approximately 7.6 percent in each year following the reform. This is consistent

with prior studies of the *ex post* effects of tort reform that suggest caps on noneconomic damages result in

lower levels of losses incurred by medical malpractice insurers. As such, our evidence does not conflict

with the contentions of certain policymakers that, following the enactment of noneconomic damage caps,

insurers' loss pay-outs are reduced.

However, our evidence does conflict with the assertion that noneconomic damage caps mitigate a

crisis and alter trends in the marketplace. If this were the case, we would expect to observe a positive

coefficient on the before trend and a negative coefficient on the after trend. But, at least for the sample of

holdout states examined in this study, it appears that insurers were paying fewer losses in each

consecutive year leading up to, and following, the enactment of caps on noneconomic damages. Attesting to this finding is that the coefficients of the before and after noneconomic damage cap trends are not statistically different (F-statistic = .52). That is, average trends in medical malpractice insurance losses incurred were no different after the enactment of the reform relative to before the reform.

When we examine trends in *Present Value of Losses* surrounding caps on punitive damages, we find little evidence of any statistically significant trends in the marketplaces of states enacting the reform. The exception is that *Present Value of Losses* appear to have been declining at an average rate of 7.6 percent in each year leading up to the reform. This provides additional evidence that market conditions before reforms were not deteriorating but, instead, appear to have been improving. Further, F-tests of coefficients for before and after punitive damage cap trends suggest no discernable difference in pre and post reform trends (F-statistic = 2.17). As such, our results are inconsistent with the notion that caps on punitive damages reverse deteriorating market conditions.

Our results also do not provide evidence that reforming collateral source rules has any influence on trends in medical malpractice insurance losses. Neither the before trend variable nor the after trend variable have coefficients that are statistically distinguishable from zero. Thus, while levels of *Present Value of Losses* do not appear to have been increasing prior to the reform, they don't appear to have been positively affected by the reform. In addition, the F-test of the before and after trend coefficients also do not indicate a statistically significant difference (F-statistic = .20).

Of all four reforms we examine, joint and several liability reforms are the reform that provide the greatest net positive impact on loss levels. Although not statistically significant, the positive coefficient on the before trend variable does not indicate that *Present Value of Losses* was declining in the holdout states prior to reforming joint and several liability rules. The magnitude of the after trend coefficient variable, however, is statistically significant and indicates *Present Value of Losses* declined by approximately 6.2 percent per year following the reformation of joint and several liability rules. We note, though, that this evidence is slightly weakened by the fact that it is not robust to the exclusion of other types of reforms in the model (column 4, Table 4).

The results of the joint and several liability reform trend variables also suggest that the reform does, in fact, change a trend in the levels of losses incurred by medical malpractice insurers. An F-test of the coefficients rejects the null hypothesis that the before and after trends are equal at the five percent level. This indicates that joint and several liability reforms significantly altered the annual rate of change in the levels of *Present Value of Losses*. Thus, even though a reform may not have been justified (because loss levels were not trending upward) or averted a crisis, the reforms caused stagnating levels of *Present Value of Losses* to decline.

Finally, in all of the models, we find that *Physicians Per Capita* is positive and significant, which is consistent with our expectation that the frequency of medical malpractice filings increases with the number of physicians. *Educational Attainment* is also significant in all of the models, suggesting that, as expected, the earnings potential of persons with an education is reflected in malpractice award levels. No other controls are significant, suggesting that the state and year effects capture much of the variation in demographic characteristics across states.

4.2 Premiums

Table 5 displays the results of estimating equation 1 when the dependent variable is the natural logarithm of *Premiums*. For the same reasons described previously, we estimate multiple specifications but focus our discussion on the results presented in column 5 of the table. We find no evidence of statistically significant trends in *Premiums* before or after the enactment of caps on noneconomic damages, the enactment of caps on punitive damages, or reforms to the collateral source rule. This does not support the notion that pre reform markets were characterized by skyrocketing premiums that typically characterize a medical malpractice insurance crisis. The evidence also does not indicate that reforms to noneconomic damages, punitive damages, or collateral source rules had any measurable effect on the rate at which premiums changed after the reform.

Interestingly, we do find evidence that, prior to joint and several liability reforms, *Premiums* were increasing in our sample of holdout states. The magnitude of the statistically significant coefficient on the

before joint and several liability trend suggests that premiums were increasing by approximately 6.8 percent to 8.4 percent per year, on average, depending on the specification. At least in the case of premium levels, it appears that market conditions preceding joint and several liability reforms were deteriorating. Following the reform, we find no evidence of a statistically meaningful trend in *Premiums.*

The F-test of the trend coefficients help to shed more light on the effectiveness of joint and several liability reforms in mitigating adverse market conditions. For the specification that includes all reform types, the test rejects the null hypothesis that the coefficient on the before trend is equal to that of the after trend at the five percent level (F-statistic = 4.30). This supports the claim that joint and several liability reforms help to turn around a deteriorating marketplace by mitigating a trend of rising premium levels.

Consistent with expectations, we find evidence that *Physicians Per Capita* is positively related to *Premiums*. As expected, *Citizen Ideology Index* is also significantly related to levels of premiums. While we were unable to hypothesize the direction of the impact, our results suggest that states with a more politically liberal population base have higher levels of *Premiums*. Again, we expect that the state and year effect absorb much of the variability in demographic characteristics across states that impacts *Premiums*. As a result, we do not find our other controls are related to *Premiums* in a statistically significant manner.

4.3 Economic Loss Ratio

In Table 6, we present multiple specifications of our general econometric models with *Economic Loss Ratio* as the dependent variable. As given in the table, the before trend coefficient for caps on noneconomic damages is not statistically significant while the after trend coefficient is negative and statistically significant. Again, this does not suggest that a crisis, characterized by rapid declines in medical malpractice insurer profitability, was occurring before the hold out states enacted caps on noneconomic damages. Instead, the reforms appear to have resulted in a steady improvement in insurer profitability. More specifically, the point estimates on the coefficient suggest the state-wide *Economic*

Loss Ratio declined, on average, by between 3.9 percent and 4.4 percent in each year following the enactment of caps on noneconomic damages. The F-test of the coefficients confirms that the before and after trends are not statistically different (F-statistic = 2.32) and casts further doubt on claims that caps on noneconomic damages pull markets out of medical malpractice insurance crises.

Interestingly, our results indicate that *Economic Loss Ratio* was declining at a rate of around 4 percent per year in the years prior to punitive damage reforms, suggesting that market conditions were improving before the reform. However, after the reform, we observe no discernable trend in *Economic Loss Ratio*. We also find some evidence that *Economic Loss Ratio* was increasing at an average annual rate of 3.2 percent following collateral source reforms (column 5) but this result is not robust to the exclusion of other reform types (column 3). We also find no evidence of statistically different trends in *Economic Loss Ratio* before and after collateral source reforms.

When we examine joint and several liability reforms, we find further evidence that these reforms lead to improvements in market conditions following the reform. In particular, while we find no statistically significant trend in *Economic Loss Ratio* in the years leading up to the reform, we observe a negative and statistically significant trend in the years following the reform. The magnitude of this coefficient indicates *Economic Loss Ratio* declined, on average, between 3 percent and 4.3 percent per year in each year following a joint and several liability reform. While this does not suggest that trends in the medical malpractice insurance marketplace were deteriorating before the reform, it does suggest that insurer profitability improved following the reform. The F-test of the before and after trend coefficients support this supposition that post joint and several liability trends are statistically different from pre reform trends (F-statistic = 3.70). However, this result is not robust to the exclusion of other reform types in the model (as given in column 4).

4.4 Non-Insurance Market Conditions

While the focus of our paper is on medical malpractice insurance market conditions, we realize that tort reforms may help to mitigate medical malpractice related crises outside of insurance markets.

Our analysis would not be complete without providing some perspective on how trends in other market conditions changed following tort reforms. As a robustness exercise, we therefore examine trends in three market characteristics that are often discussed as benefiting from tort reforms. The first is *Physicians Per Capita*, which was defined previously. The second is *Civil Cases Per Capita*, which is the number of incoming civil cases that were filed in a given state during a given year scaled by the population. The third is *Health Care Expenditures Per Capita*, which is total healthcare expenditures in a given state in a given year, scaled by the population.

Using the natural logarithm of these measures, we estimate the same general model form as given in equation 1 except that we do not include the vector of control variables (*F*). We estimate three unique specifications that differ only by the dependent variable. The results of these models are given in Table 7.

Turning first to our measure of the supply of physicians, we find some evidence that certain reforms had a positive impact on *Physicians Per Capita*. While noneconomic damages do not have an impact on physician supply, we find evidence that *Physicians Per Capita* increased by approximately 1.1 percent per year in each year following a punitive damage reform. We also find evidence that the physician supply was decreasing in the years prior to collateral source reforms by approximately 1.2 percent per year but leveled out in the years after the reform. The only reforms to negatively impact *Physicians Per Capita* are joint and several reforms. However, our point estimate suggests the magnitude of this impact is only about .6 percent per year on average.

When we examine *Civil Cases Per Capita*, we find that the only reform to have a statistically significant impact on caseloads is reforms to punitive damages. We find that, before reforms to punitive damages, *Civil Cases Per Capita* was increasing by approximately 3.8 percent per year on average. However, following the reform, *Civil Cases Per Capita* decreased by approximately 3.4 percent per year on average. The difference in coefficients of the before trend and after trend variable is significant at the one percent level (F-statistic = 32.87), indicating that caps on punitive damages changed trends in caseloads and helped to reduce burdens placed on the tort liability system.

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Finally, we find minimal evidence that *Health Care Expenditures Per Capita* was reduced by tort reforms. In particular, average *Health Care Expenditures Per Capita* decreased by approximately .6 percent per year following reforms to collateral source rules. We also observe an average annual reduction in *Health Care Expenditures Per Capita* of .8 percent following joint and several liability reforms. Although few medical malpractice cases involve punitive damages awards, we find evidence that *Health Care Expenditures Per Capita* increased by approximately 1.1 percent per year following the enactment of caps on punitive damages.

5. Conclusion

In this paper, we examine trends in medical malpractice insurance market conditions in the years surrounding the enactment of tort reforms. Our research is motivated by the fact that policy discussions and academic research pertaining to the merits of tort reforms often center on their *ex post* effects. In particular, proponents of tort reforms often justify their position by pointing to evidence that medical malpractice insurers incur fewer losses and are more profitable in the time period following reforms to the tort liability system. What is often lost in these policy discussions, however, is whether deteriorating medical malpractice insurance markets conditions were, in fact, turned around by the enactment of a tort reform.

To shed light on this topic, we examine how tort reforms affected trends in state-level medical malpractice insurance market conditions during the most recent "round" of tort reforms that occurred between 1997 and 2010. Our analysis yields little support for the notion that tort reforms avert "crises" in the medical malpractice insurance market. We find no evidence that state-level medical malpractice insurance losses incurred, premiums earned, or incurred loss ratios were increasing in the years prior to the enactment of noneconomic damage caps. In fact, we find evidence that state-level medical malpractice insurance incurred losses were declining at a rate of 4.6 percent per year in the years leading up to the enactment of caps on noneconomic damages, suggesting that the medical malpractice insurance market had begun to improve *before* the reform. While we do find evidence that incurred loss levels, premiums,

and incurred loss ratios trended downward after the enactment of noneconomic damage caps, this trend is not statistically different from the trend that existed before the reform. This casts doubt on the assertion that caps on noneconomic damages reverse deteriorating marketplace trends and pull medical malpractice insurance markets out of a crisis.

Our analysis of other reform types and non-insurance market conditions yields conclusions similar to those drawn from the noneconomic damage cap analysis. In particular, we find little evidence that market conditions were deteriorating in the years prior to punitive damage reforms or reforms to collateral source rules and these reforms also do not appear to have significantly altered any trend in the medical malpractice insurance marketplace. While we do find some evidence that joint and several liability reforms were helpful in controlling premium levels, which increased at a rate of approximately 8.1 percent per year before the reform and stopped increasing after the reform, we find no evidence that the reform led an otherwise deteriorating medical malpractice insurance market to start improving. Further, we find little evidence that any crises in physician supply, civil caseloads, and healthcare expenditures was averted by tort reforms.

Our conclusion is that, while the most recent round of tort reforms may have lowered levels of medical malpractice insurance losses incurred and improved insurer profitability, these reforms were generally not responsible for mitigating a medical malpractice insurance crisis. Our findings therefore cast doubt on tort reforms' abilities to stabilize the medical malpractice insurance market, as is often suggested in policy discussions on the merits of tort liability reforms. To the extent that tort liability reforms may avert crises outside of medical malpractice insurance markets by, for example, reducing the costs borne by the tort liability system as a whole, our analysis does not suggest there are no benefits to tort liability reforms. Rather, our research simply suggests that tort reforms do not correct deteriorating conditions the medical malpractice insurance market.

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Table 1: Summary Statistics (N = 700)

Variable	Mean	Std. Dev.
LN(Present Value of Losses)	17.72	1.22
LN(Premiums)	18.25	1.21
Economic Loss Ratio	0.65	0.31
Lawyers Per Capita	0.31	0.11
Physicians Per Capita	0.25	0.06
Citizen Ideology Index	5.14	1.58
Income Per Capita	32.54	6.75
Educational Attainment	25.99	4.76
Females Per Capita	50.25	0.95

Table 2: Years In Which States Enacted Liability Reforms (1997 - 2010)

State	Noneconomic Damage Cap	Punitive Damage Caps	Collateral Source Reform	Joint and Several Liability Reform	
Alabama			2001		
Alaska	2006	1998			
Arkansas				2003	
Florida	2003				
Georgia	2005				
Idaho		2004			
Mississippi	2003				
Missouri		2006			
Nevada	2003			2003	
Ohio		2005		2003	
Oklahoma	2004		2004		
Pennsylvania			2002		2002
South Carolina	2006			2006	
Texas	2004				
West Virginia	2003		2003		

Table 3: Illustration of Trend Variable

Year	REFORMSBEFORE	REFORMSAFTER	Traditional Reform Variable
1997	-7	0	0
1998	-6	0	0
1999	-5	0	0
2000	-4	0	0
2001	-3	0	0
2002	-2	0	0
2003	-1	0	0
2004	0	0	1
2005	0	1	1
2006	0	2	1
2007	0	3	1
2008	0	4	1
2009	0	5	1
2010	0	6	1

Table 4: Present Value of Losses Regression Results

	(1)	(2)	(3)	(4)	(5)
Noneconomic Damages - Before Trend	-0.018				-0.045*
	[0.042]				[0.025]
Noneconomic Damages - After Trend	-0.077**				-0.073**
	[0.035]				[0.029]
Punitive Damages - Before Trend		-0.041			-0.074*
		[0.031]			[0.043]
Punitive Damages - After Trend		-0.009			0.003
		[0.030]			[0.016]
Collateral Source Rule - Before Trend			-0.012		0.006
			[0.022]		[0.029]
Collateral Source Rule - After Trend			0.000		0.023
			[0.036]		[0.032]
Joint and Several - Before Trend				0.061	0.094
				[0.057]	[0.058]
Joint and Several - After Trend				-0.048	-0.060**
				[0.036]	[0.027]
Lawyers Per Capita	0.173	0.315	0.216	0.384	0.518
	[1.263]	[1.371]	[1.359]	[1.410]	[1.412]
Physicians Per Capita	4.405*	5.161**	5.048**	5.416**	4.503*
	[2.192]	[2.402]	[2.484]	[2.456]	[2.328]
Citizen Ideology Index	0.029	0.036	0.033	0.038	0.037
	[0.041]	[0.043]	[0.047]	[0.044]	[0.043]
Income Per Capita	-0.006	0.000	0.004	0.006	-0.010
	[0.025]	[0.025]	[0.025]	[0.024]	[0.025]
Educational Attainment	0.028*	0.030*	0.031**	0.031**	0.027*
	[0.015]	[0.015]	[0.015]	[0.015]	[0.014]
Females Per Capita	0.014	0.006	0.006	0.010	0.022
	[0.035]	[0.037]	[0.037]	[0.036]	[0.037]
Constant	14.862***	14.815***	14.770***	14.377***	14.401***
	[1.994]	[2.021]	[2.058]	[1.973]	[2.137]
Observations	700	700	700	700	700
R-squared	0.923	0.920	0.920	0.921	0.926
State and Year Effects?	Yes	Yes	Yes	Yes	Yes
Clustered Standard Errors?	Yes	Yes	Yes	Yes	Yes

Robust standard errors in brackets
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5: Premiums Regression Results

	(1)	(2)	(3)	(4)	(5)
Noneconomic Damages - Before Trend	-0.007				-0.025
	[0.030]				[0.015]
Noneconomic Damages - After Trend	-0.039				-0.030
	[0.026]				[0.023]
Punitive Damages - Before Trend		0.007			-0.011
		[0.016]			[0.022]
Punitive Damages - After Trend		-0.004			0.002
		[0.023]			[0.010]
Collateral Source Rule - Before Trend			-0.009		-0.009
			[0.026]		[0.020]
Collateral Source Rule - After Trend			-0.010		-0.008
			[0.024]		[0.025]
Joint and Several - Before Trend				0.066**	0.081**
				[0.031]	[0.032]
Joint and Several - After Trend				-0.019	-0.017
				[0.025]	[0.023]
Lawyers Per Capita	0.032	0.021	0.087	0.244	0.312
	[0.401]	[0.436]	[0.431]	[0.450]	[0.450]
Physicians Per Capita	2.135	2.551	2.386	2.924*	2.420
	[1.446]	[1.588]	[1.542]	[1.577]	[1.449]
Citizen Ideology Index	0.057**	0.062**	0.057**	0.065**	0.059**
	[0.025]	[0.025]	[0.027]	[0.025]	[0.025]
Income Per Capita	-0.011	-0.005	-0.007	-0.001	-0.007
	[0.017]	[0.017]	[0.017]	[0.016]	[0.017]
Educational Attainment	0.002	0.004	0.003	0.005	0.002
	[0.009]	[0.009]	[0.010]	[0.010]	[0.009]
Females Per Capita	0.022	0.021	0.015	0.021	0.020
	[0.018]	[0.018]	[0.018]	[0.018]	[0.016]
Constant	16.062***	15.852***	16.237***	15.597***	15.937***
	[1.121]	[1.173]	[1.177]	[1.105]	[1.001]
Observations	700	700	700	700	700
R-squared	0.971	0.971	0.971	0.972	0.973
State and Year Effects?	Yes	Yes	Yes	Yes	Yes
Clustered Standard Errors?	Yes	Yes	Yes	Yes	Yes

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Economic Loss Ratio Regression Results

	(1)	(2)	(3)	(4)	(5)
Noneconomic Damages - Before Trend	-0.011				-0.020
	[0.015]				[0.014]
Noneconomic Damages - After Trend	-0.038**				-0.043***
	[0.016]				[0.010]
Punitive Damages - Before Trend		-0.049**			-0.063**
		[0.020]			[0.025]
Punitive Damages - After Trend		-0.005			0.001
		[0.008]			[0.010]
Collateral Source Rule - Before Trend			-0.003		0.014
			[0.025]		[0.023]
Collateral Source Rule - After Trend			0.010		0.031**
			[0.024]		[0.014]
Joint and Several - Before Trend				-0.006	0.013
				[0.029]	[0.027]
Joint and Several - After Trend				-0.029*	-0.042***
				[0.015]	[0.012]
Lawyers Per Capita	0.141	0.294	0.129	0.140	0.206
	[0.991]	[1.064]	[1.039]	[1.036]	[1.051]
Physicians Per Capita	2.269	2.610*	2.662	2.492	2.083
	[1.527]	[1.552]	[1.649]	[1.598]	[1.595]
Citizen Ideology Index	-0.028	-0.026	-0.023	-0.027	-0.022
	[0.030]	[0.031]	[0.033]	[0.031]	[0.032]
Income Per Capita	0.005	0.006	0.011	0.007	-0.003
	[0.012]	[0.011]	[0.012]	[0.012]	[0.012]
Educational Attainment	0.025**	0.026**	0.028**	0.026**	0.025**
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
Females Per Capita	-0.008	-0.015	-0.009	-0.010	0.002
	[0.036]	[0.037]	[0.036]	[0.035]	[0.034]
Constant	-1.200	-1.037	-1.466	-1.221	-1.537
	[1.928]	[1.881]	[1.873]	[1.800]	[1.859]
Observations	700	700	700	700	700
R-squared	0.625	0.624	0.619	0.621	0.637
State and Year Effects?	Yes	Yes	Yes	Yes	Yes
Clustered Standard Errors?	Yes	Yes	Yes	Yes	Yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Non-Insurance Market Conditions Regression Results

VARIABLES	(1) DV = LN(Physicians Per Capita)	(2) DV = LN(Civil Cases Per Capita)	(3) DV = LN(Health Care Expenditures Per Capita)
Noneconomic Damages - Before Trend	0.001	0.018	-0.002
	[0.004]	[0.016]	[0.004]
Noneconomic Damages - After Trend	0.001	-0.004	-0.001
	[0.003]	[0.012]	[0.003]
Punitive Damages - Before Trend	-0.001	0.038***	-0.002
	[0.005]	[0.009]	[0.003]
Punitive Damages - After Trend	0.011*	-0.034***	0.011*
	[0.006]	[0.010]	[0.006]
Collateral Source Rule - Before Trend	-0.012***	-0.014	0.001
	[0.004]	[0.015]	[0.004]
Collateral Source Rule - After Trend	0.001	-0.011	-0.006**
	[0.003]	[0.008]	[0.003]
Joint and Several - Before Trend	-0.001	0.011	0.000
	[0.003]	[0.028]	[0.003]
Joint and Several - After Trend	-0.006*	0.006	-0.008***
	[0.003]	[0.019]	[0.003]
Constant	0.776***	-2.647***	-5.660***
	[0.007]	[0.032]	[0.007]
Observations	700	700	650
R-squared	0.984	0.915	0.992
State and Year Effects?	Yes	Yes	Yes
Clustered Standard Errors?	Yes	Yes	Yes

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Appendix A: Variable Definitions and Sources

Variable	Definition	Source
Lawyers Per Capita	The number of lawyers in a state scaled by the total population in a state	American Bar Association
Physicians Per Capita	The number of active physicians in a state scaled by the total population in a state	U.S. Census Bureau
Citizen Ideology Index	A continuous measure of the political ideology of a state's population where 0 is the most conservative and 1 is the most liberal	Citizen Ideology Index: Berry et al. (1998)
Income Per Capita	The average income level of a state scaled by the population in a state	U.S. Census Bureau
Educational Attainment	The number of persons with at least a bachelor's degree in a state scaled by the population in a state	U.S. Census Bureau
Females Per Capita	The number of females in a state scaled by the population in a state	U.S. Census Bureau
Civil Cases Per Capita	The total number of incoming civil cases in a state scaled by the population in a state	Inter-university Consortium for Political and Social Research
Health Care Expenditures Per Capita	The dollar amount of healthcare expenditures, from all sources, in a state scaled by the population in a state	Centers for Medicare and Medicaid Services

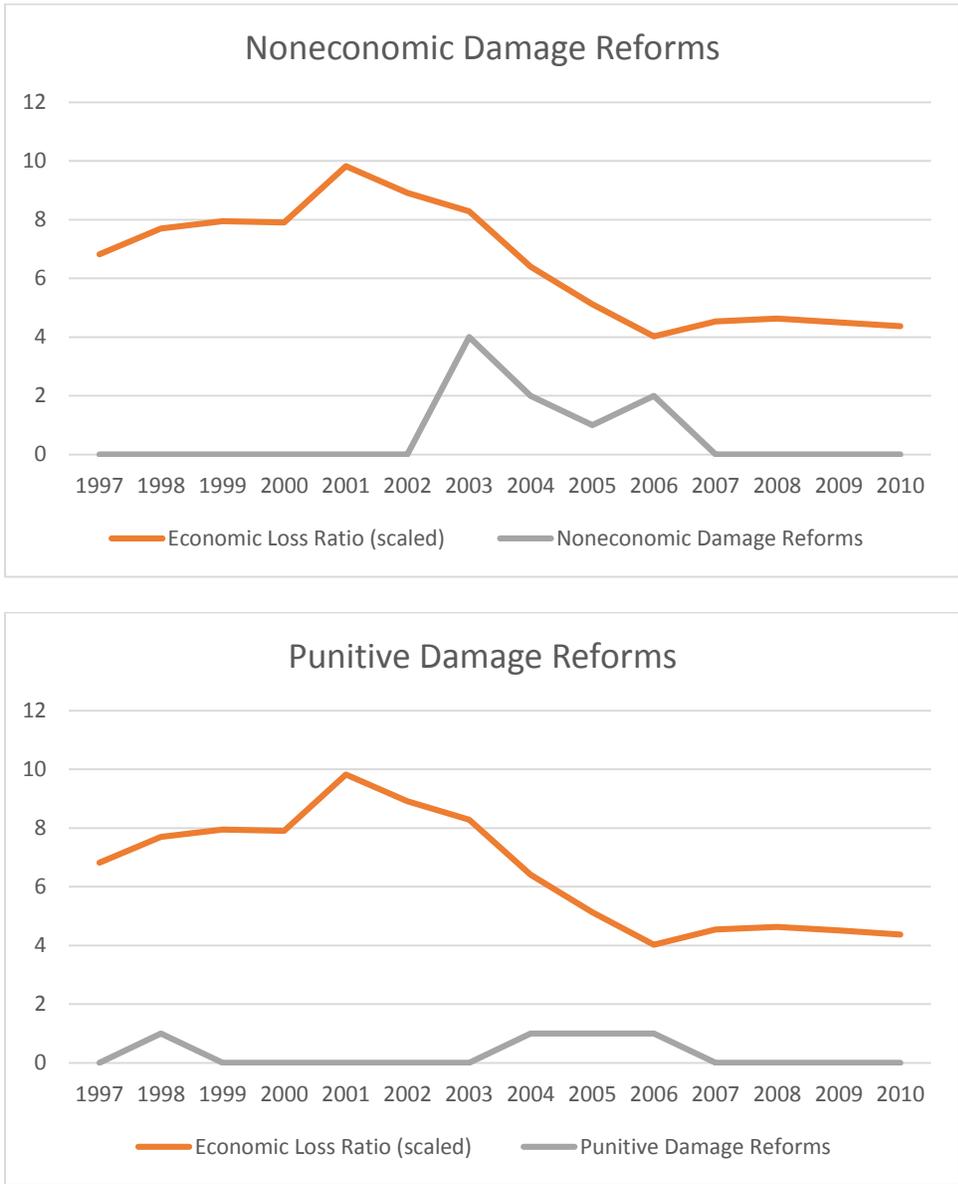**Figure 1: Economic Loss Ratios Compared to Various Reform Enactments**

Figure 1: Economic Loss Ratios Compared to Various Reform Enactments (Continued)

Collateral Source Reforms

— Economic Loss Ratio (scaled)   — Collateral Source Reforms

Joint and Several Liability Reforms

— Economic Loss Ratio (scaled)   — Joint and Several Reforms