What Drives Tort Reform Legislation?

Economics and Politics of the State Decisions to Restrict Liability Torts[1]

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ABSTRACT

This paper studies driving factors behind the timing of state-level tort reform enactments between 1971 and 2005. Using discrete time hazard models, we find the level of litigation activity, as measured by incurred liability insurance losses and premiums, number of lawyers at the state level, and tort cases commenced at the state level and national level, to be the most important and robust determinant of tort reform adoption. Political-institutional factors and regional effects---such as Republican control of the state government and single party control of the legislature and governorship---are also associated with quicker reform adoption. Beyond this, however, we do not find evidence of the influence of private interest groups---such as doctors, and insurance industry professionals---on tort reform adoption.

Key words: Tort reform, insurance, liability crisis

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I. Introduction

Over the past several decades, the United States has experienced several waves of tort reforms. The first wave came in the mid-1970's, when a number of states enacted reforms such as caps on non-economic damages, changes to collateral source rules, and limitations on the application of joint and several liability. This was followed by a larger wave in the mid-1980's and another wave in the early 2000's. Figures 1 through 7 display the timing of enactment of tort reforms in the various states.

Much research has been devoted to estimating the impact of tort reforms, with many studies finding that tort reforms have large negative effects on various measures of litigation activity. However, relatively little attention[4] has been paid to the question of why states enact tort reforms, and, as can be seen in the figures, the propensity to reform apparently varies significantly across the states. For example, as can be seen in Table 1, Florida has been extremely aggressive in instituting reforms, while, nearby, South Carolina has stood pat; similarly, one moves from an aggressive to a passive reform environment when one crosses the border from Idaho to Wyoming. This paper studies the determinants of tort reform enactment. Specifically, we focus on adoptions of four of the most common and prominent liability tort reforms[5]---caps on punitive damages, limitations on joint and several liability laws, caps on noneconomic damages, and changes to collateral source rules---during the 1971-2005 periods.

Several theories may help explain the political process of tort reform. The *economic theory* (Stigler, 1971; Peltzman, 1989; Becker, 1983) describes the legislative process as one of

[4] An important exception is Harrington (1994), who studies the adoption of automobile insurance no-fault laws in the early 1970's.

[5] The Lawyer contingency fee is not included in the analysis since only five states enact Lawyer contingency fee reform on liability and three states enact periodic payments reform related to liability. The results of the timing of states' first step to pass any type of tort reforms do not change if I include lawyer contingency fee reform and periodic payments reform.

competition among interest groups, where well-organized industrial and professional interests capture rents at the expense of more dispersed groups such as consumers. In the case of tort reform, lawyers, doctors, the insurance industry, businesses, and consumers are all interest groups to be considered. The *public interest theory* (Joskow and Noll, 1981) features a benevolent legislature with a primary concern of social welfare: In this view, lawmakers identify failures in the current civil justice system and attempt to correct them. A third group of theories emphasize the impact of *political-institutional* factors in the legislative process such as Republican versus Democratic control (Dixit, 1996; and Irwin and Kroszner, 1999), or the nature of citizen ideology (Poole and Rosenthal, 1997; and Berry, 1998).

To investigate what drives reform enactment, we use a discrete time proportional hazard model to explain the timing of tort reform adoption. We incorporate proxies for the size of various interest groups, the extent of and costs associated with litigation, political-institutional factors, the liability climate, state insurance regulation, economic conditions, and regional effects.

Our most robust finding is that various measures of litigation activity are associated with quicker enactment of tort reform. More lawyers, more tort cases in general jurisdiction courts and federal courts, and higher liability insurance costs all lead to faster tort reform adoption. Other variables are not consistently associated with tort reforms, with the exceptions of 1) Republican control of the state government and single party control of the legislature and governorship (which is positively associated with tort reform enactment in many specifications) and 2) regional effects (with states in the Northeast being significantly less likely to adopt reforms).

The paper is organized as follows. Section II provides background on insurance crises and discusses related literature on tort reforms. Section III describes the hypotheses, proxy variables and data sources. Section IV explains the empirical methods and results. Section V shows robustness checks and extensions. Section VI concludes.

II. Tort crises and Tort reforms

A. Three Tort Crises in Liability

Since the 1970s, the United States has experienced three "liability crises." The crises were characterized by sharp rises in insurance premiums, accounting recognition of liability losses by insurance companies, and restrictions in coverage. The first crisis happened in the mid-1970s, and several states enacted tort reforms during that period. The first liability crisis was especially acute in the area of medical malpractice liability, and it led several states to enact tort reforms targeted only at medical malpractice. The second liability crisis occurred in the mid-1980s, and many states passed reforms around this time. Priest (1987) attributes this crisis to the interpretation of modern tort law. He argues that judicial findings of greater levels of liability in insurance contracts, combined with a decline in the interest rate, led to insurers increase prices and restrict coverage. The third and most recent crisis started in the late 1990s and continued into the early 2000's.

B. Four Tort Reforms

There are four prominent reforms: caps on punitive damages, limitations on joint and several liability, caps on noneconomic damages, and reforms to collateral source rules. These reforms have been most widely analyzed by other researchers and also directly impact the determination of awards. Table 1 and Figures 1 to 6 illustrate the history of the four tort reform enactments state by state since 1971.

Prior to 1971, most states did not have caps on punitive damages and limitations on joint and several liability, and no states had caps on noneconomic damages and collateral source reforms related to general liability.[6] Starting in the mid-1970s, however, many states passed various reforms to the common law rules under which tort cases are tried in state courts. Most states enacted at least one of the four tort reforms during the 1970s and 1980s. The first wave of tort reform during the 1970s mainly targeted lawsuits related to health care, while the second wave of tort reform enactments during the 1980s was more general (Sloan et al., 1989).

Caps on Punitive Damages Reform Punitive damages are awarded to punish tortfeasors for malicious and reckless behavior and to deter future misconduct (American Tort Reform Association, 2012). Punitive damages awards are infrequent but the awards can be enormous and are routinely sought in civil lawsuits. Even if the jury finds the defendant's behavior to be egregious, it is hard to map the penalty into a dollar value (Viscusi, 2004). Caps on punitive damages typically limit the amount of award either to a specific dollar amount (e.g. $250,000 in Alabama) or to a multiple of compensatory damages. Some even prohibit punitive damages entirely.

Joint and Several Liability Reform Joint and several liability permits the plaintiff to recover damages from multiple defendants or from each defendant individually. If one defendant does not have enough resources to pay the tort award, the plaintiff can seek restitution from other defendants. Reform of joint and several liability modifies the joint responsibility that two or more defendants carry, typically by limiting a defendants' financial responsibility for harm to a percent of total damages according to fault. The most common form of the reform is a limit to the application of joint and several liability in awarding noneconomic damages (Lee et al., 1993).

Caps on Noneconomic Damages Reform Damages for noneconomic losses are for pain and suffering and are inherently difficult to measure (Sunstein, 2007). The discretion of juries

[6] "Tort reform on general liability" means that the application of the tort reform was not restricted to medical malpractice.

may result in substantial variation in awards. Caps on noneconomic loss place typically provide numerical guidelines for the award or provide specific dollar ceilings on awards for noneconomic damages.

Collateral Source Rule Reform The collateral source rule forbids the use of evidence at trial that the plaintiff is being compensated from alternative sources such as self-owned insurance (American Tort Reform Association, 2012). Collateral source rule reform typically requires that court awards be adjusted for compensation from other sources. Thus, total damages awarded at trial are offset by the amount paid to the plaintiff through other sources such as health insurance, auto insurance and workers compensation insurance.

C. Recent Studies of Tort reforms in Liability

The literature on tort reforms is vast and goes back at least 30 years. Previous studies have generally focused on three issues: whether tort limitations have affected the frequency and severity of claims (e.g. Browne and Puelz, 1999); whether tort reforms have affected insurance market quantities, such as premiums, losses, or loss ratios (Born et al., 2006); and whether tort reforms have had a direct influence on health market outcomes, including physician supply, the practice of defensive medicine, hospital expenditures and health insurance market indicators (Avraham et al., 2010).

Analyses of the first issue have provided strong evidence that limitations on tort liability reduce the frequency of claims and the size of claims (Sloan et al, 1989; Browne and Puelz, 1999; and Browne and Schmit, 2006). Analyses of the effect of tort reforms on insurance market quantities consistently indicate that tort reforms reduce insurance losses (Born and Viscusi, 1998, 1994 and Born et al., 2009), while studies on insurance premiums provide mixed results (Zuckerman et al., 1991; Lee et al., 1994; and Born and Viscusi, 1994). When examining the

1980s tort reforms, some researchers have found significant negative effects on general liability insurance costs but mixed evidence on medical malpractice insurance costs (e.g Viscusi et al., 1993). Analyses of the last issue provide evidence that medical malpractice tort reforms have had modest effects on defensive medicine and physician supply (Kessler et al., 1996, 2005 and Matsa, 2005), and that reforms lower the cost of health insurance to a certain extent (Avraham et al., 2010; Avraham and Schanzenbach, 2011; and Karl et al., 2013)[7].

With respect to the data structure in tort reform studies, there have been a number of papers examining the effect of liability reforms using either state level data (Viscusi, 1990; Blackmon and Zeckhauser, 1991; Viscusi, et al., 1993) or firm level data from the NAIC database (Born and Viscusi, 1994 and 1998; Viscusi and Born, 1995 and 2005). Since liability insurance claims may develop over long periods, Born et al., (2009) examine the long-run effects of tort reforms using the developed losses of insurers. Grace and Leverty (2012) show that restricting attention to 'permanent' tort reform (tort reform upheld constitutionally within the observation period) can enhance the results on insurance market quantities.

Although the content of reforms varies greatly across states (for example, the stringency of a cap is determined by the level and type of the cap), all of these papers quantify tort reform by using binary variables equal to one for all the years in which reforms are effective and zero otherwise. In this paper, we adopt this traditional method of using a dichotomous variable to indicate tort reform enactments.

III. Hypotheses and Variable Definitions

Our empirical analysis considers the timing of four major tort reforms on general torts from 1971 to 2005: caps on punitive damages, limitations on joint and several liability, caps on

[7] For example, Avraham et al., (2010) find that the enactments of various tort reforms decrease group self-insured health insurance premiums by 1 to 2 percent.

noneconomic damages, and collateral source rule reforms. Among those, caps on punitive damages and limitations on joint and severable liability usually apply to all torts rather than just medical malpractice, as shown in Figure 1 and Figure 2, whereas caps on noneconomic damages and collateral source rule reforms are often targeted exclusively at medical malpractice torts, as shown in Figures 3 to 6.

In the remainder of this section we describe the variables and how they connect to hypotheses suggested by theory concerning the influence of lobbying, public interest, political-institutional factors, state insurance regulation, and regional effects.

A. Hypotheses

We group the hypotheses that are relevant for our setting into four: Economic Interest Groups, Public Interest, Political-Institutional Arrangements, and Insurance Regulation Environments and State Spillover Hypotheses.

Economic Interest Groups Hypothesis

The Economic Interest Groups Hypothesis highlights the role of private interest groups in the legislative process. Lawyers, businesses, and insurance companies are all concentrated stakeholders with interest in tort reforms. Business and insurance lobbyists frequently cite increasing insurance losses and premiums to promote tort reform. Lawyers and injured parties, on the other hand, stand to gain from opposing tort reform. The Economic Interest Groups Hypothesis predicts that tort reform should be positively associated with the insurance lobby and medical lobby but negatively with the legal lobby.

Public Interest Hypothesis

The Public Interest Hypothesis, as formulated by Joskow and Noll (1981) stress a benevolent legislature with a primary concern of social welfare. Households are influenced by tort law but most do not belong to any organized interest group. However, if politicians pursue public interest, households may still carry considerable influence over the timing of tort reform. The government may be especially concerned if lawsuits are perceived to be affecting access to basic products or services.

While proxies for the public interest are difficult to isolate, we can measure how large the problem looms in the state economy by including incurred liability insurance losses/premiums in the state as a percentage of GDP. Another proxy is the number of tort cases filed. A positive association between either proxy and tort reforms is consistent with public interest theories, although it could also be argued to be consistent with the Economic Interest Groups Hypothesis as the extent of liability losses measure the stake that businesses have in tort reform.

Political-Institutional Arrangements

Tort reforms are often associated with Republicans rather than Democrats, suggesting that states controlled by Republicans may favor tort reform (e.g. Rubin and Shepherd, 2007; Finley, 2004). Moreover, one party controlling the legislature and the governorship should also be an advantage for tort reforms getting passed. The political ideology of the residents of each state may also influence the timing of enacting tort reform but the predicted effect is unknown. The political climate and economic environment could also be correlated within regional areas in the United States. For example, the labels “Republican” and “Democrat” may suggest different ideologies in different regions of the country.

Insurance Regulation Environments

There are eight types of rating regulation: state-made rates, prior approval without a deemed provision, prior approval with a deemed provision (rates deemed approved if no regulatory action is taken within a specified period), file-and-use, use-and-file, filing only, flex rating and file-and-use or use-and-file in a competitive market[8] (e.g. Born, Viscusi, and Baker, 2009). More stringent regulation may lead to more severe insurance market availability problems in the wake of a shock---accelerating the regulatory process in tort reform.

Auto liability insurance premiums account for a significant large proportion of liability insurance premiums. No-fault systems provide first party coverage for personal injury protection (medical cost, loss of income, etc.) while limiting the tort liability of negligent drivers. No-fault laws can reduce auto insurance costs if there are strong limitations on the right to sue (Harrington, 1994). In this sense, no-fault legislation could reduce cost pressures associated with tort environments that are in other respects permissive. However, the presence of a no-fault system could also create spillover effects to displace tort activity into other liability markets, or could be reflective of a societal willingness to experiment with tort reform generally. Thus, the predicted association between the presence of no-fault systems and the propensity to enact other tort reforms is not clear.

State Spillover Hypothesis

A state's tort reform enactment may affect the timing of its neighbors' tort reform enactments for several reasons. States may be concerned about businesses (e.g. entrepreneurs or physicians) moving out: if states' liability costs are higher than those of their neighbors, businesses may be driven away. Under this logic, a state is most influenced by the actions of those states to which its business may move. This would imply a change in civil justice system of one state, i.e. tort reform, may trigger a corresponding tort reform by neighboring states. Voters may also judge politicians' performance relative to that of politicians in nearby states. Besley

[8] Under file-and-use laws, rates are filed with the regulatory authority no later than the proposed effective date. Under a use-and-file law, rates are effective on the filer's chosen effective date and may be used prior to filing with the regulator. Under Flex-rating law, the percent ranges in which revisions for these markets may take effect without prior approval. Percentages usually range from 5 percent to 10 percent.

and Case (1995) provide evidence of "yardstick competition." This would imply that states are most influenced by the actions of those states that their voters judge to be the most similar (Baicker, 2001). All of this suggests that tort reforms in one state may have positive spillover effects on neighboring states.

B. Variable Definitions and Data Sources

We use employment in the insurance sector as a proxy for the power of the insurance lobby, and the number of lawyers in the state as a proxy for the power of the legal lobby. Lawyers per capita are obtained from the Lawyer Statistical Report and from the American Bar Association's annual report. One problem is that the data is not available for each year. We interpolate values for the years in which the data are not reported following the method used in previous studies (Schmit and Browne, 2008; and Leverty and Grace, 2012).[9]

Four variables are used to proxy state/national liability climate: insurance liability loss, insurance liability premiums, tort cases commenced at state level and national level. The measure of insurance liability loss is the ratio of directed loss incurred in the state to gross state product. The source for the information is loss data aggregated by state and year over the period 1971-2005 provided by A.M. Best. The analyses include aggregate loss incurred in medical malpractice, auto liability, other liability (including product liability before 1992), product liability, and commercial multiple liability.[10] The measure of insurance liability premiums is the ratio of directed premiums earned in the state to gross state product in that state.

[9] We have 21 years of reported data (1971, 1980, 1985, 1988 and thereafter). Similar to previous studies, I incorporate estimates for the other years, by using the 21 data points in the OLS regression model: $\text{lawyers per capita} = \mathrm{a} + \mathrm{b} \times \text{year} + \varepsilon$

[10] We also include four groups of liability insurance (i.e. other liability insurance loss, medical malpractice insurance loss, auto liability insurance loss and commercial multiple loss) separately into our regressions. We get similar results in unreported tables.

We measure the national liability climate with tort cases commenced in the U.S. federal courts nationwide per capita, using data from U.S Statistical Abstract. Jurisdictional rules only allow cases that involve questions of state law, but are 1) between citizens of different states or U.S. and foreign citizens and 2) involve more than $75,000 in losses, to be filed in federal court. The vast majority of tort cases are filed in state courts, not federal courts. Thus, we also use tort filings in general jurisdiction courts per capita as a substitute measure to proxy state liability climate. Such data are available for states from 1975 to 2005 from the National Center for State Courts.

Gross state product is used as a general indicator of economic activity connected with urbanization and business activity. Urbanization has been identified in previous research as a positively correlate of the rate of tort filings (Danzon, 1984a; and Lee et al., 1994) and has been connected with earlier enactment of tort reform according to Danzon (1984b). Business activity is also expected to be positive correlated with the rate of tort filings; for example, manufacturing and construction are major sources of product liability (Viscusi, 1991). The GSP data are from Bureau of Economic Analysis for each state for each year.

We create a continuous variable *State Spillover* to capture the influence of the process of tort reforms of nearby states. The variable measures the proportion of neighboring states enacting tort reforms before the state in question enacts tort reforms. Neighboring states are defined as states sharing a border with the state in question.[11]

The ratio of physician per capita is used as an indicator of the state's health service activities. The data are from U.S Statistical Abstract for each state for each year. This variable could reflect multiple influences. First, more physicians could lead to more malpractice and more

[11] For example, Florida shares borders with Georgia and Alabama. Georgia and Alabama enacted joint and several liability in 1988 and after 2005, respectively. Thus *State Spillover* for joint and several liability in Florida is 0 before 1988 and one half from 1988 to 2005.

tort cases. Second, physicians may lobby to promote tort reforms that can be applied to medical malpractice. Lastly, there may be a public interest in encouraging medical service, especially those in specialties facing high liability exposure such as obstetrics. Thus, less physicians or physicians moving out the state may result in states' earlier tort reform enactments.

We use three political variables from the U.S. statistical abstract. Following Kroszner and Strahan (1999), we measure the degree of Republicans control of the state government by the fraction of the three parts of the state government (the lower house, the upper house, and governorship) controlled by Republicans. For example, this variable is one-third if the Republicans control the lower house but the Democrats control the upper house and the governorship. Second, we create a dummy variable which equals one if the same party controls the governor's office and has majorities in both houses.[12] Finally, we use a measure of citizens' ideology in the state developed by Berry et al. (1998). This variable captures the political ideology of the residents in the state. The index has high value if the state's representatives in congress are liberal and low value if the state's representatives in congress are conservative (Grace and Leverty, 2012).

To measure the effect of state insurance laws, we create five variables. First, we use a dichotomous variable which equals one if punitive damages are insurable. Second, we construct an indicator variable that is one if the state requires prior approval rate regulation. Last, we include three variables relating to no-fault automobile insurance laws. No-fault systems with value thresholds make the right to sue conditional on compensatory damages exceeding a designated dollar amount. No-fault systems with a small dollar threshold may thus be ineffective

[12] We also tried three indicator variables reflecting party controls in the lower house, upper house and governorship separately. The coefficient estimates on these variables have same signs, and the results on other variables are unaffected by the changing of the political-institutional measures.

in limiting lawsuits. The benchmark variable *no-fault other* equals one for a tort law state or for a no-fault state with a low value threshold (less than $1000). Another variable, *no-fault high value*, equals one if a state has a dollar threshold greater than $1,000 and zero otherwise. States with verbal thresholds have the strictest no-fault system which allows the right to sue only in the cases where victims have severe damages such as death, disfigurement, or permanent loss of body function. The variable *no-fault verbal* equals one if the state has a verbal threshold and zero otherwise. The lagged indicators of no fault system are included in the analysis as instruments since the contemporary variables may be correlated with the error terms in the regression.

We also include two economic variables to represent economic conditions and four indicators to represent regional effects. We construct a credit spread variable to proxy the investment environment each year, which is the difference between the Moody's seasoned BAA corporate bond yield and the AAA corporate bond yield. We obtain the corporate bond yield data from Federal Reserve Bank of St. Louis' Federal Reserve economic database. Second, we construct income per capita to proxy the relative household wealth for each state each year. Last, we create four regional indicator variables representing the North, South, Midwest, and West.

All the variables and corresponding sources are described in detail in Table 2. Table 3 reports mean and standard deviations for the explanatory variables used in the analysis and the distribution of tort reforms across years. In total, there are 1750 observations (50 states with 35 years) in the whole sample.

IV. Methods and Empirical Results

In this section, we first use the non-parametric survival model to determine the shape of the baseline hazard function. Next we estimate how the economic and political variables described above are associated with the timing of the four individual state-level tort reform enactments using discrete time survival models with a Weibull baseline hazard. In this section, we treat each tort reform as "competing risk events," so that the duration time ends if any of four tort reforms is enacted. Last, we explore whether the factors that influence the timing of individual tort reforms also affect the timing of *any* of four state-level tort reforms with logit models.

A. Hazard Analysis with Nonparametric Estimates

To model the duration of the 'waiting period' before reform, we need to impose structure on the hazard function. The Kaplan-Meier product-limit estimator [13] provides a simple, nonparametric way to estimate the shape of the hazard function over time (Greene 2006). Figure 7 graphs survival estimates for the data and shows that each hazard function is relatively flat in the 1970's before dropping steeply in the mid-1980s and then becoming flat again. The graph also implies that joint and several liability limits have the shortest waiting time durations, followed by caps on punitive damages, collateral source rule reforms and caps on noneconomic damages. Table 4 presents the initial results of the state 'waiting period spells' by Kaplan-Meier product limit estimates. Column 1 displays the survival rate for states based on the enactment of *any* of the four tort reforms; 72% of states enact one or more of those tort reforms during the sample period. Column 2 through Column 5 shows survival rate by tort reforms during the sample period: 35% of states enacted caps on punitive damages, 55% enacted limitations on joint and several liability, 18% enacted collateral source rule reforms, and 13% of states enacted caps on noneconomic damages. Consistent with Figure 1 to Figure 6 shown in the Appendix, the null hypotheses of equalities of survival functions across the four tort reforms are rejected by log-

[13] The Kaplan-Meier product limit formula to estimate the survivorship function for the j^{th} year is $\hat{S}(t) = \prod_j \hat{P}r(T \geq t_j | T \geq t_j - 1) = \prod_j (1 - \frac{d_j}{r_j})$, where d_j is the number of states enacting tort reforms during j^{th} year and r_j is the number of states entering j^{th} year year.

rank tests. Survival rates when considering caps on noneconomic damages and collateral source rule reforms are significantly higher than when considering caps on punitive damages and joint and several liability, since fewer states enact the former two tort reforms. Table 4 shows that the survival rates when considering the enactment of any type of reform drops dramatically during the years of 1985 to 1989. However, the non-parametric method is limited because it cannot provide the impact of independent variables on the likelihood of events.

B. Discrete Time Proportional Hazard Model

Tort reform enactments and most of the independent variables are only observed once a year. This implies that the observed durations of tort reform should be grouped into yearly intervals. Moreover, since many of the tort reforms occurred in the mid-1970s or the mid-1980s as Table 1 shows, there exists the substantial problem of tied duration times. The Cox model (or any fully parameterized continuous time model) is inappropriate in this case (Cox and Oakes, 1984), because the Cox model is based on the assumption that duration times can be any real number (rather than certain discrete values corresponding to the number of years) and recorded duration times need to be ordered chronologically. The high number of ties and the discrete time property leads to estimation bias in both regression coefficients and in the corresponding covariance matrix.

That the duration variable of interest (time taken to enact the tort reform) is measured yearly means that the feasible approach to modeling the duration is the discrete-time proportional hazard model (also called discrete-time historical event model). The four tort reforms can be considered as “competing events” in the sense that the state can change its common law civil justice system by enacting different tort reforms. We consider the period from the beginning of the sample (1971) until any tort reform occurs as the duration of interest in the analysis. The states that enacted tort reforms before 1971 are excluded from the analysis as left censored data, but the states that had not enacted tort reform by 2005 remain in the sample as right censored data. The data structure of discrete-time duration models is time-series cross-section, which is organized with as many observations for each state in the sample as there are time periods over which the state is at risk of experiencing the event of interest (Jenkins, 1995)---the enactment of a tort reform. The core variable is discrete elapsed time and event occurrence is a series of binary outcomes denoting whether or not the event occurred at the observation point.

A survival model that can accommodate this structure is a discrete time proportional hazard model with Weibull baseline hazard.

$$h_i(t, X_{it}) = h_0(t)\exp(X_{it}'\beta) \quad \text{or} \quad \log[h_i(t, X_{it})] = \log[h_0(t)] + X_{it}'\beta \ (1)$$

where $h_i(t, X_{it})$ is the hazard rate function and $h_0(t)$ is the baseline hazard function and X_{it} is a vector of covariates. We use a complementary log-logistic hazard function rather than a logistic function since the process of enacting tort reform is intrinsically continuous but only the observations are in discrete time.[14] The discrete time hazard rate of enacting tort reform for state i in the t year with a vector of time-varying covariates, X_{it}, having spent $t-1$ years in the same common law civil justice systems can be given by:

$$h_i(X_{it}) = 1 - \exp(-\exp(\gamma(t) + X_{it}'\beta)),\ and\ \gamma(t) = log\int_{a_{t-1}}^{a_t} h_0(\tau)d\tau \ (2)$$

where $\gamma(t)$ represents the baseline hazard function of time which can be estimated either parametrically or nonparametrically. The above function can also be written in complementary log-log transformation:

$$log\left[-log\left(1 - h_t(X_{it})\right)\right] = \gamma(t) + X_{it}'\beta \ (3)$$

[14] Steele (2009) argues that the choice of binary model often has little impact on the results. To check the correctness of the proportional hazard specification, I have also estimated a discrete time logistic model and the results are very similar to complementary log-log.

To specify the baseline hazard function $\gamma(t)$, we consider the discrete-time specification similar to the Weibull model with a shape characterized by p: $\gamma(t) = \log(h_t)$=θlog(t), where θ in the discrete time case approximately corresponds to $p - 1$ in the continuous time Weibull model. If θ is greater than zero, the hazard increases monotonically, and if it is less than zero the hazard decreases monotonically. In addition, we cluster standard errors by state for each analysis since we have multiple observations across a state. The coefficients can be interpreted as the effect of covariates on the hazard rate of enacting tort reform. Positive coefficients indicate an increase in the hazard rate and thus a reduction in the duration of the 'waiting' period. The coefficients represent the percentage change in the hazard rate to tort reform enactments for a one-unit change in the covariates because we use proportional hazard model. The economic importance of coefficients on covariates can be evaluated by multiplying the coefficients by the standard deviation of the explanatory variables.

We first investigate how economic and political variables influence the timing of enacting tort reforms when considering these four reforms together. Table 5 column (1) shows the estimated effects of time varying covariates on the hazard rate of any type of tort reform enactment for the discrete time duration model with Weibull baseline hazard. Starting with the economic variables, higher *liability insurance loss* is found to be associated with a higher hazard rate of tort reform enactment: a one-standard-deviation increase in the *liability insurance loss* leads to a 90.02% increase in the hazard rate. A one-standard-deviation rise in tort cases in federal court increases the hazard rate by 45.35%. With regard to the political-institutional variables, the structure of the state government, i.e. the degree of Republican control, and single party dominating governorship and upper and lower houses, all have significantly positive impacts on the timing of tort reform. Specifically, a one-standard-deviation higher proportion of the *degree of republican control* leads to a 30.94% increase in the hazard rate. States controlled by the *same party* tend to have a 56.65% times higher hazard of tort reform. The positive coefficient on *lag of no-fault system with verbal threshold* implies that very strict no-fault systems speed up the timing of reforms but the effect is not statistically significant. In addition, *lawyer* also has a positive effect on the hazard rate of reform enactment. A one standard-deviation increase in lawyer results in a 121.2% higher probability of enacting any kind of tort reform. The regional dummies indicate that states in Northeast are associated with delayed timing of tort reform, which decrease the hazard rate by 95.25%.

With respect to insurance liability premiums[15] in column (2), a one-standard-deviation rise in premiums increases the hazard rate by 67.05%. The coefficient of tort cases in state general jurisdiction courts in column (3) indicates a one-standard-deviation rise in tort cases in state court increases hazard rate by 43.42%. The coefficient of *state spillover* is positive but not statistically significant. Finally, although there are some differences in the magnitude of the coefficients on *logarithm of duration time* across Table 5 and Table 6, the patterns of the baseline hazards all show increases with time and positive duration dependence, but the effect is not significant in Table 5. This is because the rate of tort reform enactment is not monotonically increasing, as the process of tort reform was significantly slower in the 2000s.

We then perform the analysis for each of the four reforms individually. Table 6 shows the results for the timing of the enactments of four individual tort reforms using the multinomial logit model. Model (1) uses liability insurance loss to proxy the liability environment while model (2) use tort cases filing in state courts. Specifically, there are 1352 (1172) observations in the regression for caps on punitive damages and 993 (807) observations in the regression for limitations on joint and several liability. The positive and statistically significant coefficient on

[15] The standard deviation of insurance premiums per GSP multiply 1000 for each state is 3.133

the *liability insurance loss* in column CP(1) implies that a larger insurance loss speeds up enacting caps on punitive damages, and this effect is economically important. The coefficient is 0.427, which means a one-standard-deviation increase in *liability insurance loss* per GSP results in a 119.5% higher probability of enacting caps on punitive damages. Similarly, column JS (1) shows that the coefficient of liability insurance loss with regarding to joint and several liability reform is 0.285, which means the hazard rate of tort reform enactment is higher by 81.62% with a one-standard-deviation rise in insurance loss. The positive and statistically significant coefficient on *tort cases* in column (JS) implies that more tort cases commenced in U.S federal courts are associated with accelerated enactments of the reform, and the effects are economically important. A one-standard-deviation increase in *tort cases in state court* results in a 50.19% times higher probability of enacting limitations on joint and several liability.

The structure of the state government influences the timing of joint and several liability reform as well. Consistent with the political-institutional theory, split control of the branches of government tends to delay limitations on joint and several liability. The hazard rate is 63.50% times higher for the state dominated by the *same party*. *Lawyer* has a positive effect on the hazard rate of limitations on joint and several liability. A one-standard-deviation increase in lawyer is associated with a 144.5% increase in the hazard rate. Moreover, the negative and statistically significant coefficient of physician indicates that fewer physicians accelerate the timing of joint and several liability reform. States with fewer physicians are found to have a higher hazard of enacting tort reform compared with their counterparts: a one-standard-deviation decrease in physicians is to increase the hazard rate by 178.2%.

Regional effects also appear to be present. The results suggest that states in the Midwest delay joint and several liability reform adoption significantly. The Northeast regional variables in both regressions are large in magnitude and have negative signs, which imply the two types of tort reforms occur later in the Northeast.

Turning to column CN(1) and column CS(1), there are 1541 observations in the regression for caps on noneconomic damages and 1383 observations in the regression for collateral source rule reforms. Consistent with expectations, both tort reforms occur earlier in states with larger *liability insurance loss per GSP*. In general, a one-standard-deviation increase in the liability insurance loss per GSP leads to an increase of 88.31% and 110.5% in the hazard rate of enactments of caps on noneconomic damages and collateral source rules, respectively. Collateral source rules occur earlier in states where people have less income. Specifically, relative to the mean annual income per capita, a one-standard-deviation increase is associated with a 34.17% lower hazard rate of enacting the tort reform.

The positive and statistically significant coefficient on tort cases in column CS(1) suggests that more tort cases commenced in U.S federal courts speed up enactment of collateral source rule reforms, and the effects are especially large and economically important. The hazard rate is 128.4% higher for one-standard-deviation increase in the tort case filings. The coefficients on most political-institutional variables are not statistically significant with related to collateral source rule reforms.

To summarize the results from the discrete time proportional hazard model in Table 5 and Table 6, public interest theory seems to be supported by the evidence on tort reform timing, with less clear evidence on interest group theory. The most consistent positive and significant results are those connecting insurance losses, tort cases, and insurance premiums with reform adoptions, which seem obviously consistent with a public interest theory. The former two variables (insurance losses and tort cases) could also be connected to the insurance industry and general business interest groups. Effects of the legal lobby and medical lobby are not found in the evidence, although the number of lawyers exhibits a positive and significant association with enactments and the number of physicians exhibits a negative association. Both of these findings could be interpreted as supportive of the public interest theory, or as indicators of higher liability/medical costs that could mobilize businesses to lobby for reform as predicted by the economic interest group theory. Political and institutional factors also help to explain the timing of tort reforms to some extent, as Republican control and one-party governments are both associated with quicker action. We do not find a linkage between the timing of tort reforms and state spillover effects either in Table 5 or in Table 6, although we find supportive evidence that no-fault systems are associated with quicker enactments of tort reforms.

V. Robustness Checks and Extensions

In this section, we discuss the robustness of the results by considering omitted variables problems and different estimation techniques. We use a discrete time proportional hazard model with a nonparametric baseline hazard to check the form of survival function. To consider the correlations of individual tort reform within states and use full information of our data, we use a "frailty model" to control for unobservable heterogeneity across states and a "marginal risk set model" which allows each tort reform to have its own baseline hazard function and adjusts the covariance matrix for the correlations. Fifth, we run a pooled time-series cross-section OLS regression with state-level dummies and a fractional logit model to identify whether time-series variation and/or cross-section variation drive tort reforms. Last, we estimate the *ex post* impact of tort reforms on insurance loss by fixed effect models.

A. Omitted Variables

In the process of enacting tort reforms, many states have enacted a variety of medical malpractice tort reforms to reduce award and settle amounts. One problem with other kinds of state tort reform concerns potential spillover effects. Specifically, medical malpractice tort reforms could either act on, or reflect changes in, the legislative atmosphere and liability climate in the states. To elaborate, enacting medical malpractice tort reform may partially relieve a tort liability crisis in a state, leading to a delayed enactment of tort reforms related to general liability. On the other hand, medical malpractice tort reform may provide a template for tort reform, or reflect changing attitudes in the state, and thereby be associated with a higher chance of passing general liability tort reform. Thus, these medical malpractice tort reforms may proxy for omitted variables that affect the timing of liability tort reform thereafter.

To proceed, we add four indicator variables to the same set of independent variables that are used in table 5 column (4), which equal to one if the state enacted corresponding medical malpractice tort reforms from 1971 to 2005. Table 5 column (4) shows the results after incorporating controls for medical malpractice tort reform. The coefficients on four medical malpractice tort reforms are mixed and not statistically significant even after we control for regional indicators. The signs of the other independent variables are the same and the magnitudes are virtually unchanged, which means the inclusion of medical malpractice tort reforms do not change the effects of results of previous analysis.

Next, we consider each state in each year up to and including the year of enacting either a medical malpractice tort reform or a general liability tort reform when we restructure the data into a new yearly file. This method may cause biased estimates since medical malpractice tort reforms apply only to medical malpractice and they would distort the duration periods. As shown in table 5 column (5), the coefficients on liability insurance loss, tort cases, income per capita, no-fault verbal indicator and lawyer per capita still keep the same signs and the coefficients do not change much, with a few noteworthy exceptions. First, although the coefficient estimates still suggests that degree of republican control and one party control speed up tort reforms in the state, the effects are no longer statistically significant. The coefficient on *no-fault system with value threshold larger than $1000*, however, now becomes negative and statistically significant.

B. Permanent Tort reforms

Tort reforms are subject to judicial challenge and future unconstitutionality. States enact tort reforms that declared unconstitutional (temporary) and those that are unchallenged or upheld (permanent) may have different hazard ratio, i.e. the propensity of passing temporary tort reform or permanent tort reform is different. Grace and Leverty (2012) document that 27% of medical liability tort reforms are unconstitutional and provide evidence that interested groups (e.g. insurers and customers) rationally expect tort reforms to be permanent or temporary. In our study, 18% of (19 out of 106) tort reforms on general liability are declared unconstitutional. To further capture states' decision to enact permanent tort reforms, we investigation the timing of enacting permanent tort reforms by including the observations in one state until the state enacts a permanent tort reforms. We redo the survival analysis mentioned above.

Our results in Table 7 column (1) are largely unaffected by the switch to permanent tort reforms. With the exception of *degree of Republican control* variable, the signs of the other independent variables are the same and the magnitudes are virtually unchanged, which means the analysis of permanent tort reforms do not change the effects of results of previous analysis. The *degree of Republican control* variable keeps the positive sign but is no longer statistically significant.

C. **Different Estimation Techniques.**

To check the robustness of the discrete time proportional hazard model with a Weibull baseline hazard, we use a discrete time proportional hazard model with a nonparametric baseline hazard. To eliminate assumptions about the functional form of the baseline hazard rate, we add duration dummy variables for time intervals to the same covariates that are used in the parametric model. This method requires events to occur in each period *j* since the hazard rate cannot be estimated for a period with no events. Since our data has a large number of ties with no events in some years, we split the spell times into decades with four dummies representing the 1970s, 1980s, 1990s and 2000s to ensure that there are events occurring in each time interval. The model can then calculate the hazard rate for each decade interval. The results are shown in Table 5 column (6). The signs of the significant coefficients on the *liability insurance loss*, *tort cases in federal court*, *degree of Republican control*, *same party*, *lag of no-fault verbal* indicator and *Northeast* indicator are largely consistent with the results from the model with the Weibull baseline hazard. However, the coefficients on *income per capita* are now significantly positive and *lawyer* per capita is no longer statistically significant.

Another issue that arises when investigating the timing of state enactment of any of four tort reforms (and ignoring additional tort reforms) is that some states may pass tort reforms gradually while others pass reforms as a "package." Thus, considering only the first passing of any of the four tort reforms wastes potentially relevant information. The analysis of individual tort reforms makes use of all available data while accounting for the lack of independence of the failure times. We correct the issues by stacking individual tort reforms data and applying the "frailty" model (Jenkins, 1995 and 1997) and the "marginal risk set" model (Wei, Lin and Weissfeld, 1989; Spiekerman and Lin, 1996; Box-Steffensmeier and Zorn, 2002). The frailty model explicitly models the association between the timing of tort reforms enacting within a state as a random-effect term. The equation 2 is extended as:

$$h_i(X_{it}) = 1 - \exp(-\exp(\gamma(t) + X_{it}\beta + u_i))\,, \gamma(t) = log \int_{a_{t-1}}^{a_t} h_0(\tau) d\tau$$

$$u_i \sim N(0, \sigma_u^2) \quad (4)$$

u_i represents random effects which are state-specific unobservables and σ_u^2 represents unobserved heterogeneity. To consider that different tort reforms have different baseline hazard functions, we also stratify the data on types of tort reforms and use the marginal risk set model (also called the variance-corrected model), allowing each stratum (tort reform) to have its own baseline hazard function while adjusting the covariance matrix of the estimators to account for the correlations (Box-Steffensmeier and Zorn, 2002). We report the results of frailty model in Table 7 column (3) and results of marginal risk set model in Table 7 column (4), respectively.

The results are largely consistent with those already reported. One difference is the state spillover variable, which becomes large and statistically significant. The results are consistent with the notion that states respond to the actions of their competitors with tort reforms, and that this response is sensitive to the perceived constitutional strength of the reform in the competing state.

D. Time-series Variation vs. Cross-section Variation

To check whether the time series variation in our data accounts for the hazard model results rather than the cross section variation in the data, we estimate two linear probability models with the same set of regressors used in the other models. First, we run a pooled time-series cross-section OLS regression with state-level fixed effects for all five models (any of four tort reforms, caps on punitive damages, joint and severable liability, caps on noneconomic damages, and collateral source rule). Using the same observations from hazard models, this model eliminates the cross-state variations from the covariates and emphasizes the time variation. Table 8 reports the results, and the signs of the coefficients on insurance loss and tort cases filed in state courts and federal courts are statistically significant and the signs are the same with the results from discrete time model. The results suggest that the effects of insurance losses and tort cases commenced persist even after accounting for cross-sectional variation in the states. Second, we average every independent variable over time and thus have one observation per state if it enters into the analysis sample. We invert the duration time until enacting tort reforms to get the estimate probability of tort reform for each state. For those states that had not enacted tort reforms by 2005, the probability is set to zero. This method implies that the probability is constant over time and removes the time-series variation of data. We apply the fractional logit model to the restructured data since the dependent variable is between zero and one. The results are shown in table 9. Although we have no more than 50 observations in each regressions, the coefficients on *income per capita*, *degree of Republican control, lawyer* and *GSP per capita* are generally consistent with signs of previous models and statistically significant. The results of the fractional logit models suggest that the effects these variables may be driven primarily by cross-section variation..

D. Ex-Post Consequences of Tort Reforms

To check whether the ex-post consequence of tort reform is consistent with reductions in liability costs as shown in the previous literature, we measure the effects of all four tort reforms on the insurance loss across different liability lines. We use fixed effect models relating indicators for each tort reform to potential consequences. The dependent variables representing insurance loss are the direct loss incurred of different insurance liability lines scaled by gross state product and multiplied by 1000 for each state in that year. The responses of liability insurance are known to be sensitive to the insurance type (Viscusi et al., 1993), so we divided the liability lines into four different lines rather than combining them. Loss from four different liability lines are tested: loss of other liability insurance (including other liability insurance and product liability insurance), loss of auto liability insurance (including all auto liability insurance lines), and loss of medical malpractice liability. In total, there are 1750 observations with 50 states for 35 years for automobile liability and other liability, while 1550 observation with 50 states for 31 years (after the year of 1974) for medical liability.[16] We add state dummies and year dummies for each regression and use no-fault system and medical liability tort reforms as control variables in the auto liability insurance regression and medical malpractice insurance regression, separately. The four tort reform indicators are equal to one in the years when the tort reforms are effective and zero otherwise.

According to Table 10 and Table 11, we find that caps on noneconomic damages and joint and several liability are of the expected negative signs in all four of the equations, and are statistically significant in the case of the loss of other liability insurance. The coefficient on caps on noneconomic damages is also significant in the loss of auto liability insurance regression, but the coefficient on joint and several liability is not statistically significant. In any case, coefficients on caps on noneconomic damages are larger in absolute value than any of the negative coefficients on other tort reforms. Our results are in line with prior literature studying the effect of tort reforms on insurance market (e.g. Born and Viscusi, 1998, 1994 and Born et al., 2009). However, coefficients on collateral source rule reforms and caps on punitive damages are not statistically significant in any of the regressions and the signs are mixed. None of the general tort reform indicators are statistically significant in the loss of medical malpractice insurance. Since there may be multicollinearity among the four tort reforms, we also run regressions where

[16] Medical malpractice insurance is separated from the other liability line beginning in the year of 1975.

each tort reform enters the models separately and the results are very similar, as shown in Table 11.

V. Conclusions

Our most robust and economically significant findings are that measures of litigation activity---such as insurance losses and tort cases filed---are associated with tort reform enactments. These findings are broadly consistent with public interest theories of regulation, and generally with the idea that states respond to liability cost problems with tort reforms. The findings can also be interpreted as being consistent with economic interest theories to the extent that the litigation activity measures reflect the interests of the business community and of the insurance industry.

We find no evidence of the influence of the medical or the legal lobby. Lawyers per capita are consistently associated with quicker reform enactments, while physicians per capita are associated with slower enactments. We also find very little evidence of an insurance industry lobby.

We also find that political-institutional factors, such as Republican control and control of the government by the same party, and insurance regulation environments affect tort reform, although these variables are not significant in all specifications.

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Appendix A: Tables

Table 1 Year of the First Tort Reform Legislation on Liability, by State

State	Caps on Noneconomic Damages	Caps on Punitive Damages	Collateral Source	Joint and Several Liability	Four Tort Reforms
AL	1987	1987	1987	****	1987
AK	1986	1998	1986	1986	1986
AZ	****	****	****	1987	1987
AR	****	2003	****	2003	2003
CA	****	****	****	1986	1986
CO	1986	1987	1987	1987	1987
CT	****	****	1985	1987	1985
DE	****	****	****	****	****
FL	1987	1987	1975	1987	1975
GA	****	1988	1988	1988	1988
HI	1987	****	1987	1987	1987
ID	1988	2004	1990	1988	1988
IL	1995	1995	1987	1987	1987
IN	****	1995	1987	1985	1985
IA	****	****	1987	1984	1984
KS	1989	1989	1989	1975	1975
KY	****	****	1989	1989	1989
LA	****	<1971	****	1981	<1971
ME	****	****	****	****	****
MD	1986	****	****	****	1986
MA	****	****	****	****	****
MI	****	<1971	1986	1987	<1971
MN	1986	****	1985	1989	1985
MS	****	2003	****	1990	1990
MO	****	****	****	1987	1987
MT	****	1985	1988	1988	1985
NE	****	<1971	****	1992	<1971
NV	****	1989	****	1973	1973
NH	****	1986	****	1990	1986
NJ	****	1996	1988	1988	1988
NM	****	****	****	1982	1982
NY	****	****	****	1987	1987
NC	****	1996	****	****	1996
ND	****	1993	1977	1988	1977
OH	****	1997	1988	1997	1988
OK	****	1996	****	1973	1973
OR	1988	****	1988	1976	1976
PA	****	****	****	2002	2002
RI	****	****	****	****	****
SC	****	****	****	****	****
SD	****	****	****	<1971	<1971
TN	****	****	****	1992	1992
TX	****	1988	****	1986	1986
UT	****	****	****	1986	1986
VT	****	****	****	<1971	<1971
VA	****	1989	****	****	1989
WA	1986	<1971	****	1986	<1971
WV	****	****	****	****	****
WI	****	****	****	1995	1995
WY	****	****	****	1986	1986

Table 2 Variable Definitions and Sources

	Definition	Sources
Tort reforms		
Caps on punitive damages	An indicator variable equals to 1 if state set a cap on the recovery of punitive damages	Tort reform: American Tort Reform Association (www.atra.org) and Avraham (2011)
Joint and Several liability	An indicator variable equals to 1 if state limited a party's responsibility for damages to a percent of total damages corresponding to that party's degree of fault	
Noneconomic damage caps	An indicator variable equals to 1 if state enacted a cap on the size of compensation for injured persons due to intangible but real injuries such as pain and suffering.	
Collateral source rule	An indicator variable equals to 1 if state permit insurance recovery from a victim's first party insurer to offset the damage judgment	
Economics variables		
Liability insurance loss/premiums	Direct loss incurred/direct premiums earned of other liability (including other liability, auto liability and commercial multiple-peril liability) scaled by GSP multiply 1000 for each state	Insurance data: AM best Report, 1971-2005
Employment in insurer	Ratio of the number of employees in insurance carriers divided by the number of state population multiply by 1,000 in a state	Bureau of Economic Analysis
Credit spread	The difference of AAA corporate bond yield minus BBA corporate bond yield for each year	Federal Reserve Bank of St. Louis' Federal Reserve Economic database
Income per capita	Income divided by the total population in a state scaled by 1,000	
GSP per capita	Gross domestic product divided by the total population scaled by 1,000 in a state	Bureau of Economic Analysis
Politics and law variables		
Degree of Republican Control	The fraction of the three parts of the state government (the lower house, the upper house and the governorship) controlled by Republicans	Statistical Abstract of the United States, 1971-2005
Same party	If the same party controls the governor's office and has majorities in the lower house and the upper house.	
Citizen ideology	A measure of the ideology of a state's citizens, in which 0 is the most conservative and 100 is the most liberal	Berry et.al (1998)
Tort cases in state court	Tort cases commenced in state general jurisdiction courts divided by the number of annual population multiple by 1,000 each year	National Center for State Courts, 1975-2005
Tort cases in federal court	Tort cases commenced in U.S. federal courts divided by the number of annual population multiple by 10,000 each year	Statistical Abstract of the United States, 1971-2005
Rate regulation	An indicator variable equals to 1 if the state applies prior approval rate regulation, 0 otherwise	American Insurance Association, Summary of State Laws and Regulations relating to Insurance, 1971-2005
Punitive damages insurable	An indicator variable equals to 1 if state allowed punitive damages to be insured	
No-fault verbal	An indicator variable equals to 1 if state adopted "pure" no-fault insurance with verbal threshold	
No-fault high value	An indicator variable equals to 1 if state adopted "pure" no-fault insurance with threshold larger than $1,000	
No-fault other	An indicator variable equals to 1 if state adopted "pure" no-fault insurance with threshold less than $1,000 and tort system	
Other variables		
Lawyer	Ratio of the number of Lawyers to the total population in a state multiplied by 10,000	The lawyer Statistical Report, various years
Physicians	Ratio of the number of physicians to the total population in a state multiplied by 10,000	Statistical Abstract of the United States, 1971-2005
State spillovers	The proportion of states surrounding the state passing tort reforms before the state enacts the tort reform	
South	An indicator variable equals to 1 if states are in AL, AR, FL, GA, KY, LA, MS, NC, OK, SC, TN, TX, VA, and WA	
Midwest	An indicator variable equals to 1 if states are in IA, IL, IN, KS, MI, MN, MO, NE, ND, OH, SD, and WI	
Northeast	An indicator variable equals to 1 if states are in CT, MA, MD, ME, NH, NJ, NY, PA, RI, VT, and WV	
West	An indicator variable equals to 1 if states are in other states	

Table 3 Summary Statistics of Tort Reforms and Variables in Analysis, 1971-2005

Variable	Whole Sample	Four Tort Reforms	Caps on Punitive Damages	Joint and Several	Collateral Source	Caps on Non-economic Damages
Economic Characteristics						
Liability insurance loss	8.811	8.306	8.650	8.381	8.600	8.728
	(2.725)	(2.904)	(2.799)	(2.864)	(2.748)	(2.777)
Employment in insurer	5.855	5.207	5.593	5.317	5.421	5.777
	(3.345)	(2.676)	(3.358)	(2.715)	(2.822)	(3.399)
Credit spread	1.082	1.220	1.125	1.205	1.134	1.113
	(0.397)	(0.423)	(0.409)	(0.419)	(0.411)	(0.407)
Income per capita	17.15	11.869	15.451	12.68	15.167	15.963
	(9.418)	(7.29)	(8.946)	(7.866)	(8.925)	(9.151)
GSP per capita	20.491	14.371	18.543	15.192	18.195	19.093
	(11.398)	(9.436)	(11.006)	(9.721)	(10.84)	(11.051)
Political Characteristics						
Degree of republicans control	0.410	0.319	0.375	0.326	0.380	0.402
	(0.351)	(0.322)	(0.341)	(0.325)	(0.344)	(0.351)
Same party	0.466	0.488	0.468	0.486	0.473	0.471
	(0.499)	(0.500)	(0.499)	(0.500)	(0.499)	(0.499)
Citizen ideology	47.324	48.037	48.433	47.807	46.858	46.983
	(15.602)	(16.724)	(16.447)	(16.521)	(15.996)	(15.626)
Tort cases in state court	1.111	0.737	1.034	0.789	0.921	1.022
	(1.558)	(1.296)	(1.513)	(1.287)	(1.368)	(1.609)
Tort cases in federal court	1.538	1.387	1.495	1.41	1.487	1.509
	(0.368)	(0.31)	(0.352)	(0.321)	(0.357)	(0.362)
Rate regulation	0.583	0.643	0.548	0.641	0.619	0.592
	(0.493)	(0.479)	(0.498)	(0.48)	(0.486)	(0.492)
Punitive damage insurable	0.560	0.591	0.583	0.585	0.576	0.566
	(0.497)	(0.492)	(0.493)	(0.493)	(0.494)	(0.496)
Lag of no-fault verbal	0.072	0.031	0.049	0.052	0.044	0.070
	(0.259)	(0.174)	(0.217)	(0.222)	(0.205)	(0.255)
Lag of no-fault high value	0.164	0.096	0.135	0.115	0.098	0.133
	(0.370)	(0.295)	(0.342)	(0.32)	(0.298)	(0.34)
Lag of no-fault other	0.764	0.873	0.816	0.832	0.858	0.797
	(0.569)	(0.417)	(0.499)	(0.494)	(0.459)	(0.55)
Other variables						
Lawyer	24.704	21.725	23.963	21.981	23.377	23.838
	(9.321)	(8.785)	(9.566)	(8.355)	(8.778)	(9.237)
Physician	19.435	18.130	19.21	18.437	18.942	19.023
	(6.547)	(7.163)	(7.123)	(7.127)	(6.841)	(6.524)
State spillover	0.531	0.306	0.199	0.246	0.133	0.063
	(0.368)	(0.312)	(0.238)	(0.293)	(0.207)	(0.118)
West	0.280	0.263	0.288	0.24	0.278	0.247
	(0.449)	(0.441)	(0.453)	(0.427)	(0.448)	(0.432)
Midwest	0.240	0.172	0.217	0.198	0.200	0.243
	(0.427)	(0.377)	(0.412)	(0.398)	(0.400)	(0.429)
South	0.280	0.302	0.258	0.318	0.296	0.295
	(0.449)	(0.459)	(0.438)	(0.466)	(0.457)	(0.456)
Northeast	0.200	0.263	0.237	0.245	0.226	0.215
	(0.400)	(0.441)	(0.426)	(0.43)	(0.419)	(0.411)
Average waiting time	—	18.909	29.478	20.770	27.660	30.821
Observations	1750	832	1356	997	1383	1541

Table 4 Estimated Survivor Functions: Kaplan-Meier Estimates, by Tort Reforms on Liability

Year	Four Tort Reform Survival	Caps on punitive damage	Joint and Several	Collateral Source	Caps on non-economic damage
1971	1.000 (—)	1.000 (—)	1.000 (—)	1.000 (—)	1.000 (—)
1972	1.000 (—)	1.000 (—))	1.000 (—)	1.000 (—)	1.000 (—)
1973	0.997 (0.003)	1.000 (—)	0.997 (0.002)	1.000 (—)	1.000 (—)
1974	0.997 (0.003)	1.000 (—)	0.997 (0.002)	1.000 (—)	1.000 (—)
1975	0.985 (0.005)	1.000 (—)	0.992 (0.003)	0.997 (0.002)	1.000 (—)
1976	0.978 (0.006)	1.000 (—)	0.987 (0.004)	0.997 (0.002)	1.000 (—)
1977	0.970 (0.006)	1.000 (—)	0.987 (0.004)	0.992 (0.002)	1.000 (—)
1978	0.970 (0.006)	1.000 (—)	0.987 (0.004)	0.992 (0.002)	1.000 (—)
1979	0.970 (0.006)	1.000 (—)	0.987 (0.004)	0.992 (0.002)	1.000 (—)
1980	0.970 (0.006)	1.000 (—))	0.987 (0.004)	0.992 (0.002)	1.000 (—)
1981	0.970 (0.006)	1.000 (—)	0.977 (0.005)	0.992 (0.002)	1.000 (—)
1982	0.950 (0.007)	1.000 (—)	0.967 (0.006)	0.992 (0.002)	1.000 (—)
1983	0.950 (0.007)	1.000 (—)	0.967 (0.006)	0.992 (0.002)	1.000 (—)
1984	0.956 (0.008)	1.000 (—)	0.952 (0.007)	0.992 (0.002)	1.000 (—)
1985	0.940 (0.012)	0.977 (0.004)	0.952 (0.007)	0.971 (0.004)	1.000 (—)
1986	0.871 (0.014)	0.977 (0.004)	0.862 (0.011)	0.960 (0.005)	0.969 (0.004)
1987	0.779 (0.016)	0.927 (0.007)	0.751 (0.013)	0.913 (0.007)	0.937 (0.006)
1988	0.622 (0.017)	0.887 (0.009)	0.668 (0.014)	0.863 (0.009)	0.914 (0.007)
1989	0.560 (0.017)	0.858 (0.010)	0.632 (0.015)	0.837 (0.010)	0.902 (0.008)
1990	0.494 (0.017)	0.858 (0.010)	0.595 (0.015)	0.823 (0.010)	0.902 (0.008)
1991	0.494 (0.017)	0.858 (0.010)	0.595 (0.015)	0.823 (0.010)	0.902 (0.008)
1992	0.471 (0.017)	0.858 (0.010)	0.554 (0.015)	0.823 (0.010)	0.888 (0.008)
1993	0.471 (0.017)	0.841 (0.010)	0.554 (0.015)	0.823 (0.010)	0.888 (0.008)
1994	0.446 (0.017)	0.841 (0.010)	0.511 (0.015)	0.823 (0.010)	0.888 (0.008)
1995	0.446 (0.017)	0.823 (0.010)	0.511 (0.015)	0.823 (0.010)	0.872 (0.009)
1996	0.388 (0.017)	0.765 (0.011)	0.511 (0.015)	0.823 (0.010)	0.872 (0.009)
1997	0.357 (0.016)	0.745 (0.012)	0.485 (0.015)	0.823 (0.010)	0.872 (0.009)
1998	0.357 (0.016)	0.724 (0.012)	0.485 (0.015)	0.823 (0.010)	0.872 (0.009)
1999	0.357 (0.016)	0.724 (0.012)	0.485 (0.015)	0.823 (0.010)	0.872 (0.009)
2000	0.357 (0.016)	0.724 (0.012)	0.485 (0.015)	0.823 (0.010)	0.872 (0.009)
2001	0.357 (0.016)	0.724 (0.012)	0.485 (0.015)	0.823 (0.010)	0.872 (0.009)
2002	0.320 (0.016)	0.724 (0.012)	0.455 (0.015)	0.823 (0.010)	0.872 (0.009)
2003	0.282 (0.015)	0.675 (0.012)	0.455 (0.015)	0.823 (0.010)	0.872 (0.009)
2004	0.282 (0.015)	0.650 (0.013)	0.455 (0.015)	0.823 (0.010)	0.872 (0.009)
2005	0.282 (0.015)	0.650 (0.013)	0.455 (0.015)	0.823 (0.010)	0.872 (0.009)

Table 5 Discrete Time Proportional Hazard Model with Weibull Baseline Hazard of the Timing of Political and Economic Variables Influencing Any Tort Reform Legislation on Liability and Robustness Checks, 1971-2005

	(1)	(2)	(3)	(4)	(5)	(6)
Liability insurance loss	0.310***	—	—	0.308***	0.336***	0.258***
	(0.081)			(0.107)	(0.089)	(0.084)
Liability insurance premium	—	0.214***	—	—	—	—
		(0.082)				
Tort cases in state court	—	—	0.335***	—	—	—
			(0.114)			
State spillover	0.065	0.021	0.245	0.964	0.065	0.475
	(0.877)	(0.970)	(0.872)	(0.752)	(0.917)	(0.846)
Credit spread	0.396	0.746	0.642	0.062	0.442	0.400
	(0.547)	(0.527)	(0.507)	(0.438)	(0.574)	(1.017)
Income per capita	-0.009	-0.057	-0.048	-0.468***	-0.026	0.613***
	(0.105)	(0.120)	(0.151)	(0.159)	(0.114)	(0.167)
GSP per capita	-0.023	0.010	-0.063	0.177	-0.009	-0.017**
	(0.051)	(0.055)	(0.057)	(0.110)	(0.056)	(0.075)
Degree of Republicans control	0.961*	0.998*	1.174*	0.473	1.137*	0.961*
	(0.570)	(0.569)	(0.675)	(0.689)	(0.633)	(0.568)
Same Party	1.133**	0.910**	0.786*	-0.049	1.145**	1.228**
	(0.414)	(0.460)	(0.479)	(0.407)	(0.486)	(0.548)
Citizen ideology	-0.016	-0.018	0.001	-0.002	-0.013	-0.010
	(0.019)	(0.019)	(0.022)	(0.018)	(0.020)	(0.018)
Tort cases in federal court	1.463**	1.506**	2.164***	2.071***	1.400**	1.138
	(0.646)	(0.633)	(0.678)	(0.787)	(0.608)	(0.923)
Employment in insurer	0.101	0.109	0.203	0.094	0.073	0.112
	(0.169)	(0.178)	(0.162)	(0.060)	(0.184)	(0.237)
Physicians	-0.177	-0.143	-0.104	-0.003	-0.157	-0.265**
	(0.113)	(0.119)	(0.111)	(0.070)	(0.098)	(0.124)
Lawyer	0.138***	0.109**	0.090*	0.099*	0.148***	0.732
	(0.045)	(0.045)	(0.052)	(0.055)	(0.047)	(0.472)
Lag of no-fault verbal	0.919	1.065	1.562	1.582	0.948	2.238**
	(0.911)	(1.059)	(1.127)	(1.124)	(1.100)	(1.060)
Lag of no-fault high value	-0.181	-0.041	0.139	-1.392***	-0.514	-0.396
	(0.509)	(0.524)	(0.620)	(0.475)	(0.648)	(0.545)
Punitive damages insurable	0.244	0.015	0.574	0.287	0.169	-0.113
	(0.683)	(0.735)	(0.704)	(0.587)	(0.684)	(0.723)
Rate regulation	-0.084	-0.154	-0.122	0.457	0.090	0.359
	(0.607)	(0.631)	(0.632)	(0.535)	(0.688)	(0.634)
Log of duration time	0.279	0.564	1.090	0.696	0.288	—
	(0.486)	(0.544)	(1.312)	(0.443)	(0.517)	
Duration dummies in 1970s	—	—	—	—	—	8.467***
						(2.336)
Duration dummies in 1980s	—	—	—	—	—	6.725***
						(1.671)
Duration dummies in 1990s	—	—	—	—	—	2.680**
						(1.364)
South	-0.640	-0.544	-0.323	-0.572	-0.553	-0.820
	(0.564)	(0.545)	(0.520)	(0.664)	(0.538)	(0.528)
Midwest	0.0209	-0.200	-0.260	0.600	0.128	-0.552
	(0.773)	(0.809)	(0.821)	(0.501)	(0.832)	(1.041)
Northeast	-2.160*	-2.030	-2.025	-1.660	-2.524*	-3.513**
	(1.115)	(1.290)	(1.437)	(1.061)	(1.293)	(1.563)

Table 5 continuous

	(1)	(2)	(3)	(4)	(5)	(6)
Medical caps on noneconomic damages	—	—	—	1.504	—	—
				(0.973)		
Medical collateral source	—	—	—	-1.211	—	—
				(0.802)		
Medical caps on punitive damages	—	—	—	-0.0989	—	—
				(0.935)		
Medical joint and several	—	—	—	-3.682*	—	—
				(2.171)		
Constant	-8.974***	-9.565***	-10.603***	- 9.724***	-9.486***	-17.001***
	(1.897)	(2.249)	(2.836)	(2.287)	(1.694)	(4.060)
Log pseudolikelihood	-120.822	-127.744	-114.303	-120.113	-126.412	-109.896
Wald Chi2	222.24	207.63	216.77	266.61	107.03	167.73
Observations	832	832	658	832	544	832

The dependent variable for this model is binary which equals one if a state enacting any type of tort reform in that year and zero otherwise. Observations of each state are included in the analyses until the state passed the tort reform. Tort case in federal court and credit spread are measured yearly from 1971 to 2005. All other variables are measured for each state in each year from 1971 to 2005. All the variables are described as in table 1. Column (1) reports results of the discrete time hazard model with Weibull baseline hazard and has 832 observations. Column (2) replaces liability insurance loss with liability insurance premium. Column (3) replaces liability insurance loss with tort cases filings in state courts and has 658 observations since it uses samples after 1975. Column (4) is the robustness check by adding medical malpractice tort reforms. Column (5) is robustness check by incorporating medical malpractice tort reforms when we calculate the duration time until the state enacting any type of tort reforms, which has 544 observations. The results of discrete time hazard model with four duration dummies baseline hazard are reported in column (6). Cluster standard errors are showed in the parentheses. ***, **, and * denote statistically significant at the 1, 5, and 10 percent levels.

Table 6 Discrete Time hazard model of Political Economy Factors Influencing the Timing of State Enacting Four Individual Tort Reform, 1971-2005

	CP (1)	CP (2)	JS (1)	JS (2)	CN (1)	CN (2)	CS (1)	CS (2)
Liability insurance loss	0.427***	—	0.285***	—	0.318**	—	0.402***	—
	(0.135)		(0.069)		(0.155)		(0.110)	
Tort cases in state court	—	0.264	—	0.390***	—	0.398*	—	0.458***
		(0.266)		(0.118)		(0.211)		(0.169)
State Spillover	-3.503*	-4.541**	0.417	0.013	0.823	0.942	3.090**	2.814*
	(1.984)	(2.156)	(0.726)	(0.829)	(2.814)	(2.597)	(1.498)	(1.510)
Credit spread	-0.758	-0.521	-0.038	0.244	1.563	1.689	-0.345	-0.348
	(0.573)	(0.523)	(0.557)	(0.536)	(1.231)	(1.229)	(0.749)	(0.570)
Income per capita	0.444*	0.603**	-0.055	-0.245	-0.180	-0.311	-0.438***	-0.538***
	(0.235)	(0.294)	(0.122)	(0.195)	(0.209)	(0.243)	(0.097)	(0.150)
GSP per capita	-0.275**	-0.454***	0.010	-0.016	0.029	-0.011	0.097**	0.028
	(0.126)	(0.151)	(0.048)	(0.061)	(0.104)	(0.111)	(0.040)	(0.050)
Degree of republicans	2.087**	2.044**	0.873	1.294*	0.097	-0.216	1.221	0.749
control	(0.998)	(1.025)	(0.583)	(0.684)	(1.046)	(1.004)	(0.756)	(0.779)
Same party	-0.534	-0.626	1.270***	1.038**	0.642	0.556	0.328	0.139
	(0.632)	(0.639)	(0.484)	(0.463)	(0.608)	(0.603)	(0.617)	(0.627)
Citizen ideology	-0.073***	-0.048*	0.009	0.030	0.026	0.045	0.064**	0.086**
	(0.028)	(0.027)	(0.020)	(0.024)	(0.035)	(0.036)	(0.032)	(0.034)
Tort cases in federal court	1.707***	1.507***	0.821*	1.202**	3.657***	3.798***	2.955***	3.547***
	(0.508)	(0.518)	(0.459)	(0.578)	(0.908)	(1.189)	(0.633)	(0.773)
Employment in insurer	-0.113	-0.0845	0.050	0.224**	0.039	0.174	0.419***	0.530***
	(0.198)	(0.184)	(0.127)	(0.100)	(0.176)	(0.179)	(0.161)	(0.205)
Physicians	-0.194	-0.229**	-0.250***	-0.188**	-0.160	-0.159	-0.475***	-0.461***
	(0.121)	(0.108)	(0.075)	(0.085)	(0.145)	(0.150)	(0.098)	(0.103)
Lawyer	0.073	0.090	0.173***	0.166***	0.151**	0.189***	0.268***	0.274***
	(0.059)	(0.063)	(0.039)	(0.054)	(0.062)	(0.069)	(0.066)	(0.079)
Lag of no-fault verbal	-1.808	-1.222	0.744	1.228*	-1.978	-1.699	-0.617	-0.034
	(2.015)	(2.426)	(0.628)	(0.637)	(1.624)	(1.678)	(1.623)	(1.431)
Lag of no-fault high value	2.055**	1.996**	-0.193	0.162	1.572**	1.487*	2.910***	2.900***
	(0.949)	(0.976)	(0.553)	(0.614)	(0.752)	(0.765)	(0.783)	(0.870)
Punitive damages insurable	1.005	0.747	0.105	0.651	-0.289	-0.133	1.333**	1.136*
	(0.684)	(0.614)	(0.526)	(0.454)	(0.779)	(0.793)	(0.659)	(0.690)
Rate regulation	1.573**	1.261*	-0.057	-0.248	0.417	0.076	-0.055	-0.256
	(0.646)	(0.718)	(0.509)	(0.473)	(0.717)	(0.684)	(0.726)	(0.719)
Log duration time	0.369	1.484	0.779	3.820*	0.884	3.153	1.370	3.246
	(0.716)	(1.432)	(0.705)	(2.197)	(2.055)	(2.435)	(1.177)	(2.083)
South	-0.0553	0.685	-0.784	-0.626	-0.875	-0.328	0.198	0.616
	(0.755)	(0.768)	(0.654)	(0.618)	(1.016)	(0.973)	(0.804)	(0.847)
Midwest	1.865	1.151	-0.202	-0.758	-0.111	-0.702	0.380	-0.268
	(1.250)	(1.166)	(0.551)	(0.518)	(0.950)	(0.884)	(1.035)	(1.132)
Northeast	-2.186	-2.148	-2.236***	-2.380**	-3.867*	-4.623**	-2.627*	-3.000*
	(2.039)	(3.168)	(0.785)	(0.999)	(2.064)	(2.208)	(1.594)	(1.599)
Constant	-9.949***	-8.643**	-9.116***	-15.77***	-18.11***	-21.56***	-16.750***	-18.09***
	(2.662)	(4.156)	(2.162)	(4.387)	(5.664)	(7.056)	(3.487)	(4.950)
Log likelihood	-72.824	-73.209	-125.179	115.593	-59.007	-59.665	-69.598	-70.941
Wald Chi2	46.75	101.61	113.12	102.13	123.26	176.92	200.91	175.21
Observation	1352	1172	993	807	1541	1341	1383	1183

The discrete-time hazard models of state enacting caps on punitive damages (CP), joint and several liability (JS), caps on noneconomic damages (CN) and collateral source rule (CS) are reported. The dependent variable for each model is binary which equals one if a state enacting the tort reform in that year and zero otherwise. Model 1 uses liability insurance loss to proxy liability climate change, while model 2 use tort cases commenced in state courts to proxy liability climate change. Observations of each state are included in the analyses until the state passed the tort reform. Tort case in federal court and credit spread are measured yearly from 1971 to 2005. All other variables are measured for each state in each year from 1971 to 2005. All the variables are described as in table 1. Cluster standard errors are showed in the parentheses. ***, **, and * denote statistically significant at the 1, 5, and 10 percent levels.

Table 7 Discrete Time Hazard Models of Political Economy Factors Influencing the Timing of State Enacting Permanent Tort Reform, 1971-2005

	Model (1)	Model (2)	Model (3)	Model (4)	CP	JS	CN	CS
Liability insurance loss	0.277***	—	0.330***	0.328***	0.426***	0.287***	0.490**	0.439***
	(0.080)		(0.056)	(0.048)	(0.113)	(0.072)	(0.200)	(0.133)
Tort cases in state court	—	0.324**		—	—	—	—	—
		(0.143)						
State Spillover	1.008	1.171	2.436***	2.422***	-2.607	0.717	-4.646	2.505
	(0.895)	(0.861)	(0.448)	(0.381)	(2.042)	(0.673)	(9.024)	(1.974)
Credit spread	0.398	0.730	0.635	0.649*	-0.785	-0.014	2.290*	0.248
	(0.520)	(0.449)	(0.424)	(0.349)	(0.701)	(0.570)	(1.238)	(0.869)
Income per capita	-0.073	-0.171	-0.115	-0.112*	0.543**	-0.112	0.004	-0.294*
	(0.101)	(0.156)	(0.078)	(0.066)	(0.236)	(0.128)	(0.215)	(0.157)
GSP per capita	0.009	-0.017	0.030	0.029	-0.271**	0.023	0.054	0.089
	(0.050)	(0.060)	(0.044)	(0.039)	(0.113)	(0.058)	(0.122)	(0.103)
Degree of republicans	0.651	0.913	0.331	0.314	1.195	0.644	-0.775	0.218
control	(0.551)	(0.675)	(0.432)	(0.364)	(0.991)	(0.612)	(1.815)	(0.929)
Same party	1.272***	1.040**	0.421*	0.420*	-0.357	1.138***	-0.962	0.509
	(0.468)	(0.450)	(0.240)	(0.253)	(0.657)	(0.411)	(1.187)	(0.637)
Citizen ideology	-0.012	0.009	-0.007	-0.007	-0.082***	0.012	-0.032	0.043
	(0.020)	(0.024)	(0.013)	(0.013)	(0.028)	(0.020)	(0.046)	(0.037)
Tort cases in federal court	1.341**	1.958***	1.753***	1.752***	1.757***	0.781	3.943***	2.654**
	(0.684)	(0.689)	(0.442)	(0.403)	(0.601)	(0.756)	(1.512)	(1.266)
Employment in insurer	0.101	0.223	0.104	0.103	-0.099	0.073	-0.296	0.470***
	(0.201)	(0.168)	(0.068)	(0.083)	(0.193)	(0.106)	(0.586)	(0.136)
Physicians	-0.178	-0.115	-0.215***	-0.217***	-0.187*	-0.248***	-0.290	-0.458***
	(0.127)	(0.141)	(0.064)	(0.065)	(0.111)	(0.092)	(0.402)	(0.097)
Lawyer	0.140***	0.109*	0.086***	0.088***	0.006	0.182***	0.040	0.141**
	(0.049)	(0.057)	(0.026)	(0.025)	(0.072)	(0.047)	(0.116)	(0.056)
Lag of no-fault verbal	0.396	1.118	-0.300	-0.289	-1.538	0.627	-4.052	-0.538
	(1.275)	(1.456)	(0.561)	(0.490)	(2.064)	(0.929)	(2.762)	(1.265)
Lag of no-fault high value	0.182	0.415	1.665***	1.667***	2.304**	-0.184	4.903***	3.456***
	(0.549)	(0.551)	(0.352)	(0.353)	(0.955)	(0.666)	(1.270)	(0.822)
Punitive damages	0.202	0.562	0.376	0.381	0.802	0.203	0.317	0.546
insurable	(0.701)	(0.733)	(0.335)	(0.318)	(0.741)	(0.619)	(1.140)	(0.742)
Rate regulation	-0.149	-0.360	0.422	0.417	1.988***	-0.026	0.656	0.123
	(0.617)	(0.637)	(0.289)	(0.288)	(0.771)	(0.462)	(2.257)	(0.633)
Log duration time	0.331	1.722	0.346	0.338	-0.213	0.881	0.696	1.078
	(0.551)	(1.494)	(0.455)	(0.355)	(0.599)	(0.757)	(1.379)	(1.503)
South	-0.415	-0.180	-0.433	-0.436	-0.371	-0.677	-0.180	-0.559
	(0.564)	(0.583)	(0.400)	(0.374)	(0.828)	(0.622)	(1.089)	(1.205)
Midwest	0.043	-0.369	0.301	0.292	1.734	-0.267	0.854	-0.128
	(0.813)	(0.752)	(0.422)	(0.444)	(1.293)	(0.671)	(2.674)	(0.910)
Northeast	-1.850	-1.836	-1.111*	-1.099*	-1.759	-2.378**	1.494	-1.918
	(1.315)	(1.621)	(0.656)	(0.642)	(2.102)	(1.013)	(3.327)	(1.468)
Constant	-9.028***	-12.33***	-10.36***	-10.31***	-8.600***	-9.344***	-16.440***	-14.69***
	(1.988)	(3.245)	(1.443)	(1.215)	(2.661)	(2.075)	(2.966)	(2.511)
Log pseudolikelihood	-121.884	114.083	-344.634	—	-70.649	-124.276	-35.404	-57.821
Wald chi2	172.48	195.63	141.14	—	295.16	106.10	772.62	660.74
Observation	866	692	5499	5499	1405	1006	1605	1483

The model (1) and model (2) report results of state enacting any of four permanent tort reforms by using discrete-time hazard models, in which observations of each state are included in the analyses until the state passed any of tort reform. The model (3) and model (4) report results of timing of state enacting four permanent tort reforms gradually by using multivariate survival analysis, in which observations of each state are stacked. The model (3) uses frailty model with random effects and the model (4) uses marginal risk set model to control correlations and different baseline hazard functions of tort reforms. The discrete-time hazard models of state enacting permanent caps on punitive damages (CP), joint and several liability (JS), caps on noneconomic damages (CN) and collateral source rule (CS) are reported in the following columns.

Table 8 Pooled Time-series Cross-Section OLS Regression of Political Economy Variables Influencing the Timing of Tort Reform Legislations on Liability, 1971-2005

	Four Tort Reform	CP	JS	CN	CS
Liability insurance loss	0.018***	0.006***	0.013***	0.003**	0.004***
	(0.005)	(0.002)	(0.004)	(0.001)	(0.002)
State spillover	-0.008	-0.019	0.061	0.032	0.049**
	(0.011)	(0.028)	(0.041)	(0.035)	(0.022)
Employment of insurers	-0.036	-0.003	0.000	0.000	0.005*
	(0.055)	(0.003)	(0.008)	(0.002)	(0.003)
Credit spread	0.008	-0.009	0.008	0.004	0.005
	(0.019)	(0.009)	(0.016)	(0.007)	(0.007)
Income per capita	0.013*	0.007***	-0.000	0.000	-0.001
	(0.008)	(0.003)	(0.006)	(0.002)	(0.002)
GSP per capita	-0.004	-0.004**	0.001	-0.001	-0.001
	(0.004)	(0.002)	(0.003)	(0.001)	(0.002)
Degree of Republicans	0.098**	0.041**	0.034	0.006	-0.012
control	(0.038)	(0.016)	(0.030)	(0.011)	(0.012)
Same Party	0.044**	0.003	0.039**	0.005	0.002
	(0.019)	(0.008)	(0.015)	(0.005)	(0.006)
Citizen ideology	-0.001	-0.000	0.000	0.000	0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Tort cases in federal court	0.120***	0.035**	0.078***	0.035***	0.031***
	(0.038)	(0.014)	(0.030)	(0.010)	(0.011)
Physicians	-0.003	-0.001	-0.002	-0.001	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)
Lawyer	-0.004	-0.002	-0.000	0.001	0.000
	(0.003)	(0.001)	(0.003)	(0.001)	(0.001)
Lag of no-fault verbal	0.054	-0.010	0.014	-0.031	-0.024
	(0.085)	(0.030)	(0.054)	(0.021)	(0.027)
Lag of no-fault high value	0.001	0.021	0.024	0.026*	0.069***
	(0.060)	(0.019)	(0.041)	(0.015)	(0.017)
Punitive damages insurable	-0.054	-0.038	0.185	0.005	-0.074
	(0.167)	(0.050)	(0.138)	(0.037)	(0.058)
Rate regulation	0.001	0.041***	0.027	0.006	-0.004
	(0.038)	(0.013)	(0.029)	(0.009)	(0.010)
Constant	0.174	-0.009	-0.229	-0.030	0.098*
	(0.156)	(0.052)	(0.184)	(0.038)	(0.056)
State level dummies	Yes	Yes	Yes	Yes	Yes
R-square	0.172	0.086	0.118	0.074	0.094
Observations	832	1352	993	1541	1483

The pooled time-series cross-Section OLS regression of any type of tort reforms, caps on punitive damages (CP), limitations on joint and several liability (JS), collateral source rule (CS) and caps on noneconomic damages (CN) are reported. The dependent variable for each regression is binary which equals one if a state enacting tort reforms in that year and zero otherwise. Tort case and credit spread are measured for each year from 1971 to 2005. All other variables are measured for each state in each year from 1971 to 2005. All the variables are described as in table 1. Cluster robust standard errors are in parentheses. ***, **, and * denote statistically significant at the 1, 5, and 10 percent levels.

Table 9 Fractional Logit Regressions of Political and Economic Influencing the Timing of Liability Tort Reform, 1971-2005

	Four Tort Reform	CP	JS	CN	CS
Liability insurance loss	0.002	-0.005	-6.5e-5	0.975***	0.124*
	(0.024)	(0.082)	(0.036)	(0.351)	(0.075)
Employment of insurer	0.009	0.0328	-2.4e-5	0.023***	2.29e-5
	(0.032)	(0.071)	(0.036)	(0.007)	(0.002)
Income per capita	-4.1e-4***	-0.001***	-4.4e-4***	-0.004***	-0.001***
	(6e-5)	(0.0001)	(6.27e-5)	(0.001)	(0.0002)
GSP per capita	0.506	1.452**	0.655*	9.213***	0.760
	(0.291)	(0.701)	(0.390)	(2.477)	(1.221)
Degree of Republicans	0.164	0.810*	0.706**	15.621***	1.087**
control	(0.173)	(0.485)	(0.343)	(4.554)	(0.470)
Same Party	0.086	-1.060**	0.554*	12.501***	0.374
	(0.182)	(0.513)	(0.333)	(3.596)	(0.244)
Citizen ideology	0.003	-0.026***	0.016***	0.001	0.020*
	(0.005)	(0.008)	(0.005)	(0.032)	(0.010)
Physicians growth	0.563	8.866***	0.408	-8.277***	0.953
	(0.357)	(1.799)	(0.488)	(1.593)	(0.796)
Lawyer	0.540***	0.030	0.667***	4.980***	0.432*
	(0.200)	(0.482)	(0.199)	(1.039)	(0.251)
Lag of no-fault verbal	0.135	0.861	0.188	-6.881***	-0.768
	(0.285)	(0.616)	(0.331)	(1.307)	(0.627)
Lag of no-fault high value	-0.117	-0.321	-0.137	-3.668***	0.267
	(0.149)	(0.431)	(0.144)	(0.959)	(0.240)
Rate regulation	0.116	-0.195	-0.009	3.250***	0.150
	(0.118)	(0.271)	(0.161)	(0.983)	(0.254)
Constant	-1.146***	1.986**	-1.970***	-8.510**	-1.416**
	(0.293)	(0.864)	(0.382)	(3.652)	(0.650)
Log pseudolikelihood	-7.101	-3.218	-6.342	-1.807	-3.045
Observations	44	46	48	50	50

The fractional logit model is used because of proportional dependent variable, where the dependent variable is the inverse of duration time until enacting tort reforms for each state. All variables are measured for each state in each year from 1971 to 2005. All the independent variables here are the mean value of the corresponding variables described as in table 1. Cluster robust standard errors are in parentheses. ***, **, and * denote statistically significant at the 1, 5, and 10 percent levels.

Table 10 Fixed Effect Regressions of Ex Post Consequences of Liability Tort Reforms, 1971-2005

	Loss of other liability insurance	Loss of auto liability insurance	Loss of medical malpractice insurance
Caps on noneconomic damages	-0.427***	-0.426***	-0.047
	(0.103)	(0.135)	(0.037)
Joint and several liability	-0.232*	-0.150	-0.015
	(0.132)	(0.087)	(0.025)
Caps on punitive damages	-0.158	0.148	0.035
	(0.110)	(0.097)	(0.027)
Collateral Source	0.093	-0.176	-0.037
	(0.117)	(0.112)	(0.032)
No-fault 1	—	-0.730***	—
		(0.234)	
No-fault 2	—	0.048	—
		(0.145)	
Constant	0.982***	5.450***	0.166***
	(0.107)	(0.138)	(0.035)
Year dummies	Yes	Yes	Yes
State dummies	Yes	Yes	Yes
Medical malpractice tort reforms	No	No	Yes
F value	23.70	50.63	24.55
Observations	1750	1750	1550

The dependent variables are directed loss of different liability insurance lines scaled by GSP. All variables are measured for each state in each year. Each dependent variable is regressed on a set of state dummies, calendar year dummies, and the set of four liability tort reforms. The four tort reforms indicators are equal to one in the years when the tort reforms are effective and zero otherwise. No-fault 1 indicator is 1 if the state adopts no-fault system with verbal threshold. No-fault 2 indicator is 1 if the state adopts no-fault system with value threshold larger than $1000. State fixed effects and year fixed effects are included across regressions. Four medical malpractice tort reforms are included in the loss of medical malpractice insurance regression. The standard errors adjusted for clustering (i.e., dependence) at the state level are in the parentheses.*, **, and *** indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 11 Fixed Effect Regressions of Ex Post Consequences with Tort Reforms Entered Separately, 1971-2005

	Loss of other liability insurance	Loss of auto liability insurance	Loss of medical malpractice insurance
Caps on noneconomic damages	-0.426*** (0.103)	-0.491** (0.197)	-0.056 (0.040)
Limitations on joint and several	-0.230* (0.139)	-0.197 (0.239)	-0.029 (0.171)
Caps on punitive damages	-0.155 (0.124)	0.126 (0.284)	0.038 (0.045)
Collateral Source	-0.058 (0.111)	-0.278 (0.248)	-0.059 (0.050)
No-fault 1	—	Yes	—
No-fault 2	—	Yes	—
Year dummies	Yes	Yes	Yes
State dummies	Yes	Yes	Yes
Medical malpractice tort reforms	No	No	Yes
Observations	1750	1750	1550

The dependent variables are directed loss of different liability insurance lines scaled by GSP. Each tort reform is entered separately. Each dependent variable is regressed on a set of state dummies, calendar year dummies, and the set of four liability tort reforms. All variables are measured for each state in each year. The four tort reforms indicators are equal to one in the years when the tort reforms are effective and zero otherwise. No-fault 1 indicator is 1 if the state adopts no-fault system with verbal threshold. No-fault 2 indicator is 1 if the state adopts no-fault system with value threshold larger than $1000. State fixed effects and year fixed effects are included across regressions. Corresponding medical malpractice tort reforms are included in the loss of medical malpractice insurance regression. The standard errors adjusted for clustering (i.e., dependence) at the state level are in the parentheses. *, **, and *** indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Appendix B: Figures

Figure 1 Map of Caps on Punitive Damages

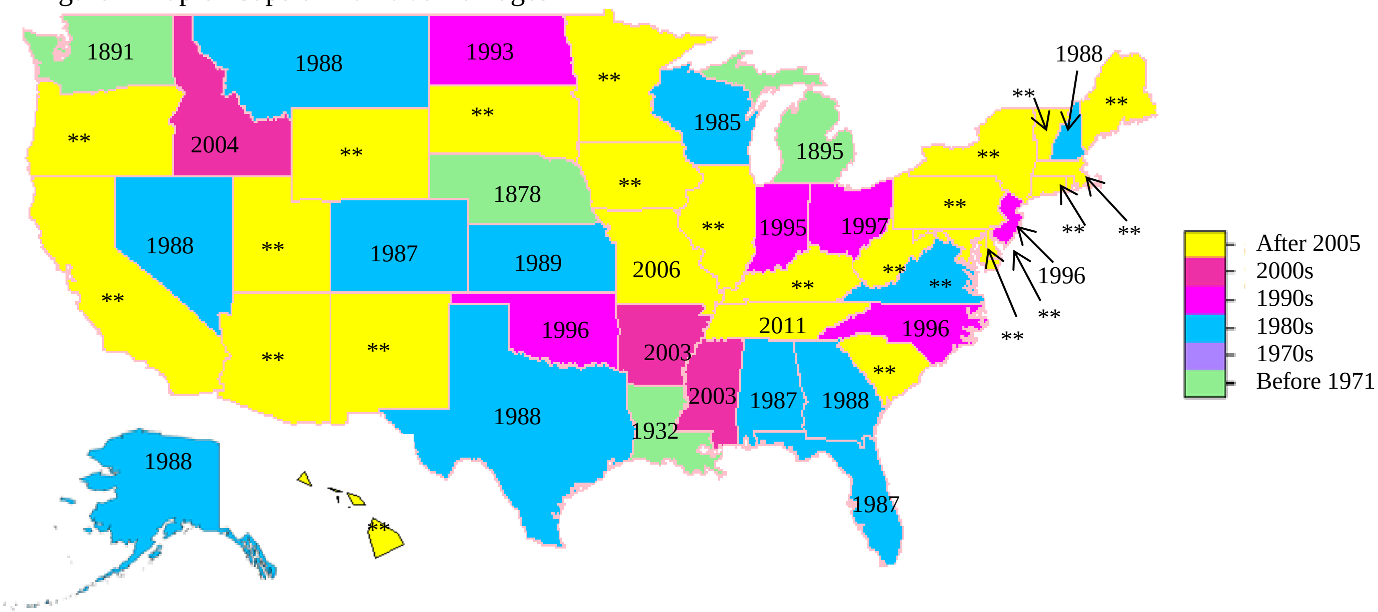

Figure 2 Map of Limitations on Joint and Several Liability

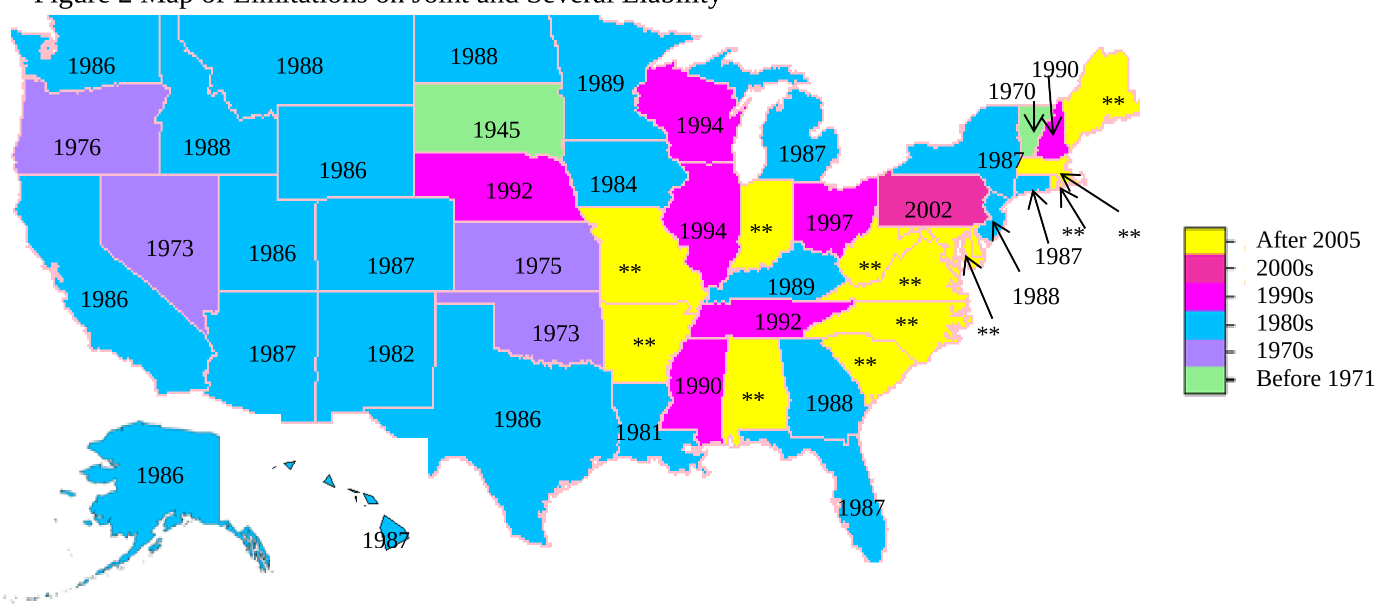

Figure 3 Map of Caps on Noneconomic Damages

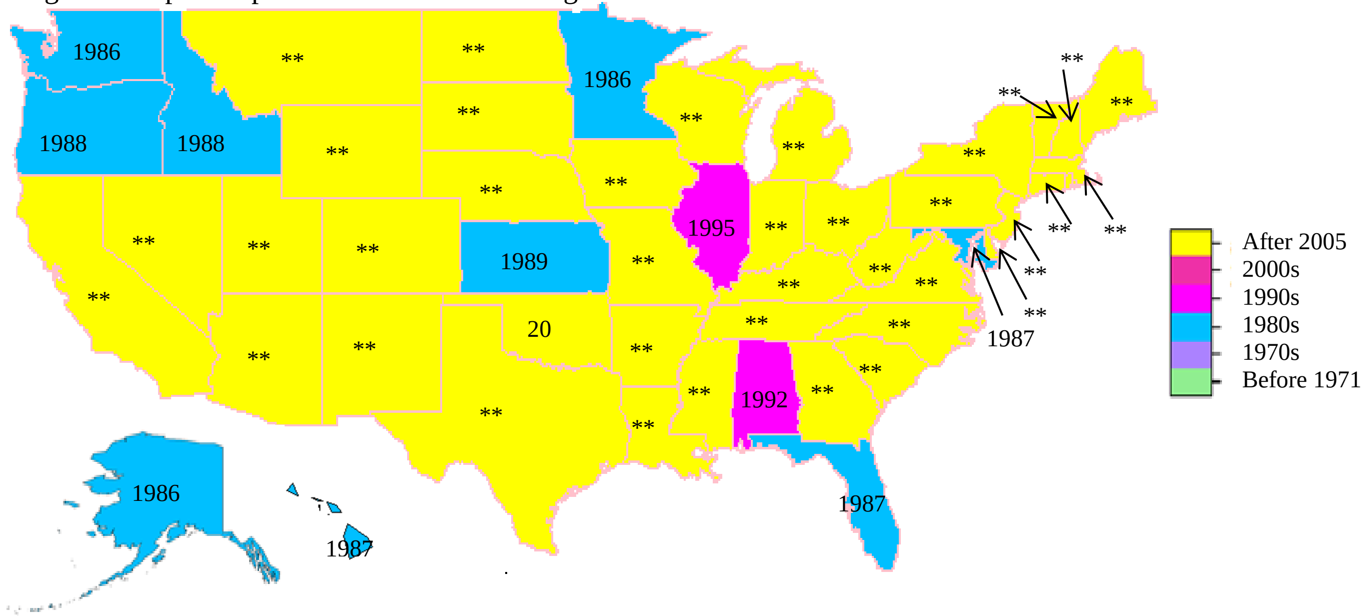

Figure 4 Map of Caps on Noneconomic Damages of General Liability and Medical Malpractice Liability

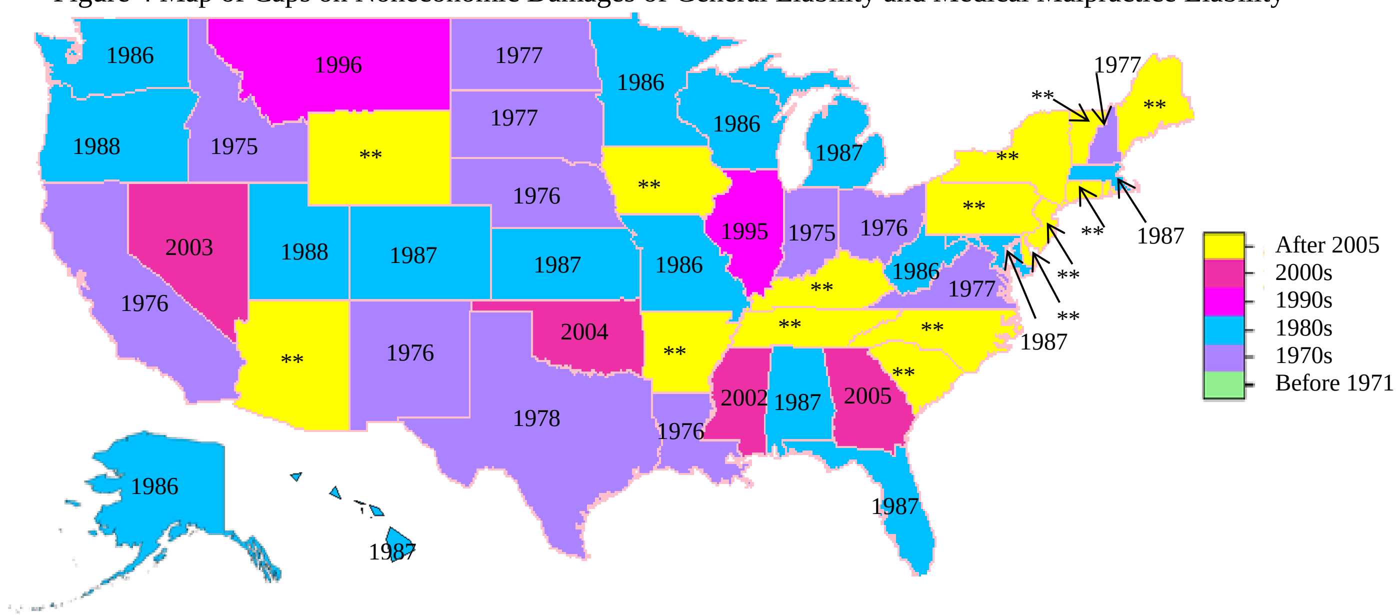

Figure 5 Map of Collateral Source Rules Reform

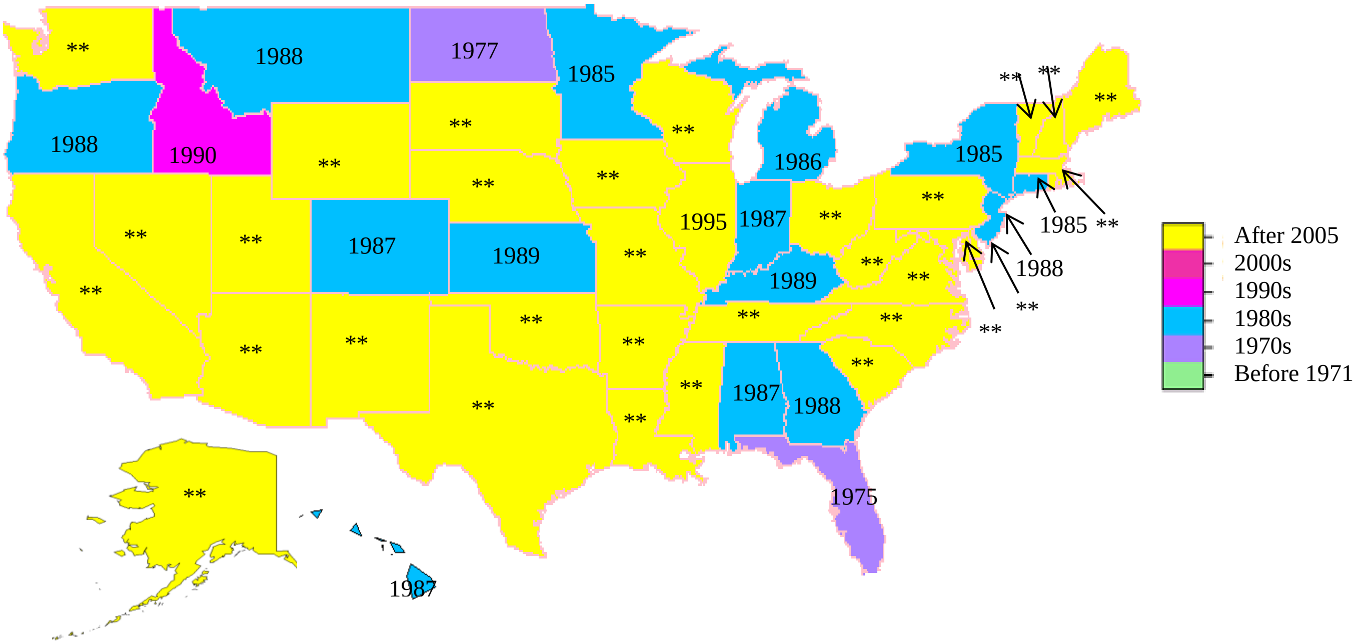

Figure 6 Map of Collateral Source Reform on General Liability and Medical Malpractice Liability

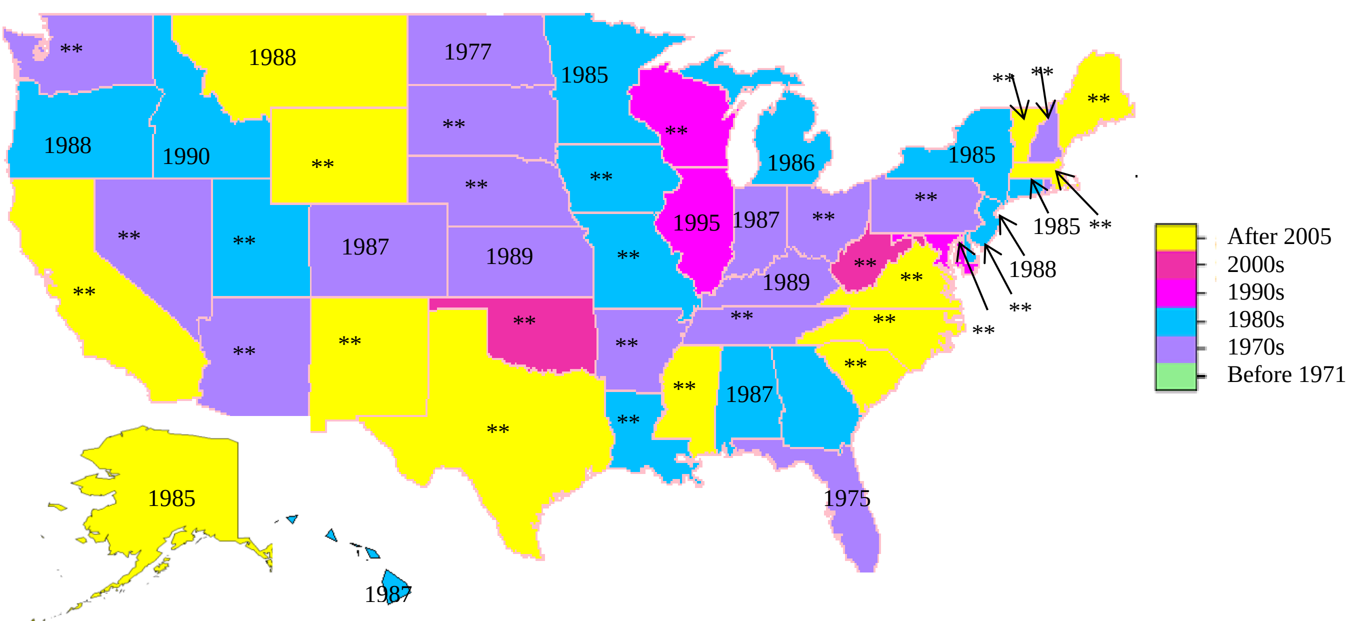

Figure 7 Map of Any of Four Tort Reforms on Liability

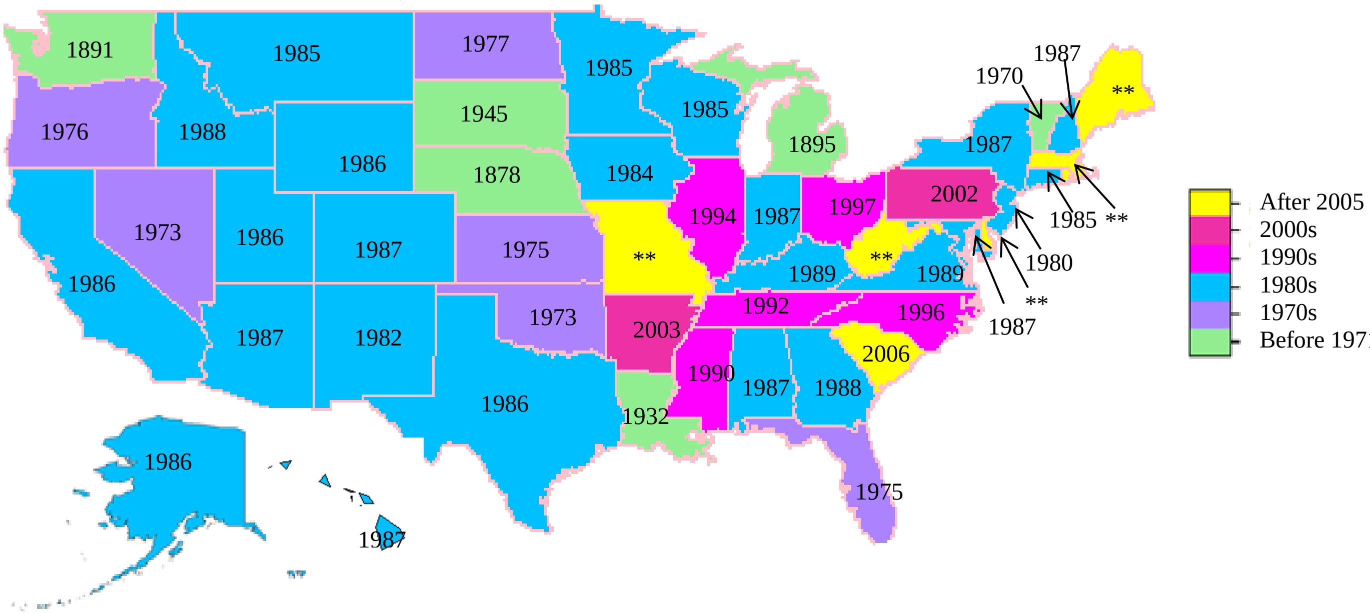

Figure 8 Kaplan-Meier Estimate of Survival Rate, by Tort Reform