

## **Did Tort Reforms Mitigate Crises in Medical Malpractice Insurance Markets?**

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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 reform of the tort system. 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.”

## Did Tort Reforms Mitigate Crises in Medical Malpractice Insurance Markets?

### 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 insurance markets experienced significant regulatory intervention, the most notable of which were 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 Rick Perry advocated that tort reform was necessary because physicians needed “relief from spiraling malpractice insurance premiums as soon as possible” (Texas Medical Association, 2003).

In support of their assertion that reform measures – including, for example, caps on noneconomic damages – 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 consistent with many academic studies which 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 insurance marketplace do not necessarily justify certain policymakers' assertions that tort reforms avert a crisis and reverse a deteriorating trend in insurance marketplace conditions. Rather, *ex ante* evidence is necessary to provide a complete picture on the merits of reform.

Our paper therefore explores medical malpractice insurance marketplace conditions before and after the enactment of various tort reform measures in order to understand whether reforms averted a crisis by reversing deteriorating marketplace conditions. The particular sample for our study is the medical malpractice insurance markets in states that enacted tort liability reforms during the most recent round of reform activity that occurred in the mid-2000s, but had no previous reform activity. These “hold out” 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 or that the evidence from other states, particularly in regards to the effects of reform on the legal environment, were compelling.

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 approximately 7 percent (4 percent) in each year following the enactment of caps on noneconomic damages. 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 were increasing at a rate of approximately 8 percent per year, on average, before the reform and stopped increasing after the reform. These reforms also led to average annual reductions in state-wide incurred loss ratios in the magnitude of approximately 3 percent. However, we find no evidence that joint and several liability reforms fixed an otherwise deteriorating medical malpractice insurance market. 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. Additionally, we find our results to be robust when we consider a variety of other factors, including the enactment of reform packages, differential cap levels, and whether the reform was subsequently struck down. Our results also hold under an alternative specification that allow for more flexibility in the modeled relationship, as well as a structural break analysis.

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 on medical malpractice insurance markets. 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 during the time period surrounding the enactment of tort liability reforms.

Our results do not call into question the existence of crises, as there is ample evidence in the literature to support their existence (e.g. Neal, Eastman, and Drake, 2005). Our study also does not rule out the possibility that reforms may have benefits for crisis conditions outside of the insurance market (e.g. physician supply, civil caseloads, etc.). Rather, our analysis suggests that tort reforms may not be the

reason medical malpractice insurance crises are mitigated, as they do not appear to significantly reverse deteriorating trends in medical malpractice insurance market conditions. 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 reform and the studies that examine the influence of reform activity on insurance markets. We then discuss our sample and methods in section 3 and we discuss our main results in section 4. In section 5 we consider several additional specifications to confirm our main results. Finally, in section 6, 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. The existing literature points to a variety of causes and consequences of these crises. Studies show, for example, that some medical malpractice insurers – especially those with a lack of specialization in medical malpractice insurance – have historically underpriced coverage in soft markets which led to their rapid growth and subsequent poor underwriting performance (see Danzon, Epstein & Harrington, 2007). 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. Beginning in the mid-1970s, states enacted these reforms in several “rounds”, the most recent of which occurred during 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 damages.

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, which are less likely to be binding. In addition, the analysis of Grace and Leverty (2013) indicates that reforms that were eventually declared unconstitutional or otherwise struck down 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 economic and social welfare costs associated with tort liability reforms.<sup>1</sup> To the extent that the expected benefits of reforms are associated with potential costs, understanding whether

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<sup>1</sup> 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.

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 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**

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 the Database of State Tort Law Reforms (Avraham, 2014; DSTLR 5<sup>th</sup>), which is considered to be the most current and comprehensive State-level tort reform data set (Grace and Leverty, 2013). From this database, we identify the years in which caps on noneconomic damages (*NE*), caps on punitive damages (*PD*), reforms to collateral source rules (*CSR*), and modifications to joint and several liability rules (*JS*) became effective in a given state.<sup>2</sup>

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<sup>2</sup> 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



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 losses), we aggregate 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 aggregation 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.<sup>3</sup> 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

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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).

<sup>3</sup> In unreported analysis, we find that the use of undiscounted losses incurred does not qualitatively change the analysis presented in this paper.

(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 index, which is the same as that used in Grace and Leverty (2013), is a continuous variable, ranging from 0 (conservative) to 1 (liberal).

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 provided 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 reform 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, enacted by nine states 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. Neale, 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 shown in Figure 1 in more detail.

#### **4. Methods and Results**

We are particularly interested in assessing the extent to which tort reforms mitigate potentially deteriorating conditions in the medical malpractice insurance 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 are associated with trends in insurer performance. 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. In the analysis that follows, we employ multiple, distinct econometric models that allow us to more explicitly explore pre- and post-reform medical malpractice insurance market conditions.

#### 4.1 Time Trend Specification

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

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

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

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 this first 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 2003. 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 both *REFORMSBEFORE* and *REFORMSAFTER* also allows us to directly test whether the enactment of a reform significantly 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 changes in law (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*.<sup>4</sup> While we expect *Lawyers Per Capita* and *Citizen Ideology Index* to have a non-

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<sup>4</sup> 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

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 ( $\delta_i$ ) and year fixed effects ( $\tau_t$ ), which control for unobserved factors, unrelated to tort reforming activities, that could affect any or all of our dependent variables. More specifically, state (year) effects absorb differences across states (time) and imply that within state (year) variation is examined. Finally,  $\varepsilon$  is an error term and the model is estimated with robust standard error and clustering at the state-level.

Table 4 displays the results of estimating equation 1 when the dependent variables are the natural logarithms of *Present Value of Losses*, *Premiums*, and *Economic Loss Ratios*. Turning first to the results of *Present Value of Losses*, we find no evidence that state-wide loss levels were increasing after states enacted caps on noneconomic damages. The lack of statistical significance on the before trend noneconomic damage cap variable is not consistent with the notion that market conditions were deteriorating in the years prior to states' enactments of noneconomic damage caps. However, the statistically significant after trend coefficient estimate on noneconomic damage caps indicates that *Present Value of Losses* in reforming states was decreasing by approximately 7 percent, on average, 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.

The evidence in Table 4 does not conflict with the contentions of certain policymakers that, following the enactment of noneconomic damage caps, insurers' loss pay-outs are reduced. However, the findings conflict with the assertion that noneconomic damage caps mitigate a crisis and alter trends in the

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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*.

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 not paying more losses in each consecutive year leading up to 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 that *Present Value of Losses* appear to have been declining at an average rate of 8.5 percent in each year leading up to the reform. This suggests 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) which is 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 of the trend variables have coefficients that are statistically distinguishable from zero. The same also holds true for joint and several liability reforms. However, while we observe no statistically significant relation between pre- and post- joint and several liability reform trends and *Present Value of Losses*, an F-test of the coefficients rejects the null hypothesis that the before and after joint and several liability trend variables are equal (F statistic = 4.95). 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 the reform may not have averted a crisis (because loss levels were not consistently trending upward), the reform did appear to change a change in trend in *Present Value of Losses*.

Table 4 also displays the results of estimating equation 1 when the dependent variable is the natural logarithm of *Premiums*. 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 8.4 percent per year, on average, suggesting that market conditions preceding joint and several liability reforms were deteriorating. While we find no evidence of a statistically meaningful trend in *Premiums* following a joint and several liability reform, 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 = 3.59). 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.

In Table 4, we also present the results of estimating equation 1 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 a rapid decline in medical malpractice insurer profitability, was occurring in the years before the hold out states enacted caps on noneconomic damages. Instead, the reforms appear to have coincided with a steady improvement in insurer profitability and the point estimate on the coefficient suggest the state-wide *Economic Loss Ratio* declined, on average, by about 4.2 percent in each year following the enactment of caps on noneconomic damages.

The F-test of the coefficients, however, indicates that the before and after trends are statistically different at the 10 percent level. Thus, while noneconomic damage caps don't appear to have reversed pre-reform deteriorating conditions, they did cause loss ratios to decline at an average rate that was greater than that in the pre-reform period. Again, this finding is consistent with the evidence in prior



studies that insurer profitability is improved as a result of caps on noneconomic damages and corroborates policy claims that, once in effect, tort reforms have a real, beneficial impact on malpractice insurer's loss ratios. However, our finding suggests that the benefit of noneconomic damage caps is not that it stopped loss ratios from steadily deteriorating but rather that it led to an increase in the average rate at which loss ratios declined.

Interestingly, our results indicate that *Economic Loss Ratio* was declining at a rate of around 7 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 about 3 percent following collateral source reforms. Thus, for both punitive damage reforms and collateral source reforms, we find no evidence that reforms were responsible for mitigating a trend of declining incurred loss ratios.

When we examine joint and several liability reforms, we find evidence that the reform is associated with improvements in market conditions. 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, around 3 percent per year in each year following a joint and several liability reform. The F-test of the before and after trend coefficients support the supposition that post-joint and several liability trends are statistically different from pre-reform trends (F-statistic = 4.52). This further attests to the apparent *ex post* benefits of reforms, though it does not substantiate any claim that the mitigation of a medical malpractice insurance crisis is the source of these benefits.

We also note that, consistent with expectations, we find evidence that *Physicians Per Capita* is positively related to *Present Value of Losses* and *Premiums*. As expected, *Citizen Ideology Index* is also significantly related to levels of *Premiums*. In addition, *Educational Attainment* is positively related to loss levels and loss ratios, which is consistent with the notion that 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.

#### 4.1.1 Time Trend Specification – Robustness Checks

The results of the analysis presented in section 4.1 generally refute the notion that tort liability reforms are responsible for mitigating a crisis in the medical malpractice insurance market. We begin exploring the robustness of this finding by noting that states can enact tort liability reform “packages” whereby a given state passes multiple reforms in the same year.<sup>5</sup> In Table 5, we provide the results of re-estimating the general specification given in equation 1 except that we create two new *REFORMSBEFORE* and *REFORMSAFTER* variables that track the time period surrounding the enactment of reform packages in a given year by a given state.<sup>6</sup> We find no evidence that market conditions were deteriorating in the years leading up to the enactment of a reform package, as evidenced by the insignificant coefficients on the pre-reform trend variable. Similar to our previous analysis, we find evidence that losses and incurred loss ratios declined at a statistically significant rate following the enactment of multiple reforms in a given year. The results in Table 5 therefore do not suggest that packages of reforms are more effective at mitigating medical malpractice crises.

A separate issue to consider is that the amount of the cap on noneconomic awards can vary by state.<sup>7</sup> We explore the possibility that our results may be sensitive to cap size in Table 6 by re-estimating

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<sup>5</sup> It may be the case that the effect of a reform package is greater than that of a single reform, in terms of reversing deteriorating marketplace trends. Further, there are other types of reforms that a state can enact alongside one or more of the four main types of reforms considered in our analysis, though there is little empirical evidence that these other reforms have a meaningful impact on medical malpractice insurance markets. Nevertheless, it is important to evaluate the pre- and post-medical malpractice insurance market conditions surrounding reform packages.

<sup>6</sup> In our analysis, a state is classified as enacting a reform package if it enacts at least one of the four major reforms considered in our main analysis (i.e. *NE*, *PD*, *CSR*, and *JS*) as well as at least one other type of reform given in Avraham’s reform database. These other reforms are caps on total damages, split recovery reform, punitive evidence reform, periodic payments reform, contingency fee reform, patient compensation fund reform, and comparative fault reform. In total, 8 states enacted a package of reforms during our sample period.

<sup>7</sup> For example, the dollar limit on noneconomic damage caps enacted by states during our sample period ranges from \$250,000 to \$500,000. Born and Neale (2013) evaluate differential effects of cap amounts on medical malpractice insurance losses, suggesting that the amount of the noneconomic damage cap may affect the extent to which crises are mitigated. Although they conclude that the existence of a cap is more relevant than the actual size of the cap, our results may be sensitive to state caps that may be non-binding.

our pre- and post-noneconomic damage trend models and separately analyzing trends surrounding the enactment of noneconomic damage caps with different cap amounts.<sup>8</sup> We find no evidence that medical malpractice insurance market conditions were deteriorating in the years prior to the enactment of caps on noneconomic damages, regardless of the cap amount. In fact, we find evidence that losses and loss ratios were already improving before the enactment of reforms that capped noneconomic damages at \$500,000. We also find evidence that losses, premiums, and loss ratios declined, on average, in each year following the enactment of \$500,000 damage caps. This evidence further suggests that the cap is not a relevant factor in mitigating deteriorating conditions in medical malpractice insurance markets.

As noted by Grace and Leverty (2013), whether or not a reform is ultimately declared unconstitutional or otherwise repealed has consequences for the reforms' effectiveness in reducing losses, premiums, and loss ratios. Our reform database was last updated in 2014 and, as of that time, only two reforms enacted during our sample period were struck down.<sup>9</sup> We therefore would not expect our main result to be sensitive to the impact of reversed reforms. Nevertheless, we confirm this expectation in Table 7, which gives the output of estimating our main models except that we treat states whose reforms were struck down as never having enacted the given reform (i.e. replace the given pre- and post- trends to 0 for the given state). While we find evidence that premiums were increasing by approximately 9.3 percent per year, on average, prior to joint and several liability reforms, we find no other evidence that suggests "permanent" reforms reversed deteriorating trends in medical malpractice insurance markets.

#### *4.2 Time Dummy Specification*

While the previous section's econometric approach of examining law-specific trend variables is commonly employed by prior studies in the regulatory economics literature (e.g. Hoyt et al., 2006; Plassman and Whitely, 2003; Mustard, 2001), the approach inherently assumes a degree of monotonicity

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<sup>8</sup> As noted in Born and Neale (2013), larger caps are likely to be less binding. Since \$500,000 is the largest cap limit enacted during our sample, we separately examine the trends in medical malpractice insurance losses in states that enacted caps equal to \$500,000 versus states that enacted caps less than \$500,000.

<sup>9</sup> Georgia's cap on noneconomic damages was struck down in 2010 and Pennsylvania's joint and several liability reform was struck down in 2006.

in the structure of the relationship between market conditions and the trend variables. Thus, if loss increases (decreases) were specific to a year or two before (after) the enactment of a given reform, it is possible that this might not be captured by the trend variable used in the previous section. To address this concern, we estimate a variant of equation 1 that allows for a more flexible model of the relationship between reform enactments and market conditions. The general framework of this modeling strategy has been used previously to examine the effects of law changes in market conditions (e.g. Heaton, 2015; Frakes, 2013). Our model takes the form of:

$$Y_{it} = \alpha + \sum_{t=-5}^5 \theta_t NECD_{it} + \eta' F_{it} + \sum_{t=1997}^{2010} \tau_t T_t + \sum_{i=1}^{50} \delta_i S_i + \varepsilon_{it} \quad 2)$$

With the exceptions of  $NECD_{it}$ , all variables are the same as defined previously. Our variables of interest in this model are the event time indicator variables,  $NECD_{it}$ , which are series of lead and lag dummies that explicitly track the five year time period before and after a given state enacts a cap on noneconomic damages in a given year. For example,  $NECD_{i-1}$  ( $NECD_{i+1}$ ) equals 1 if a cap on noneconomic damages became effective in a given state in the following (preceding) calendar year and zero otherwise. By examining the magnitude and significance of the coefficients,  $\theta_t$ , this specification allows us to examine pre- and post-reform market conditions in a manner that imposes less structure on the modeled relationship.

Note that, for the sake of brevity, we focus our time dummy specification analysis only on noneconomic damage caps. However, in unreported analysis, we find that the general conclusions drawn in this section also apply to the other reform types (i.e. *PD*, *CSR*, and *JS*). Furthermore, prior studies (e.g. Grace and Leverty, 2013; Born et al., 2009; Born and Viscusi, 2005) suggest that, relative to the other reform types, noneconomic damage caps have the most substantial impact on medical malpractice insurance market. In addition, caps on noneconomic damage caps are often the focus of policy discussions pertaining to the merits of tort reform and are the most common of all reform types enacted

during our sample period. Focusing our discussion on noneconomic damage caps therefore likely carries the most policy relevance.

Since our research interest lies in examining the trends in medical malpractice insurance market conditions, we plot the coefficient estimates Figure 2 and center our discussion on this figure.<sup>10</sup> The plotted line in this figure reflects a time trend of the differential between states that enacted caps on noneconomic damages and those that did not, where time is measured in reference to the year a cap on noneconomic damages went into effect in a given state. The figure clearly shows the drop in mean levels of losses, premiums, and loss ratios in the years following caps on noneconomic damages that is robustly documented in the literature (e.g. Born and Viscusi, 2005). Thus, our analysis reinforces the notion that caps on noneconomic damages are an effective method for lowering the average amount of premiums and losses incurred by medical malpractice insurers.

However, as is evident in Figure 2, none of the observed trends suggest a caps on noneconomic damages reversed medical malpractice insurance market conditions that were “spiraling out of control.” Premiums levels in reforming states appear to be relatively stable in the five years preceding the reform then drop suddenly and stabilize again in the year of, and years following, the enactment of a cap on noneconomic damages. While an F test to jointly examine the coefficients of the  $NECD_{T-5}$  to  $NECD_{T-1}$  provides weak evidence that the variables are jointly significant (F statistic = 2.06) thereby suggesting a statistically meaningful trend in *Premiums*, the figure clearly indicates that this trend is not characterized by rapidly rising premiums. Test of the significance of the post-reform year indicators do, however, indicate that the general decline in post-reform premium levels is statistically significant (F statistic = 4.84).

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<sup>10</sup> Appendix B reports the estimated coefficients of the six lead and lag dummy variables when equation 2 is estimated. Note that the output omits the point estimates on the control variables, which were included when estimating the model. In addition, state and year effects were included and robust standard errors clustered at the state level are displayed. Further, in unreported analysis, we find that the inclusion of a general time trend variable (i.e. not specific to a given reform) that controls for growth in premiums and losses over time, does not negate the main findings.

Even more striking than the trend in premiums are the trends in *Present Value of Losses* and *Economic Loss Ratio* given in Figure 3. Here, we observe that losses and loss ratios do appear to have trended upward from five years before the reform until two or three years before the reform. However, the figure shows that losses and loss ratios then trended downward in the years before and during the enactment of a cap on noneconomic damages. This observation is again inconsistent with the belief that tort reforms are responsible for reversing deteriorating market conditions, as the market appears to have already started improving prior to the enactment of a reform. F-tests to examine the joint significance of the pre-reform dummies fail to reject the null hypothesis that of equality of coefficients, which confirms that no statistically meaningful trend in losses or loss ratios is observed. That is, we again find no evidence that losses and loss ratios were spiraling out of control in each of the years leading up to the enactment of a tort reform. In contrast, we do find that the general decline in *Present Value of Losses* and *Economic Loss Ratio* visible in Figure 3 is statistically significant, as indicated by joint F-tests.

#### 4.3 Structural Break Analysis

As the analysis presented in this paper does not find much support of pre-reform deteriorating medical malpractice insurance market conditions, it is useful to provide perspective on when conditions in the medical malpractice insurance market changed. To do so, we estimate the Zivot and Andrews (1992) trend break model to identify the year of a structural break in medical malpractice insurance market conditions in a given state that enacted a reform during our sample period.<sup>11</sup> A common criticism in the literature of this, and similar methods related to structural breaks, is the lack of sufficient power. This is especially true in studies like ours that have relatively short sample periods. Despite this drawback, when viewed alongside the prior analysis presented in this paper, a structural break analysis helps to provide an additional element of robustness to the conclusions drawn in our paper.

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<sup>11</sup> This method is used in prior studies (e.g. Narayan and Smyth, 2005) to identify the location and significance of structural breaks in panel data analyses.

Table 8 provides the results of the Zivot and Andrews (1992) test for breaks in premiums, losses, and loss ratios for each state that enacted a reform during our sample period. The year of the trend break is associated with the minimum t-statistic identified for each state. As it relates to *Present Value of Losses*, we find that most of the break points occur around 2002 and 2003 and only six states have breaks in trends that are statistically significant at the 10 percent level or better. Further, Mississippi, South Carolina, and West Virginia are the only two states that enacted a reform within one year of a statistically significant structural break. This evidence is inconsistent with the notion that tort reforms were responsible for reversing deteriorating trends in the amounts of losses incurred by medical malpractice insurers. Examining the trend breaks in *Premiums* and *Economic Loss Ratio* provides a similar picture. We find only three (one) instances of a statistically significant trend breaks in *Premiums* (*Economic Loss Ratio*), though all three significant breaks in *Premiums* coincide with the time period immediately surrounding the enactment of a reform. Taken in its entirety, our structural break analysis indicates that few of the breaks, significant or not, coincide with reforming activity which casts further doubt on reforms' effectiveness in mitigating a medical malpractice insurance crisis.

## **6. 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 averted “crises” in the medical malpractice insurance market during this time period. 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. 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 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 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. We also find our results to be robust to a variety of other factors, including the enactment of reform packages, differential effects of cap levels, whether the reform was struck down, an alternative specification that allows for more flexibility in the modeled relationship, and a structural break analysis.

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 do not call into question the existence of an insurance crisis, as many studies (e.g. Neale et al., 2005) provide evidence of significantly deteriorating medical malpractice insurance market conditions during our sample period. Rather, our study casts doubt on tort reforms’ effectiveness in stabilizing a medical malpractice insurance market that is in crisis, as is often suggested in policy discussions on the merits of



tort liability reforms. Furthermore, our analysis does not imply that tort reforms are meritless, as there are many other potential benefits to tort reform – e.g., reducing the time to settle a case – which our analysis does not address.

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**Table 1: Summary Statistics (N = 700)**

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

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

<b>State</b>	<b>Noneconomic Damage Cap</b>	<b>Punitive Damage Caps</b>	<b>Collateral Source Reform</b>	<b>Joint and Several Liability Reform</b>
Alabama			2000	
Alaska	2005	1997		
Arkansas				2003
Florida	2003			
Georgia	2005			
Idaho		2003		
Mississippi	2003			
Missouri		2005		
Nevada	2002			2002
Ohio		2005		2003
Oklahoma	2003		2003	
Pennsylvania			2002	2002
South Carolina	2005			2005
Texas	2003			
West Virginia	2003		2003	

**Table 3: Illustration of Trend Variable**

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

**Table 4: Regression Results**

	(1)	(2)	(3)
	Present Value of Losses	Premiums	Economic Loss Ratio
Noneconomic Damages - Before Trend	-0.036 [0.025]	-0.020 [0.017]	-0.017 [0.013]
Noneconomic Damages - After Trend	-0.073** [0.031]	-0.031 [0.023]	-0.043*** [0.012]
Punitive Damages - Before Trend	-0.085* [0.050]	-0.014 [0.026]	-0.071** [0.029]
Punitive Damages - After Trend	-0.002 [0.014]	0.000 [0.010]	-0.002 [0.010]
Collateral Source Rule - Before Trend	0.010 [0.032]	-0.009 [0.027]	0.019 [0.026]
Collateral Source Rule - After Trend	0.016 [0.029]	-0.011 [0.024]	0.027** [0.013]
Joint and Several - Before Trend	0.092 [0.058]	0.081** [0.035]	0.012 [0.025]
Joint and Several - After Trend	-0.040 [0.024]	-0.008 [0.021]	-0.032** [0.013]
Lawyers Per Capita	0.533 [1.420]	0.323 [0.454]	0.210 [1.055]
Physicians Per Capita	4.605* [2.325]	2.442* [1.456]	2.163 [1.580]
Citizen Ideology Index	0.036 [0.043]	0.058** [0.025]	-0.022 [0.032]
Income Per Capita	-0.009 [0.025]	-0.007 [0.017]	-0.002 [0.012]
Educational Attainment	0.027* [0.014]	0.002 [0.009]	0.025** [0.011]
Females Per Capita	0.021 [0.037]	0.020 [0.017]	0.002 [0.034]
Constant	14.392*** [2.119]	15.951*** [1.005]	-1.559 [1.853]
Observations	700	700	700
R-squared	0.926	0.973	0.637
State and Year Effects?	Yes	Yes	Yes
Clustered Standard Errors?	Yes	Yes	Yes

Robust standard errors in brackets

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Table 5: Regression Results: Reform Packages**

VARIABLES	(1) Present Value of Losses	(2) Premiums	(3) Economic Loss Ratio
Reform Package - Before Trend	0.025 [0.042]	0.024 [0.033]	0.000 [0.017]
Reform Package - After Trend	-0.029 [0.029]	-0.007 [0.020]	-0.022 [0.016]
Lawyers Per Capita	0.266 [1.368]	0.098 [0.445]	0.168 [1.027]
Physicians Per Capita	5.340** [2.530]	2.837* [1.597]	2.503 [1.635]
Citizen Ideology Index	0.033 [0.045]	0.064** [0.026]	-0.031 [0.032]
Income Per Capita	0.004 [0.025]	-0.003 [0.017]	0.007 [0.012]
Educational Attainment	0.030* [0.015]	0.004 [0.010]	0.026** [0.011]
Females Per Capita	0.009 [0.035]	0.021 [0.019]	-0.012 [0.035]
Constant	14.603*** [1.958]	15.728*** [1.159]	-1.126 [1.872]
Observations	700	700	700
R-squared	0.920	0.971	0.620
State and Year Effects?	Yes	Yes	Yes
Clustered Standard Errors?	Yes	Yes	Yes

Robust standard errors in brackets

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

**Table 6: Regression Results: Differing Levels of Noneconomic Damage Cap**

VARIABLES	(1) Present Value of Losses	(2) Premiums	(3) Economic Loss Ratio
Noneconomic Damages (Under \$500k) - Before Trend	-0.007 [0.045]	-0.004 [0.035]	-0.003 [0.014]
Noneconomic Damages (Under \$500k) - After Trend	-0.062 [0.042]	-0.027 [0.027]	-0.036 [0.022]
Noneconomic Damages (Over \$500k) - Before Trend	-0.052*** [0.017]	-0.023 [0.019]	-0.029*** [0.011]
Noneconomic Damages (Over \$500k) - After Trend	-0.103*** [0.016]	-0.057** [0.023]	-0.045*** [0.013]
Lawyers Per Capita	0.185 [1.258]	0.038 [0.397]	0.146 [0.990]
Physicians Per Capita	4.188* [2.237]	2.011 [1.472]	2.177 [1.538]
Citizen Ideology Index	0.033 [0.040]	0.060** [0.025]	-0.027 [0.029]
Income Per Capita	-0.005 [0.025]	-0.011 [0.017]	0.006 [0.012]
Educational Attainment	0.027* [0.015]	0.002 [0.009]	0.025** [0.011]
Females Per Capita	0.013 [0.035]	0.022 [0.018]	-0.009 [0.036]
Constant	14.937*** [1.964]	16.094*** [1.129]	-1.157 [1.907]
Observations	700	700	700
R-squared	0.924	0.972	0.626
State and Year Effects?	Yes	Yes	Yes
Clustered Standard Errors?	Yes	Yes	Yes

Robust standard errors in brackets

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1





**Table 7: Regression Results: Reversed Reforms Omitted**

VARIABLES	(1) Present Value of Losses	(2) Premiums	(3) Economic Loss Ratio
Noneconomic Damages - Before Trend	-0.043 [0.027]	-0.032 [0.020]	-0.011 [0.015]
Noneconomic Damages - After Trend	-0.064* [0.034]	-0.025 [0.026]	-0.039*** [0.013]
Punitive Damages - Before Trend	-0.085 [0.052]	-0.020 [0.028]	-0.065** [0.029]
Punitive Damages - After Trend	0.003 [0.014]	0.012 [0.014]	-0.009 [0.010]
Collateral Source Rule - Before Trend	0.026 [0.030]	0.007 [0.025]	0.019 [0.026]
Collateral Source Rule - After Trend	0.009 [0.026]	-0.014 [0.021]	0.023 [0.015]
Joint and Several - Before Trend	0.101 [0.063]	0.093** [0.041]	0.008 [0.026]
Joint and Several - After Trend	-0.050* [0.029]	-0.026 [0.025]	-0.024* [0.014]
Lawyers Per Capita	0.517 [1.440]	0.338 [0.464]	0.179 [1.070]
Physicians Per Capita	4.816** [2.322]	2.332 [1.458]	2.484 [1.588]
Citizen Ideology Index	0.035 [0.044]	0.056** [0.025]	-0.020 [0.032]
Income Per Capita	-0.005 [0.025]	-0.006 [0.017]	0.001 [0.012]
Educational Attainment	0.024 [0.015]	0.001 [0.010]	0.024** [0.011]
Females Per Capita	0.016 [0.037]	0.018 [0.017]	-0.002 [0.035]
Constant	14.581*** [2.124]	16.062** *	-1.482 [1.885]
Observations	700	700	700
R-squared	0.925	0.972	0.634
State and Year Effects?	Yes	Yes	Yes
Clustered Standard Errors?	Yes	Yes	Yes

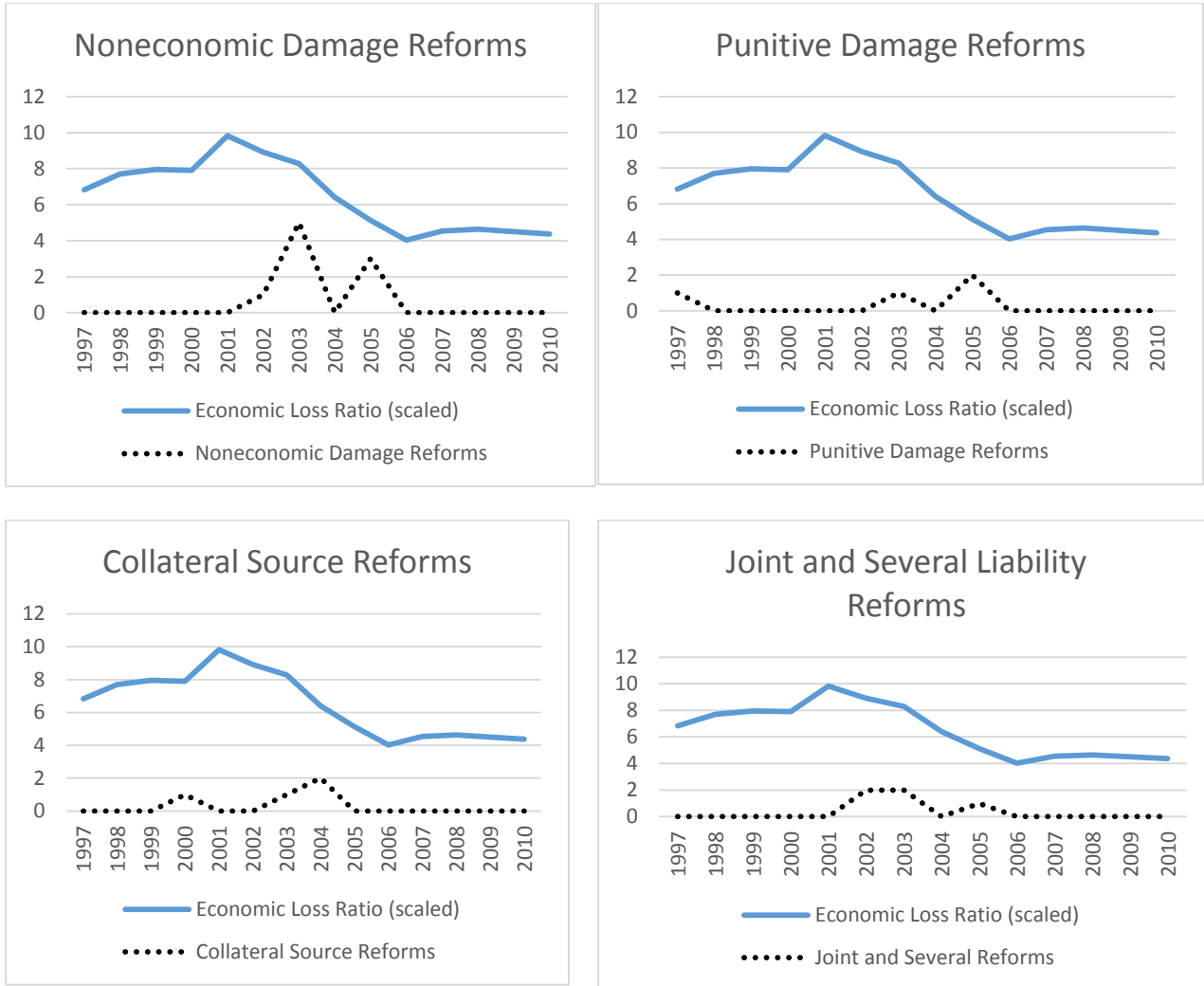
Robust standard errors in brackets

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

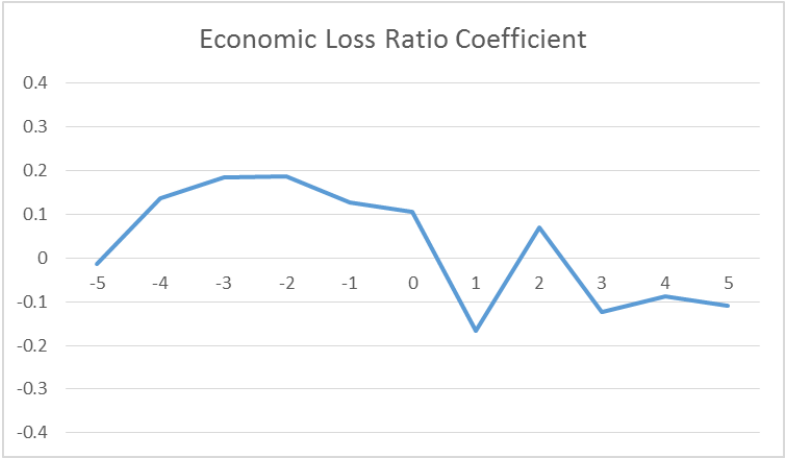
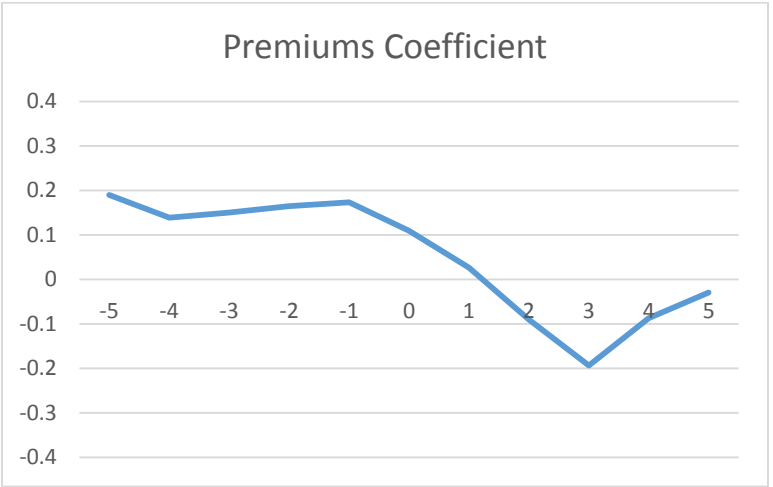
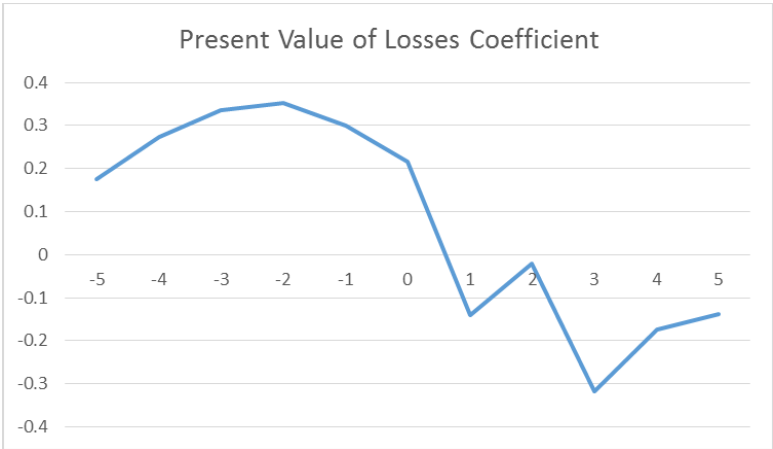
**Table 8: Structural Break Analysis**

State	<i>Present Value of Losses</i>		<i>Premiums</i>		<i>Economic Loss Ratio</i>	
	Year of Trend Break	Minimum T-Stat	Year of Trend Break	Minimum T-Stat	Year of Trend Break	Minimum T-Stat
Alabama	2008	-4.174*	2007	-3.431	2003	-3.258
Alaska	2003	-4.576**	2006	-4.476**	2000	-3.943
Arkansas	2003	-3.788	2007	-2.182	2002	-3.016
Florida	2003	-4.054	2004	-3.305	2001	-2.35
Georgia	2003	-3.911	2005	-3.553	2002	-3.073
Idaho	2006	-4.525**	2005	-2.985	2002	-4.058
Mississippi	2002	-5.232***	2004	-4.149*	2002	-4.726*
Missouri	2003	-3.027	2005	-3.521	2002	-2.063
Nevada	2003	-2.584	2008	-3.891	2007	-2.071
Ohio	2003	-3.689	2005	-2.95	2007	-2.304
Oklahoma	2007	-2.735	2000	-4.074	2008	-3.102
Pennsylvania	2002	-3.288	2006	-3.41	2000	-2.909
South Carolina	2004	-4.201*	2006	-5.223***	1999	-3.516
Texas	2003	-2.386	2004	-3.189	2008	-2.589
West Virginia	2003	-4.981***	2003	-3.493	2002	-3.23

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



**Figure 2. Plot of Coefficient Estimates from Equation 2**



## Appendix A: Variable Definitions and Sources

<b>Variable</b>	<b>Definition</b>	<b>Source</b>
<i>Lawyers Per Capita</i>	The number of lawyers in a state scaled by the total population in a state	American Bar Association
<i>Physicians Per Capita</i>	The number of active physicians in a state scaled by the total population in a state	U.S. Census Bureau
<i>Citizen Ideology Index</i>	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)
<i>Income Per Capita</i>	The average income level of a state scaled by the population in a state	U.S. Census Bureau
<i>Educational Attainment</i>	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
<i>Females Per Capita</i>	The number of females in a state scaled by the population in a state	U.S. Census Bureau

## Appendix B. Regression Results: Time Dummy Specification

VARIABLES	(1) Present Value of Losses	(2) Premiums	(3) Economic Loss Ratio
NECDt-5	0.176 [0.174]	0.190** [0.085]	-0.014 [0.137]
NECDt-4	0.274* [0.140]	0.139 [0.100]	0.136 [0.106]
NECDt-3	0.335** [0.160]	0.150 [0.111]	0.185* [0.109]
NECDt-2	0.353** [0.167]	0.165 [0.125]	0.188** [0.075]
NECDt-1	0.301** [0.148]	0.174 [0.129]	0.127 [0.086]
NECDt	0.215 [0.216]	0.110 [0.126]	0.105 [0.152]
NECDt+1	-0.140 [0.233]	0.027 [0.149]	-0.167 [0.123]
NECDt+2	-0.021 [0.176]	-0.090 [0.159]	0.069 [0.091]
NECDt+3	-0.317 [0.276]	-0.194 [0.191]	-0.124 [0.129]
NECDt+4	-0.174 [0.241]	-0.087 [0.092]	-0.087 [0.177]
NECDt+5	-0.139 [0.159]	-0.030 [0.132]	-0.110 [0.072]
Lawyers Per Capita	0.121 [1.252]	-0.008 [0.401]	0.129 [0.996]
Physicians Per Capita	3.885* [2.311]	1.712 [1.444]	2.173 [1.579]
Citizen Ideology Index	0.029 [0.044]	0.060** [0.027]	-0.031 [0.031]
Income Per Capita	0.000 [0.025]	-0.008 [0.017]	0.009 [0.012]
Educational Attainment	0.027* [0.015]	0.002 [0.010]	0.025** [0.011]
Females Per Capita	0.012 [0.030]	0.023 [0.018]	-0.011 [0.031]
Constant	14.925*** [1.810]	16.034*** [1.102]	-1.109 [1.699]
Observations	700	700	700
R-squared	0.924	0.972	0.628
State and Year Effects?	Yes	Yes	Yes
Clustered Standard Errors?	Yes	Yes	Yes

Robust standard errors in brackets

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