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How Tort Reform Affects Insurance Markets

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ABSTRACT

A critique of tort reform is that promised declines in insurance prices do not follow the enactment of significant tort reforms. This study examines whether insurance prices reflect the uncertainty of the reform since they are subject to judicial challenge. We undertake a two stage approach to investigate the effect of tort reform on insurance prices. In the first stage, we investigate the likelihood tort reforms will be found unconstitutional and the expected duration of reforms. We then use the estimated survival probability as an explanatory variable in a regression which estimates the effect of tort reform on state liability insurance markets. Our results indicate that as the estimated survival probability of tort reform increases, the premiums and volatility of losses in the insurance market decrease.

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> Tort reform has failed and will fail again to reduce rates, let alone having terrible consequences for many innocent people. [Joanne Doroshow, President, Center for Justice and Democracy][1]

1. Introduction

The objective of liability reducing tort reforms is to decrease losses and lower loss volatility with the intent of decreasing the premiums charged for insurance coverage. One of the major complaints alleged about tort reform, however, is that the evidence on premium declines after reform is weak. In fact, consumer advocates assert that tort reform is an "insidious public relations scam" that enriches insurers at the expense of consumers (Doroshow and Hunter, 1999, 2002).[2] Since the purpose of liability reforms is to reduce the size and frequency of damage awards, insurance losses should be the first indicators of the reforms' effects. Consistent with this argument, the literature documents an inverse relationship between insurance losses and tort reform (Viscusi, Zeckhauser, Born, and Blackmon, 1993; Born and Viscusi, 1994 and 1998; Viscusi and Born, 1995 and 2005; Brown and Puelz, 1999; and Browne and Schmit, 2008).[3] A number of these studies also show that liability reforms improve insurer profitability as reflected by lower loss ratios. Nevertheless, the expectation is that there should be a close connection between changes in losses and premiums in competitive insurance markets. However, the literature fails to document a decline in premiums following the enactment of a tort reform. An overlooked fact is that a significant number of tort reforms are declared unconstitutional.

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[1] Press Release, http://www.commondreams.org/news2002/0618-06.htm.

[2] Americans for Insurance Reform (AIR) have a listing of quotes (and their citations) of insurance executives and tort reform proponents suggesting that insurance rates would fall (see e.g. http://www.insurance-reform.org/pr/Quotes.pdf). AIR then claims either the lack of price reductions or the request for price increases after tort reform.

[3] An exception is Black *et al*. (2006) which finds that insurance claiming behavior has not changed over time even in the presence of tort reforms.

Our hypothesis is that premiums will not be as responsive as losses to tort reforms because of uncertainty about the real impact of reform given the reforms are subject to judicial challenge. While state legislatures enact tort reforms, courts often void them for various reasons, such as presenting a bar to access to the courts or because of due process concerns.[4] Thus, while initial losses may initially be reduced from tort reforms, premiums may not fall if insurers do not expect the reform to withstand judicial scrutiny. Given the real risk of judicial intervention and potential nullification of the legislatures' reforms, it is rational for insurers to exercise caution with respect to setting their premiums given the uncertainty of a particular tort reform's potential longevity.

There have been a number of analyses of the structure of liability reform efforts and their effect on insurance markets (Viscusi, 1990; Blackmon and Zeckhauser, 1991; Viscusi, Zeckhauser, Born, and Blackmon, 1993; Born and Viscusi, 1994 and 1998; and Viscusi and Born, 1995 and 2005). All of these papers quantify tort reform using dichotomous variables that take on a value of 1 for all the years affected by the reform measure and a value of 0 for all non-reform years. In contrast, the main distinguishing feature of our research is we examine the effect of major tort reforms (damage caps for punitive and/or non-economic damages, changes in the collateral source rule, and changes in joint and severable liability) on insurance markets by explicitly accounting for the likelihood that the tort reform is declared unconstitutional by a state's Supreme Court. The importance of this feature is that it acknowledges insurers may not change their pricing, loss reserving, etc. in the face of a reform which is likely to fail judicial review. If insurers forecast the state's judiciary will declare a tort reform provision

[4] For example, in 1987 Alabama passed three separate damages caps to be applied in medical malpractice cases. In 1991, however, the Alabama Supreme Court held that the cap on non-economic damages was unconstitutional and the other caps were similarly invalidated by the Court in 1993 and 1995, respectively (Yoon, 2001).

unconstitutional, the insurers should rationally price as if tort reform does not exist. Thus, our framework brings us closer to the true economic impact of tort reform on insurance markets.

A few of other aspects of this research distinguish it from previous studies of the effects of tort reform on insurance markets. First, we examine a much longer time period of reforms, 1985 to 2006. A majority of the prior research considers reforms from the mid-1980's to the early 1990's. Second, in addition to investigating insurance market profitability and loss and premium levels, we also examine loss volatility. Ostensibly, one of the major rationales for tort reform is to control the variability of losses. Finally, instead of examining insurance market profitability using the loss ratio—the ratio of undiscounted losses incurred to premiums earned—we utilize the economic loss ratios, which is the ratio of discounted losses incurred to premiums earned. The economic loss ratio is more meaningful than the traditional loss ratio because premiums reflect the discounting of losses in a competitive market.

As a preview of our results, we find that the survival probability of tort reform, generated from a time varying hazard model, has an effect on insurance market behavior. While not all tort reforms behave identically, our results suggest that investigating the effect of the likelihood of a reform surviving judicial review is different from previous analysis which merely examined whether the state enacted a reform. In fact, most reforms in our sample do not have a significant effect on premiums when an indicator variable is used. This is consistent with the consumer advocates' conjecture. However, when we use the likelihood that a reform will survive judicial review, we find premiums are inversely and statistically related to the survival likelihood. That is, as the tort reform is more likely to survive, the premiums are lower within a state. This is consistent with our major hypothesis that rational insurers will adjust premiums only to the extent they believe that the reform will be upheld.

The paper is organized as follows. Section 2 provides a brief review of the literature on tort reform and its impact on insruance markets. Section 3, describes the data. Section 4 explains the estimation of the survival probability of tort reform. Section 5 investigates how the survival probability of reform influences state liability insurance markets. Section 6 concludes.

2. Literature Review

There have been three "liability crises" since the 1970s. The first was in the mid 1970s and as a result the first round of tort reform was undertaken. California, for example, enacted caps on non-economic damages of $250,000 in order to reduce the uncertainty behind insurance prices. A second set of reforms occurred during the liability crisis of the mid 1980s. This crisis was set off in part by a re-evaluation of pricing after a judicial change in interpretation of liability contracts which expanded insurer's liability (Priest, 1987). While causation is difficult to prove, the most recent crisis may have been the result of spiking reinsurance premiums after 9/11. As a result of liability shocks, states enacted various reforms over the last 30 years to reduce uncertainty regarding outcomes by limiting the amount of total damages.

A number of early studies attempted to determine the effect of tort reform on insurance premiums (See e.g. Zuckerman *et al*. 1991). Further, more recently papers like Lee, Brown, and Schmidt (1994) have examined the effects of single reforms (e.g. joint and severable liability) on insurance markets and found a relatively weak relationship between reform and insurance markets. However, in a series of papers, starting with Born and Viscusi (1988), Born and Viscusi examine a panel of firm/state level data to see the effects of tort reforms in the late 1980s. Their analysis focused on how premiums and losses were influenced by tort reforms. In general, Born and Viscusi found that tort reform reduce losses. However, while losses were

generally reduced, firms reacted differently to when it came to premiums. Ideally, losses would be reduced by tort reform and as competitive markets respond premiums would also decline. Born and Viscusi also find that there are strong distributional effects within the states. In particular that unprofitable firms benefit the most from tort reform.

The enactment of tort reform laws in the mid-1980s generally decreased insurers' loss ratios especially for those firms with the highest loss ratios. A few of these studies find that premium fall but always less than the amount by which losses drop, while other studies find a substantial drop in insured losses, but no significant change in insured premiums. In all the studies, the main mechanism for the loss ratio change is that the decrease in insured losses is greater in magnitude than the decrease in insured premiums.

Born and Viscusi (1994) explain the differential impact between premiums and losses as a natural functioning of the insurance market. They argue that one might expect tort liability reforms to affect premiums less than losses to the extent that insurance company operations were previously unprofitable. Higher premiums would be necessary to return companies to their pre-crisis level of profitability and to a more normal level of competitive profits.

Finally, Born, Viscusi, and Baker (2006) find that developed losses, which represent the actual court and settlement outcomes, are below initially reported incurred losses, which reflect the insurers perception of how claims will be paid, and conclude that the long-run effects of tort reforms are greater than insurers' initial expectation. This study is directly relevant to our research as it documents insurers' uncertainty with respect to tort reform measures. Insurers rely on losses incurred as a basis for establishing premiums. Thus, to the extent that there is uncertainty with regard to the duration of tort reform we would naturally expect a divergence

between incurred losses and developed losses as insurers expectations would diverge from actuality.

Our paper is comparable to the general Born and Viscusi approach. We depart from their methodology in that we account for the survival probability of a reform instead of using indicator variables. An additional difference is that we focus on the aggregated state insurance market rather than on individual firms within the state market.

3. Data

Our main empirical variables of interest are tort reforms. We obtain a listing of all enacted and repealed tort reforms by state in the years 1985 to 2006 from the American Tort Reform Association (2007). We cross-reference these reforms with the dataset constructed by Ronen Avraham (2006) and the American Association for Justice. The major tort reforms we examine are changes to the collateral source rule, modifications to joint and several liability, caps on punitive damages, and limits on non-economic damages.

Collateral source rule reforms focus on offset provisions for collateral damages. Plaintiffs often receive compensation from a variety of sources. Collateral source reforms generally try to limit double indemnification through any type of insurance payment (a collateral source) as well as through a tort award. Thus tort damages in states with a collateral source rule are reduced by the amount of any other insurance proceeds paid to the victim from government insurance programs, workers compensation, life insurance, disability insurance, health insurance, or personal auto insurance.

The modification of joint and severable liability has to do with the assignment of responsibilities between two associated parties that may be jointly liable for a tort. A typical

example is the liability of a hospital for the actions of a physician operating at the hospital. The notion is the parties jointly are in control and that they are in the best position to mitigate harm. Under the old rule, a jury could find both parties jointly responsible and, if one party did not have the resources to pay the tort award the other party would still be responsible for the total amount. The modification generally limits the ability of the jury to find a party jointly liable merely because it has a deep pocket. A reform would generally require each party to pay according to its responsibility for the harm, rather than be responsible for the entire amount.

Punitive damage limits typically seek to impose caps on the amount of punitive damages. The idea behind punitive damage reform is to limit the jury's discretion in awarding punitive damages. Reform is implemented either through a specific numeral cap (say $500,000), restricting the upper limit of punitive damage awards based on economic damages, and/or by limiting the situations under which punitive damages can be awarded.[5]

The last major tort reform we study is the restriction on non-economic damages. These damages include compensation for loses other than medical costs and lost earnings, including pain and suffering, loss of consortium, and bereavement. A criticism is that it is difficult to value these damages and that there can be substantial differences between jurisdictions within a state as well as between juries in the same court. Further there is no science to guide a jury in making decisions and the variation in awards violates due process because it is not a clear standard. (see e.g., Sunstein, 2007) The purpose of non-economic damage reforms is to establish numerical guidelines, numerical limits, or specific principles for awarding non-economic damages.

[5] Recently, the U.S. Supreme Court has held that a ratio of less than 10 to one between punitive damages and compensatory damages would not violate due process. See *State Farm Mutual Automobile Insurance Co. v. Campbell*, 538 US 408,123 S.Ct. 1513 (2003) which was an appeal of a Utah Supreme court opinion that permitted punitive damages that were 145 times the compensatory damages.

Table 1 summarizes the tort reforms that we focus on in this paper. It displays the total number of reforms enacted by state and reform type for the years 1985 – 2006. In addition, the table documents the number of reforms that were determined unconstitutional. Of the 148 reforms that were enacted during our sample period 40 (27 percent) did not pass state constitutional muster. Limitations of noneconomic damages is the most likely tort reform to be determined unconstitutional (35 percent), while modifications to joint and several liability are the least likely (18.2%). The most important conclusion from the table is that a large number of reforms are later repealed and a strict dichotomous variable may misestimate a reforms true impact.

Insurance market data comes from the 1985-2006 National Association of Insurance Commissioners (NAIC) Property-Casualty Annual Statement Database. We use the NAIC database's "State Page" to calculate the total premiums earned and losses incurred in liability lines of insurance for each state in each year of our sample. Premiums earned and losses incurred are used to calculate two other variables: the economic premium ratio (Winter, 1994) and the economic loss ratio. The economic premium ratio is defined as the ratio of the premiums to the present value of discounted losses. The economic loss ratio is the inverse of the economic premium ratio. The present value factors are computed by estimating the loss payout tail for each of the liability lines of insurance. The payout proportions are estimated using the method prescribed by the Internal Revenue Service for computing loss present values for tax purposes (Cummins, 1990). We discount using the risk-free rate, which is estimated from the U.S. Treasury spot-rate yield curves for each year of the sample period provided in the Federal Reserve Bank of St. Louis' Federal Reserve Economic Data (FRED) database. In addition, we calculate, for each state and year, the cross-sectional volatility of liability losses, the percent of

total premiums earned by the largest medical malpractice insurer, and the total number of insurers providing liability insurance.

Data on the demographic characteristics of the states comes from a variety of sources. First, we have a number of variables which relate to the presence of business activity within the state. We obtain from the Bureau of Economic Analysis the state gross state product (GSP), as well as the corporate and the insurance industry's share sector's share of state product (income).

Second, we obtain information of the number of lawyers. The Lawyer Statistical Report and from the American Bar Association (ABA) publish data on the number of lawyers in a state, but not for every year of our study. We extrapolate the values for the years in which the data are not reported.[6] Another limitation of the lawyer data is that all lawyers are captured and information on the number of trial lawyers is not obtained.

Third, we investigate the influence of judicial selection on whether a tort reform is determined unconstitutional. We obtain information on each state's judicial selection mechanism from the American Judicature Society (2007) and Hansen (2004). In particular, we determine whether a state uses a partisan election, a non-partisan election, an appointment system, or merit appointment system to place judges. A partisan election is where the candidates are running based on identification with a political party. In a non-partisan election the candidates do not identify with a political party. With a political appointee system, the judge is appointed through a political process (either by the governor and/or the legislature). Instead of running for competitive elections or being appointed, the merit plan mandates unopposed "retention elections"; ballots read simply "Should Judge X be retained in office." The state bar generally has a strong degree of influence in a merit system.

[6] We only have 8 years of reported data (1985, 1988, 1991, 1998, 2003, 2004, 2005 and 2006). Similar to Browne and Schmit (2008), we incorporate estimates for the other years, by using the 8 data points in the following regression model: #lawyers/population = a + b(year) + ε

Finally, we obtain information about the politics of the state. In particular, we compute the total percent of the state legislature that is democratic. In addition, we use a measure of the state's citizens' ideology developed by Berry et al. (1998). This measure is an index which takes into account each state's federal house and senatorial ideology based upon various scores created by interest groups. The index level is high if the state's representatives to Congress are liberal according to various liberal interest groups and it is low if the state's representatives are conservative.[7]

Turning to the data, Table 2 reports the means and medians of state and insurance market characteristics stratified by whether tort reforms pass state constitutional muster. Overall, the null hypothesis is that state and insurance market characteristics should not be related to a tort reforms constitutionality as judges only rule on the legal merits of the legislation. Consistent with this hypothesis, very few state characteristics are related to a tort reforms eventual repeal. Two exceptions are GSP per capital and the insurance sector as a percentage of corporate GSP. On average, tort reforms are less likely to be repealed in states with high income and more likely in states with a large insurance industry.

Insurance market characteristics, in contrast to general state characteristics, are associated with the longevity of tort reform. Tort reforms in states with higher economic premium ratios (economic loss ratios) experience significantly higher (lower) rates of repeal. Thus, tort reform in states with higher premiums relative to losses is more likely to be declared unconstitutionally. In addition, tort reforms in state with a large medical malpractice insurer are more likely to be

[7] As a quick example, if the state's representatives had high scores from the liberal interest group Americans for Democratic Action, then this would be attributed to the state's citizenry. In addition to interest group scores, the index also takes into account the party in power in a state, as well as party affiliation of governors. The citizen ideology index employed by Berry *et al.* (1998) is a richer index than examining whether the Democrats or the Republicans control a state legislature. One need only note that Southern Democrats often appear to be more conservative than Northern Democrats.

repealed. These differences, however, do not necessarily imply a casual effect. For example, if states with high premium ratios or a large medical malpractice insurer are more inclined to pass tort reforms quickly or with less due diligence, then tort reforms in these states will be more likely to be found unconstitutional, regardless of whether the high premium ratios or the large insurer has any effect.

On average the year in which the reform is enacted influences whether it is recorded as passing state constitutional muster or not. In particular, reforms enacted earlier in the sample period are more likely to be found unconstitutional. This indicates that it is possible that reforms enacted later in the sample period may eventually be repealed in the coming years. Therefore, right censoring in the duration of tort reform is an econometric issue that we must account for.

Probit regression offers an initial assessment of whether the mean differences in the likelihood of unconstitutionality persist after controlling for other characteristics. Table 3 reports the results of this regression. A positive coefficient implies that a variable is associated with a higher probability that a tort reform is found unconstitutional, while a negative coefficient indicates a lower likelihood. We also report the estimated marginal effects from the probit regression. The marginal effects are calculated in three ways to account for differences in variable construction. First, the marginal effect for continuous variables is the change in the predicted probability due to an increase from the 25th to the 75th percentile of the variable of interest and keeping all other variables at their mean value. Second, the marginal effect for discrete variables is the change in the predicted probability due to a change from 0 to 1. Finally, our estimated equation includes interactions of a continuous variable (lawyers per capita) with three dichotomous variables (appointed, nonpartisan, and partisan judges). Two of the judicial selection indicators (appointed and partisan) are zero at both the 25th and 75th percentile;

therefore, we evaluate the marginal effect of all interaction variables as the change in the predicted probability due to an increase from the 5th percentile to the 95th percentile.

The probit equation shows that after controlling for other factors, insurance market characteristics no longer influence the probability of unconstitutionality. A number of state characteristics, however, correlate with a higher probability of unconstitutionality.[8] In particular, states with a large insurance industry are associated with an increased likelihood that a tort reform is repealed. The probability of repeal within the sample period is 12.9 percentage points higher for states with an insurance industry in the 75th percentile in size compared to states with an insurance industry at the 25th percentile.

In contrast to insurance market characteristics, state characteristics influence the probability of unconstitutionality. Tort reforms are less likely to be repealed in states with higher incomes and a more liberal citizenry. The second finding is contrary to initial expectations; however, the analysis is based on tort reforms that have been enacted. Thus, this result suggests that tort reforms that are legislated in states with a liberal citizenry, and thus meet the standards of the liberal citizenry, are more likely to pass constitutional muster.

The equation also shows that the interaction of the lawyers per capital and the judicial elections (no matter whether they are partisan or non-partisan) significantly influences the probability of a reform's unconstitutionality. Nevertheless, the composite (or overall) impacts of lawyers per capita and the partisan and nonpartisan election of judges are not significant. While it is interesting that lawyers do not have a significant influence on whether a state declares a

[8] Although we have data on the number of physicians per capita in each state over the sample period, this variable is not included in the probit regression. The reason for its exclusions is its high correlation with a number of other variables – *GSP per capita* (0.46), *Insurance GSP* (0.48), *Lawyers per Capita* (0.47), *Citizen Ideology Index* (0.53), *Economic Premium Ratio* (-0.40), and *Log of the # of Medical Malpractice Insurers* (0.44). No other variable included in the probit regression is correlated with another variable above 0.36. The inclusion of physicians per capita, which is not found to significantly impact the probability of unconstitutionality, does not qualitatively change the results.

reform unconstitutional, one must remember that our variable is all lawyers in a state and not just trial lawyers, who arguably have a bigger stake in the judicial outcome of tort reform legislation. The geographical region of the state also plays a role. States in the East North Central, West North Central, South Atlantic, and Pacific regions are more likely to have tort reforms ruled unconstitutional.[9]

Limitations on non-economic damages are significantly more likely to be determined unconstitutional. The probability of unconstitutionality within the sample period is 15.6 percentage points higher for limitations on non-economic damages after accounting for observed differences in state and insurance market characteristics. This is noteworthy given that caps on non-economic damages are found to decrease the probability of filing a claim and reduce the size on non-economic damage claims (e.g., Browne and Puelz, 1999).

In sum, the probit regressions suggest that some state characteristics and types of tort reform are related to the probability of unconstitutionality. Estimates from standard regression techniques, however, may be biased because they do not account for censoring in the data. The next section attempts to account for this censoring by applying a hazard analysis.

4. Hazard Analysis

A. Nonparametric Estimates

Twenty-seven percent of tort reforms are declared unconstitutional during the sample period. The average spell length for these reforms 4.75 years compared to 12.33 years for the reforms not declared unconstitutional. Thus, judicial review reduces the duration of tort reform. The

[9] The excluded states are those located in the South Central U.S., which is comprised of two geographical divisions—East South Central and West South Central (source: U.S. Census Bureau).

Kaplan-Meier survival functions provide an initial look at the spells of tort reforms.[10] Table 4 presents these results. Column 1 shows the survival rate for all four tort reforms examined in this paper. Columns 2 thru 5 display the survival rates by reform type—modifications to the collateral source rule, changes to joint and several liability, caps on punitive damages, and limitations on non-economic damages. The probability of tort reform of any type remaining in place beyond 5 years is 0.788, while it is 0.606 for non-economic damages reform. A log-rank test of the equality of these two survival functions rejects the null hypothesis of equality at the 5 percent level (*p*-value = 0.0141). The survival function for non-economic damages is also significantly less than the survival functions of each of the other three reforms. In contrast to noneconomic damage reforms, the probability of survival for modifications to joint and several liability rules is significantly greater than the survival function of all reforms (*p*-value = 0.0286). Although the nonparametric estimates do not account for the role of other explanatory variables, they offer initial evidence that the duration of tort reform significantly differs by reform type.

B. Hazard Models

To account for the right censoring in the duration of tort reform and to control for the effects of state and insurance market characteristics, a hazard model is estimated. A hazard at time *t* measures the probability that a spell will end in the next instant, conditioned on it having lasted from time 0 to time *t.* The hazard function for tort reform *i* with regressors X_i is specified as $h(t, X_i) = h_0(t) * \exp(X_i\beta)$ where β is the vector of coefficients. The term $\exp(X_i\beta)$ shifts the baseline hazard function, and a positive coefficient indicates that the regressor increases the

[10] The Kaplan-Meier or product limit estimate of the survival function is a nonparametric estimate of the probability of surviving past time *i*. If n_i is the risk set or number of tort reforms enacted at the beginning of time *i* and d_i is the number of tort reforms declared unconstitutional at time *i*, then $p_i = (n_i - d_i)/ n_i$ is the proportion of tort reforms still in place at the end of time j. The product limit estimate of the survival function S(t) is $S(t) = \Pi_{i|t_i<t(p_i)}(p_i) = \Pi_{i|t_i<t(p_i)}[(n_i - d_i)/n_i]$, where the product is taken over all observed tort reforms less than or equal to *t*. See Kaplan and Meier (1958).

hazard and reduces the duration of the spell. Our objective is to measure the expected duration of the tort reform spell and then use the estimated probability of survival to examine the impact of tort reform on insurance markets. Since we need to compute expected spell durations, we use the Weibull form of the hazard because computing expected spell durations with it is relatively straightforward. The Weibull form imposes a baseline hazard of $h_o(t) = \alpha t^{\alpha-1}$.[11] We jointly estimate the parameters of the baseline hazard with the coefficients on the explanatory variables. To allow for the hazard function for each reform to change over time, we restructure the data into a yearly tort reform file, with a tort reform entering the file repeatedly to reflect each month that it is in force. The explanatory variables are allowed to vary over the sample period, i.e. the hazard model can accommodate time-varying covariates. This adds a temporal dimension to the analysis that we were not able to capture with a simple probit regression.

Table 5 shows the results of the Weibull hazard model with time-varying covariates. The estimates indicate that after controlling for state and insurance market characteristics, the hazard rate is higher for non-economic damage reforms than for other reform types. The coefficients on the insurance market characteristic variables are statistically insignificant. Thus, insurance market dynamics do not influence the duration of tort reform.

A few of the coefficients on the state characteristic variables are statistically significant. States with a large insurance industry are associated with a lower tort reform hazard rate. The style of judicial selection also influences the hazard rate. Judicial elections, both partisan and non-partisan, significantly influence the probability of a reform's unconstitutionality. This may suggest either that citizens who elect judges do not like tort reforms or that there is an influence on judicial elections not captured by our model, such as campaign contributions or other interest

[11] An α less than one implies a monotonically decreasing hazard rate, an α greater than one indicates an increasing hazard, and an α equal to one implies a constant hazard.

group pressures. The omitted judicial selection category is a merit selection plan, which arguably makes the state bar's influence on eventual selection stronger than other forms of selection (Hanssen, 2002). Thus, it is interesting that elected judges are more likely to overturn a tort reform than a judge who is selected though a merit process.

The geographical region of the state also influences the hazard rate. The estimates reveal that tort reforms in states in the East North Central, West North Central, South Atlantic, and Pacific regions of the United States have higher hazard rates and thus lower survival functions.

Again our goal is to obtain a measure of a tort reform's estimated probability of survival. Accordingly, we calculate estimated hazard probabilities, survival probabilities, and expected duration times using the Weibull model. This allows us to obtain unique probability and duration estimates for each reform enacted in a state and for each year that the reform is in place.

Table 6 reports the summary statistics of our estimated survival probabilities. The estimates reveal that the survival rate varies over time and over the cross-section of reforms. The mean survival probability is at a maximum in year one and a minimum in year twelve. Over the breadth of reforms, the difference in the survival probability at the 95^{th} and the 5^{th} percentiles averages 0.503. It is at its lowest in year one at 0.133 in year one, but the divergence grows to 0.704 in year nine. There is also ample heterogeneity in the survival probabilities across the types of reforms (not reported). The median survival probability of limitations on non-economic damages is 0.782. In comparison, the median is 0.922, 0.892, and 0.868 for reforms to joint and several liability, the collateral source rule, and punitive damages. The lowest estimated probability of survival for our sample is 0.083, indicating that a researcher's use of dichotomous tort reform variable for this particular reform-year would severely misestimate the influence of tort reform.

5. Insurance Market Response

We examine the effect of tort reform on insurance markets at the state level. The data set in this part of the paper includes one observation for each state and year for the years 1985 to 2006. Our econometric models investigate whether tort reform influences state variations in economic loss ratios, losses, premiums, and loss volatility. To estimate this relationship, we follow the prior literature and estimate the following autoregressive models (e.g, Viscusi et al., 1993; and Born and Viscusi, 1994 and 1995):

$$\text{Log Econ. Loss Ratio}_{it} = \alpha_1 + \beta_1 \text{Log Econ. Loss Ratio}_{it-1} + \gamma_1 \text{Reform}_{jit} + \varepsilon_{it} \quad (1)$$

$$\text{Log Losses}_{it} = \alpha_1 + \beta_1 \text{Log Losses}_{it-1} + \psi \text{Log Premiums}_{it} + \gamma_1 \text{Reform}_{jit} + \varepsilon_{it} \quad (2)$$

$$\text{Log Premiums}_{it} = \alpha_1 + \beta_1 \text{Log Premiums}_{it-1} + \gamma_1 \text{Reform}_{jit} + \varepsilon_{it} \quad (3)$$

$$\text{Log Loss Volatility}_{it} = \alpha_1 + \beta_1 \text{Log Loss Volatility}_{it-1} + \gamma_1 \text{Reform}_{jit} + \varepsilon_{it} \quad (4)$$

The economic loss ratio is the ratio of discounted losses incurred in liability lines to premiums earned in liability lines for state *i* in year *t*. Reform is either an indicator of whether state *i* had a tort reform of type *j* in place in year *t* or the survival probability of reform type *j* in year *t*.[12] The use of a logarithmic dependent variable reduces the impact that large outliers may have on the estimation. The explanatory variables are also in logarithmic terms, allowing the coefficients to be interpreted as the elasticity of the dependent variable with respect to the explanatory variable of interest. The inclusion of the lagged dependent variable as an independent variable allows us to interpret the shift in the overall level of the dependent variable as a function of liability reforms. The lagged value captures aspects of the risks associate with policies written in a particular state.

[12] The liability reform indicators and survival probabilities begin at the start of the calendar year, even though some reforms may have been instituted during the year.

The results of these ordinary least squares (OLS) regressions are shown in Table 7. Panel A displays the results using tort reform indicator variables. Panel B presents the results using the survival probabilities of tort reform in place of the dichotomous tort reform variables. Standard errors are adjusted for heteroskedasticity (White, 1980) and state clustering.

The results in Panel A indicate that when using indicator variables to account for the effect of tort reform only modifications to the collateral source rule and limitations to non-economic damage awards significantly impact the level of premiums and losses in liability lines of insurance. Reforms of the collateral source rule and non-economic damage awards have negative impacts on a state's economic loss ratio. The size of the coefficients implies that the establishment of a non-economic damage reform reduces the economic loss ratio by 9 percent and collateral source reforms reduce the economic loss ratio by roughly 13 percent. The principal mechanism for the decline in the economic loss ratio is a reduction in losses. Collateral source and noneconomic damage reforms lower losses by roughly 13 and 8 percent, respectively. Noneconomic damage reforms are not found to significantly impact premiums. Reforms to the collateral source rule *increase* premiums by 6 percent, which also results in a lower economic premium ratio. The results indicate that punitive damage reforms increases loss volatility by approximately 6 percent, while noneconomic damage reforms lower loss volatility by 9 percent. Overall, our evidence is broadly consistent with a number of other studies (e.g., Born and Viscusi, 1994 and 1995; and Viscusi and Born, 1995 and 2005) that find discover that tort reforms enhance insurers profitability (lower loss ratios) and increase premium levels. Thus, like other studies that account for tort reform using an indicator variable, we find evidence that substantiates the consumer advocates critique of tort reform – that tort reforms do not reduce prices but rather merely add to insurers' profitability.

The results in Panel B, which use the survival probabilities of tort reform in place of the dichotomous tort reform variables, show a different view of the effect of tort reform. Limitations on non-economic damage awards are still found to have a negative impact on the economic loss ratio, but modifications to the collateral source rule do not. The size of the coefficient for non-economic damage reforms implies that a 10 percent increase in the probability of the reform surviving, reduces the economic loss ratio by 0.13 percent. More importantly, the results reveal that a greater survival probability of joint and several liability reforms and caps on punitive damages increase the economic loss ratio. A 10 percent increase in the survival probability of joint and several liability reform is associated with a 0.22 percent increase in the economic loss ratio. Similarly, for limitations on punitive damage awards the increase is 0.11 percent.

The mechanisms of influence of the tort reforms for the economic loss ratios are through both losses and premiums. Modifications to the collateral source rule and non-economic damage caps reduce the level of the present value of losses incurred. The size of the coefficients for collateral source and non-economic damages indicate that a 10 percent increase in survival probability lowers losses by 0.17 and 0.14 percent, respectively. Contrary to expectations the results indicate that reforms of joint and several liability and punitive damages increase the present value of losses. Nevertheless, an increase in losses without a similar increase in premiums may suggest that a lower per unit price of insurance.

Modifications to the collateral source rule and non-economic damage caps reduce premium levels. The size of the coefficients for collateral source and non-economic damages indicate that a 10 percent increase in survival probability lowers losses by 0.17 and 0.14 percent and reduces premiums by 0.10 and 0.05 percent, respectively. Joint and several liability reforms also lead to lower premiums. The elasticity associated with the survival probability of joint and

several reforms with respect to premiums is a reduction of 0.16 percent. Punitive damage caps, however, do not significantly impact premium levels. Thus, joint and several liability and punitive damage reforms increase losses without a similar increase in premiums, suggesting that these reforms may lower the per unit price of liability insurance. Overall, using a more realistic measure of the impact of tort reform indicates that liability reforms lower premiums, indicating that tort reforms may reduce prices.[13]

The results also indicate that tort reforms reduce the volatility of losses. In particular, higher survival probabilities for joint and several liability reform and limitations to non-economic damages lower the cross-sectional volatility of losses in a state. A ten percent increase in the survival probability of modifications to joint and several liability translates to a 0.22 percent reduction in loss volatility. A similar increase in the survival probability of non-economic damage reforms leads to a 0.15 percent reduction in volatility. To our knowledge, this is the first paper to document the ameliorating effect of tort reform on state-wide loss variability. Overall, using the survival probability of tort reform leads to much different conclusions for the effect of tort reform on insurance markets than the indicator variables used in previous studies.

We conduct additional analyses to determine the robustness of our results. First, we investigate whether our results are driven by unobservable differences across states. For this purpose, we re-estimate the regressions using state fixed effects. Second, we examine whether the lagged dependent variable influences our result. To this end, we re-calculate our estimates using a reduced form of equations (1) thru (4) that omits the lagged dependent variable. Third, the specification of equations (1) thru (4) assumes that the effect of tort reform is to modify the overall level of the dependent variable—the economic loss ratio, losses, premiums, or loss

[13] Premiums are not the price of insurance; rather they comprise two components, price and quantity. Therefore, a reduction in premium levels could be due to lower prices as well as a decrease in the quantity of insurance demanded.

volatility. However, it may be that tort reform modifies the structure of the insurance market as well as the level. To examine this possibility, we let the coefficient of the lagged dependent variable vary with tort reform regime by interacting the lagged dependent variable with our reform variables. This lets the lagged dependent variable to have a different effect in the post-reform period accounting for the possibility that the past performance of the insurance market may not have the same impact in the future if the state reforms the tort liability system. Finally, in addition to using the survival probabilities of tort reform in Panel B, we also use the predicted mean and median duration times. Our results are robust to all these alternate specifications.[14]

6. Conclusion

In previous studies, the impact of tort reform was examined using dichotomous tort reform variables. We find, however, that a large number of enacted reforms are later repealed. Given that the risk of judicial intervention and the potential nullification of tort reforms is significant, it is rational for insurers to exercise caution with respect to setting their premiums given the uncertainty of a particular tort reform's potential longevity. A strict dichotomous variable may misestimate a reforms true impact, especially with respect to insurance premiums. We explicitly account for the probability that not all tort reforms will survive and we find strong evidence that the survival probability of tort reform matters. Moreover, we document that the indicator variable common to other studies misestimates the impact of tort reform on insurance markets since it does not account for the insurers' rational reaction to the potential reforms uncertain reception in the courts.

Unlike prior studies, we find almost universal evidence that tort reform lowers premiums. While we also find that certain types of tort reform may increase loss ratios, which on the surface

[14] The results of these alternate model specifications are available from the authors upon request.

suggest a failure of tort reform, we provide two important pieces of evidence to suggest that tort reform works to stabilize insurance markets beyond the observed reduction in premiums. First, both losses and premiums decrease for most reforms. The rate of decrease for premiums and losses is unequal as losses fall faster than premiums. Second, our results indicate that tort reform reduces loss volatility. Less uncertainty makes pricing easier and potentially enhances the willingness of firms to supply liability insurance, which may explain our finding of increased losses and loss ratios for certain reforms.

Controlling for potential reform survival is an important contribution to the tort reform literature. It brings us closer to the true insurance market dynamics and allows us to more precisely measure the economic value of tort reform. Nevertheless, there is still a limitation to our tort reform measures—they do not capture the continuous quantitative impact of the specific reforms. Tort reforms differ in "strength". For example, Colorado limits the award of non-economic damages to $250,000, whereas the state of Washington limits the award of non-economic damages just for bodily injury to 0.43% times the average annual wage times the plaintiff's life expectancy. These two reforms will obviously have differing impacts on insurer loss costs and therefore premiums. We, however, categorize all reforms only by their type and their likelihood of their survival. The true impact of a reform should also vary depending on its "strictness". However, the nature of the reforms does not lend itself to these types of quantitative metrics. We also note that tort reforms often comprise multiple components, but we only recognize specific qualities that are identifiable for all states. Both of these limitations are common to all extant studies of tort reform.

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APPENDIX A

Variable Definitions and Sources (1985 to 2006)

Variable:	Definition:	Source:
Tort Reform:		
Collateral	An indicator variable set equal to 1 if the state enacted a reform to the collateral source rule, and 0 otherwise.	Tort Reform: American Tort Reform Association (www.atra.org) and Avraham (2006)
Joint	An indicator variable set equal to 1 if the state modified its joint and several liability law, and 0 otherwise.	
Punitive	An indicator variable set equal to 1 if the state instituted a cap on the size of punitive damage awards, and 0 otherwise.	
Non-Econ	An indicator variable set equal to 1 if the state enacted a cap on the size of noneconomic damages awards, and 0 otherwise.	
State Characteristics:		
GSP per Capita	Total gross state product (GSP or Gross Domestic Product by State) divided by the total state population. The variable is scaled by 10,000. Gross state product is a measure of value added, calculated from three components: compensation to employees, indirect business tax and nontax liability, and property-type income (including corporate profits, business transfers, rental income, and net interest).	GSP: Bureau of Economic Analysis (BEA). See BEA, "Regional Accounts Data: Gross State Product Data" (http://www.bea.gov/regional/gsp/)
Insurance GSP	Percentage of GSP attributable to insurance companies and agents in the state to total GSP attributable to all private industries in the state.	
Lawyers per Capita	Ratio of the total number of lawyers in a state to the total population in the state multiplied by 10,000.	*The Lawyer Statistical Report* , various years
Physicians per Capita	Ratio of the number of doctors in a state to the total population in the state multiplied by 10,000.	*Statistical Abstract of the United States* , various years
Appoint	An indicator variable set equal to 1 if state's judicial selection mechanism is appointment, and 0 otherwise.	Judicial Selection: Hanssen (2004) and American Judicature Society (http://www.judicialselection.us/)
Nonpartisan Election	An indicator variable set equal to 1 if judges in the state are elected in a nonpartisan election, and 0	
Partisan Election	An indicator variable set equal to 1 if judges in the state are elected in a partisan election, and 0	
Merit	An indicator variable set equal to 1 if state select judges based on the merit plan, and 0 otherwise.	
Percent Democratic	Percent of state legislators that belong to the Democratic Party	*Statistical Abstract of the United States* , various years
Citizen Ideology Index	A measure of the ideology of a state's citizens, 0 is the most conservative and 100 is the most liberal	Berry et al. (1998)

(*Continued on Next Page*)

Insurance Market Characteristics:		
Premiums	Total premiums earned in liability lines in a state.	
PV (Losses)	Present value of losses incurred in liability lines in a state. The present value is the payout tail proportion, i.e., percentage of losses paid in year t (t = 1, 2,…, T), discounted by the risk-free rate. The payout tail proportions were estimated using the method prescribed by the Internal Revenue Service for computing loss present values for tax purposes (Cummins, 1990).	Insurance Data: National Association of Insurance Commissioners (NAIC) Property-Casualty Annual Statement Database - 1985-2006.
Economic Loss Ratio	PV(Losses) / Premiums	
Economic Premium Ratio	Ratio of the premiums for liability line to the present value of expected discounted losses (Premiums /	Risk-free rates: Estimated from the U.S. Treasury spot-rate yield curves for each year of the sample period provided in the Federal Reserve Bank of St. Louis' Federal Reserve Economic Data (FRED) database.
Loss Volatility	The cross-sectional standard deviation of losses incurred in liability lines a state. In Tables 2, 3, and 5, this variable is scaled by the cross-sectional standard deviation of premiums written in liability lines in a state.	
Mkt Share Largest Med Mal Co.	Percent of total premiums earned by the largest medical malpractice insurer in the state.	
Number of Liability Insurers	Total number of insurers providing liability insurance in a state.	
Geographical Divisions		
Northeast	Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut	
Mid-Atlantic	New York, New Jersey, and Pennsylvania	
East North Central	Ohio, Indiana, Illinois, Michigan, and Wisconsin	
West North Central	Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas	
South Atlantic	Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina,	U.S. Census Bureau
East South Central	Kentucky, Tennessee, Alabama, and Mississippi	
West South Central	Arkansas, Louisiana, Oklahoma, and Texas	
Mountain	Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, and Nevada	
Pacific	Washington, Oregon, California, Alaska, and Hawaii	

TABLE 1

Summary of Tort Reforms by State and Type (1985 - 2006)

	All Reforms			Collateral			Joint			Punitive			NonEcon		
	Total	Unconst.		Total	Unconst.		Total	Unconst.		Total	Unconst.		Total	Unconst.	
STATE	#	#	%	#	#	%	#	#	%	#	#	%	#	#	%
AK	6	2	33.3	1	0	-	1	0	-	1	1	100.0	3	1	33.3
AL	3	2	66.7	1	1	100.0				2	1	50.0			
AR	2	0	-				1	0	-	1	0	-			
AZ	2	1	50.0	1	0	-	1	1	100.0						
CA	1	1	100.0				1	1	100.0						
CO	6	1	16.7	1	0	-	1	0	-	1	0	-	3	1	33.3
CT	2	1	50.0	1	0	-	1	1	100.0						
FL	8	4	50.0	1	1	100.0	2	1	50.0	2	1	50.0	3	1	33.3
GA	3	1	33.3	1	1	100.0	1	0	-				1	0	-
HI	4	0	-	1	0	-	2	0	-				1	0	-
IA	2	0	-	1	0	-	1	0	-						
ID	6	2	33.3	1	0	-	1	0	-	1	0	-	3	2	66.7
IL	6	4	66.7	1	0	-	2	2	100.0	1	1	100.0	2	1	50.0
IN	3	0	-	1	0	-	1	0	-	1	0	-			
KS	4	2	50.0	1	1	100.0				1	0	-	2	1	50.0
KY	3	1	33.3	1	1	100.0	2	0	-						
LA	1	0	-				1	0	-						
MA	1	0	-				1	0	-						
MD	2	1	50.0										2	1	50.0
ME	1	0	-	1	0	-									
MI	4	1	25.0	1	1	100.0	1	0	-				2	0	-
MN	4	2	50.0	1	1	100.0	2	0	-				1	1	100.0
MO	5	0	-	1	0	-	2	0	-	1	0	-	1	0	-
MS	4	0	-				2	0	-	1	0	-	1	0	-
MT	6	1	16.7	1	0	-	3	1	33.3	1	0	-	1	0	-
NC	1	1	100.0							1	1	100.0			
ND	4	0	-	1	0	-	1	0	-	1	0	-	1	0	-
NH	3	1	33.3				1	0	-	1	0	-	1	1	100.0
NJ	4	0	-	1	0	-	2	0	-	1	0	-			
NM	1	0	-				1	0	-						
NV	3	0	-				1	0	-	1	0	-	1	0	-
NY	2	0	-	1	0	-	1	0	-						
OH	9	5	55.6	3	2	66.7	1	1	100.0	2	1	50.0	3	1	33.3
OK	4	0	-	1	0	-	1	0	-	1	0	-	1	0	-
OR	4	1	25.0	1	0	-	2	0	-				1	1	100.0
PA	3	1	33.3	1	0	-	1	1	100.0	1	0	-			
SC	2	0	-				1	0	-				1	0	-
SD	1	0	-				1	0	-						
TN	1	0	-				1	0	-						
TX	6	0	-				3	0	-	2	0	-	1	0	-
UT	1	0	-				1	0	-						
VA	1	1	100.0							1	1	100.0			
VT	1	0	-				1	0	-						
WA	2	1	50.0				1	0	-				1	1	100.0
WI	2	2	100.0				1	1	100.0				1	1	100.0
WV	2	0	-				1	0	-				1	0	-
WY	2	0	-				2	0	-						
Total	148	40	27.0	28	9	32.1	55	10	18.2	26	7	26.9	40	14	35.0

TABLE 2

Mean and Median Differences Between Tort Reforms Found Unconstitional and Tort Reforms Not Found Unconstitional

Variable	Not Unconstitutional (1)			Unconstitutional (2)			Test of Differences (3)	
	Mean	Median	Std Dev.	Mean	Median	Std Dev.	t-Test	Wilcoxon z
Reform Type:								
Collateral	0.176	0.000	0.383	0.225	0.000	0.423	-0.673	-0.675
Joint	0.417	0.000	0.495	0.250	0.000	0.439	1.873 *	1.857 *
Punitive	0.176	0.000	0.383	0.175	0.000	0.385	0.013	0.013
Non-Econ	0.231	0.000	0.424	0.350	0.000	0.483	-1.454	-1.449
Year	1994.343	1995.000	7.351	1989.800	1987.000	4.659	3.642 ***	3.257 ***
State Characteristics:								
GSP per Capita	2.584	2.515	0.841	2.177	1.879	0.680	2.740 ***	2.828 ***
Insurance GSP	2.249	2.145	0.761	2.631	2.051	1.183	-2.312 **	-1.278
Lawyers per Capita	29.694	28.125	11.309	28.165	27.720	6.141	0.811	0.294
Appoint	0.093	0.000	0.291	0.075	0.000	0.267	0.334	0.335
Nonpartisan Election	0.315	0.000	0.467	0.425	0.000	0.501	-1.251	-1.248
Partisan Election	0.194	0.000	0.398	0.200	0.000	0.405	-0.075	-0.075
Merit	0.398	0.000	0.492	0.300	0.000	0.464	1.094	1.094
Percent Democratic	0.517	0.533	0.147	0.537	0.513	0.150	-0.729	-0.484
Citizen Ideology Index	46.919	46.889	12.810	45.221	45.829	12.113	0.726	0.695
Insurance Market Characteristics:								
Economic Loss Ratio	0.624	0.584	0.202	0.560	0.523	0.195	1.723 *	2.077 **
Economic Premium Ratio	1.744	1.712	0.482	1.963	1.911	0.563	-2.349 **	-2.077 **
Loss Volatility	1.043	0.850	0.759	0.875	0.835	0.294	1.356	1.058
Mkt Share Largest Med Mal Co.	0.368	0.346	0.133	0.423	0.425	0.112	-2.317 **	-2.539 **
Number of Liability Insurers	297.213	297.000	83.450	308.100	297.500	70.252	-0.734	-0.557
N		108			40			

Note.-- See Appendix A for a description of the variables. ***,**, and * denote significance at the 1, 5, and 10 percent level.

TABLE 3

Probit Regressions of Probability of Unconstitutionality During The Sample Period

	Probit on the Probability of Unconstitutionality		Estimated Marginal Effects
	(1)		(2)
State Characteristics:			
GSP per Capita	-0.969 ***	(0.267)	-0.275
Insurance GSP	0.624 ***	(0.235)	0.129
Lawyers per Capita	0.116 **	(0.055)	0.215
Appoint	2.409	(1.513)	0.771
Nonpartisan Election	6.703 ***	(2.495)	0.999
Partisan Election	5.158 **	(2.223)	0.978
Percent Democratic	0.485	(1.006)	0.026
Citizen Ideology Index	-0.045 ***	(0.016)	-0.158
Lawyers X Appoint	-0.071	(0.047)	-0.203
Lawyers X Nonpartisan	-0.216 **	(0.087)	-0.869
Lawyers X Partisan	-0.150 **	(0.075)	-0.417
Insurance Market Characteristics:			
Economic Premium Ratio	0.788	(0.492)	0.142
Loss Volatility	0.422	(0.266)	0.034
Mkt Share Largest Med Mal Co.	2.472	(1.694)	0.099
Log of # of Liability Insurers	1.179	(0.97)	0.102
Reform Type:			
Collateral	0.119	(0.392)	0.030
Punitive	0.303	(0.315)	0.080
Non-Econ	0.575 *	(0.329)	0.156
Geographical Divisions			
Northeast	1.403	(1.131)	0.486
Mid-Atlantic	1.429	(1.012)	0.494
East North Central	2.022 **	(0.805)	0.663
West North Central	1.439 *	(0.764)	0.478
South Atlantic	2.194 ***	(0.576)	0.718
Mountain	0.737	(0.791)	0.215
Pacific	2.730 ***	(0.875)	0.827
Composite Effect[a]:			
Lawyers per Capita	0.006	(0.04)	0.260
Appoint	0.335	(0.598)	0.764
Nonpartisan Election	0.391	(0.447)	0.525
Partisan Election	0.777	(0.521)	0.889
Log Likelihood	-54.565		
Pseudo R^2	0.368		
Observations	148		

Note.-- Standard errors adjusted for heteroskedasticity (White (1980)) and state clustering are in parentheses. Column 1 reports the coefficients from a probit regression in which the dependent variable is binary. It takes the value of one if the tort reform was declared unconstitutional during the sample period and zero otherwise. Column 2 reports the marginal effects from the probit regression. The marginal effect for continuous variables is the change in the predicted probability due to an increase from the 25th to the 75th percentile of the variable of interest and keeping all other variables at their mean value. Interaction variables are evaluated from the 5th percentile to the 95th percentile. The marginal effect for discrete variables is the change in the predicted probability due to a change from 0 to 1. The regression includes a constant term which is not reported here to conserve space. All variable definitions are available in Appendix A. ***,**, and * denote significance at the 1, 5, and 10 percent level.

[a] The Composite Effect is the composite linear combination evaluated at the mean. For example, the composite effect of Appoint is: $\beta_{\text{Appoint}} + (\beta_{\text{Lawyers X Appoint}})(\mu_{\text{Lawyers}})$

Table 4

Estimated Survivor Functions: Kaplan-Meier Estimates

Year	All Reforms (1)	Collateral (2)	Joint (3)	Punitive (4)	Non-Economic (5)
1	0.966 (0.015)	0.929 (0.049)	0.965 (0.024)	0.962 (0.038)	0.974 (0.026)
2	0.931 (0.021)	0.929 (0.049)	0.928 (0.035)	0.962 (0.038)	0.915 (0.047)
3	0.879 (0.028)	0.891 (0.059)	0.890 (0.043)	0.920 (0.055)	0.820 (0.067)
4	0.863 (0.029)	0.891 (0.059)	0.890 (0.043)	0.871 (0.07)	0.779 (0.075)
5	0.788 (0.036)	0.814 (0.075)	0.870 (0.046)	0.775 (0.09)	0.606 (0.096)
6	0.771 (0.037)	0.814 (0.075)	0.849 (0.049)	0.726 (0.096)	0.606 (0.096)
7	0.737 (0.039)	0.736 (0.086)	0.828 (0.052)	0.678 (0.101)	0.606 (0.096)
8	0.737 (0.039)	0.736 (0.086)	0.828 (0.052)	0.678 (0.101)	0.606 (0.096)
9	0.719 (0.04)	0.698 (0.09)	0.807 (0.055)	0.678 (0.101)	0.606 (0.096)
10	0.701 (0.041)	0.698 (0.09)	0.807 (0.055)	0.678 (0.101)	0.519 (0.1)
11	0.692 (0.042)	0.659 (0.093)	0.807 (0.055)	0.678 (0.101)	0.519 (0.1)
12	0.680 (0.043)	0.659 (0.093)	0.807 (0.055)	0.678 (0.101)	0.462 (0.104)
13	0.680 (0.043)	0.659 (0.093)	0.807 (0.055)	0.678 (0.101)	0.462 (0.104)

Note.-- Standard errors are in parentheses. The table reports Kaplan-Meier estimates of survival probabilities that represent the probability that a tort reform's spell will last beyond a specified time.

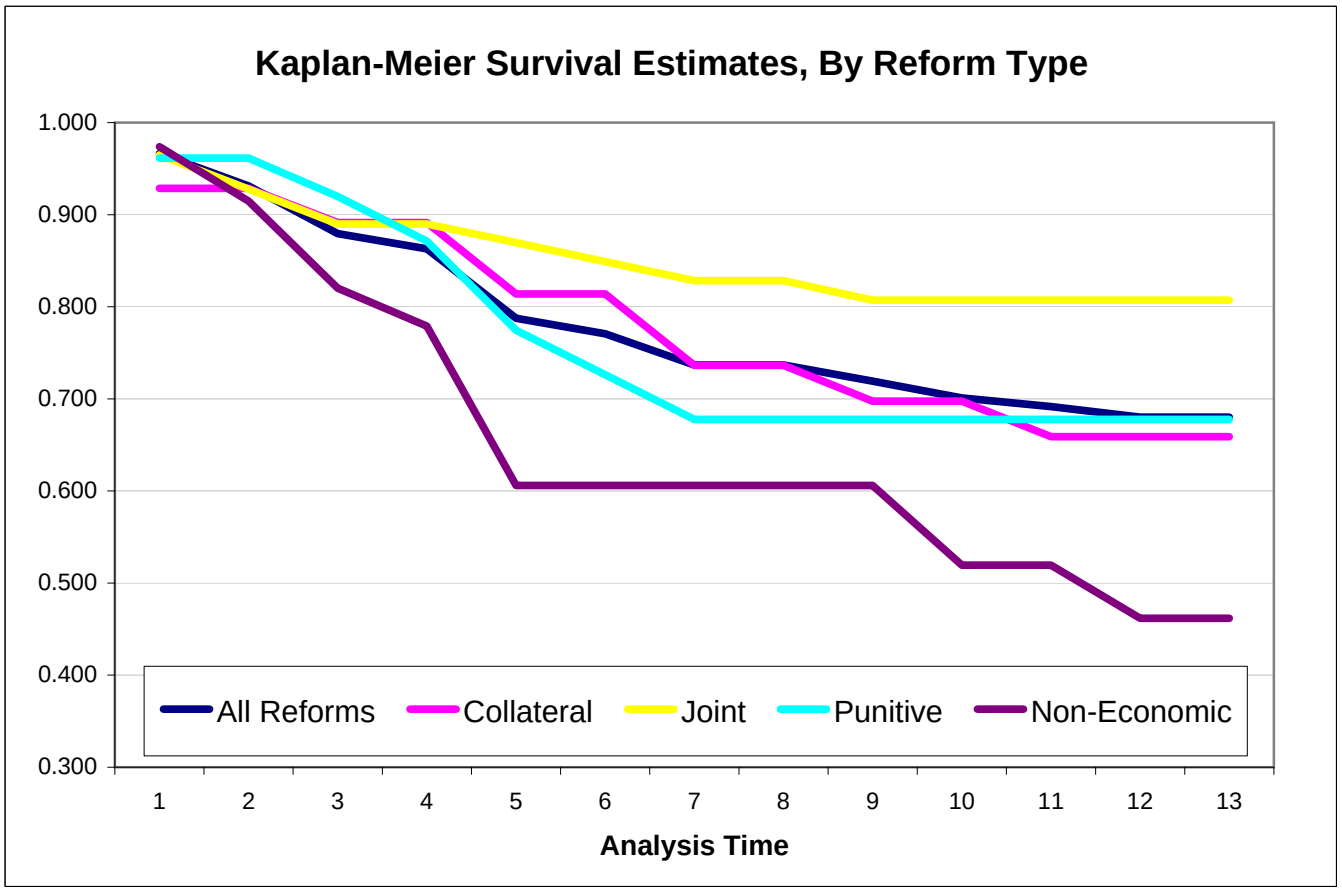

TABLE 5

Effects of Explanatory Variables: Weibull Hazard Model

	Weibull with Time-Varying Covariates	
	(1)	
State Characteristics:		
GSP per Capita	-0.952 ***	(0.358)
Insurance GSP	0.183	(0.198)
Lawyers per Capita	0.062	(0.053)
Appoint	1.394	(1.696)
Nonpartisan Election	3.708 **	(1.661)
Partisan Election	3.828 *	(2.275)
Percent Democratic	1.243	(1.858)
Citizen Ideology Index	-0.031	(0.022)
Lawyers X Appoint	-0.005	(0.046)
Lawyers X Nonpartisan	-0.088 *	(0.052)
Lawyers X Partisan	-0.080	(0.074)
Insurance Market Characteristics:		
Economic Premium Ratio	-0.496	(0.563)
Loss Volatility	-0.418	(0.425)
Mkt Share Largest Med Mal Co.	0.712	(2.042)
Number of Liability Insurers	0.004	(0.004)
Reform Type:		
Collateral	0.019	(0.523)
Punitive	0.666	(0.507)
Non-Econ	1.271 ***	(0.476)
Geographical Divisions		
Northeast	1.668	(1.696)
Mid-Atlantic	0.682	(1.932)
East North Central	2.388 **	(1.127)
West North Central	1.959 *	(1.092)
South Atlantic	2.744 ***	(0.764)
Mountain	0.971	(1.089)
Pacific	2.388 *	(1.361)
Composite Effect[a]:		
Lawyers per Capita	0.022	(0.031)
Appoint	1.240	(1.161)
Nonpartisan Election	0.850 *	(0.456)
Partisan Election	1.232 **	(0.536)
Constant	-6.073 ***	(1.986)
Observations	1470	
Total Number of Tort Reforms	148	
Number of Unconstitutional Tort Reforms	40	

Note.-- Standard errors adjusted for heteroskedasticity (White (1980)) and state clustering are in parentheses. A positive coefficient indicates that the regressor increases the hazard and reduces the duration of tort reform. All variable definitions are available in Appendix A. ***,**, and * denote significance at the 1, 5, and 10 percent level.

[a] The Composite Effect is the composite linear combination evaluated at the mean.

Table 6

Estimated Conditional Probability of Tort Reform Survival

				Percentile				
	N	Mean	Std Dev	5th	25th	50th	75th	95th
t = 1	138	0.963	0.050	0.865	0.950	0.983	0.994	0.998
t = 2	125	0.931	0.077	0.756	0.909	0.967	0.986	0.995
t = 3	107	0.900	0.108	0.654	0.870	0.947	0.977	0.991
t = 4	97	0.875	0.132	0.595	0.849	0.930	0.968	0.987
t = 5	95	0.848	0.159	0.469	0.807	0.913	0.959	0.983
t = 6	86	0.835	0.163	0.463	0.785	0.894	0.950	0.980
t = 7	81	0.817	0.179	0.409	0.761	0.878	0.940	0.976
t = 8	77	0.807	0.184	0.315	0.736	0.867	0.932	0.975
t = 9	74	0.786	0.195	0.263	0.713	0.845	0.921	0.967
t = 10	69	0.777	0.196	0.316	0.714	0.832	0.911	0.964
t = 11	55	0.772	0.197	0.291	0.703	0.819	0.907	0.970
t = 12	51	0.763	0.198	0.271	0.693	0.817	0.902	0.945
t = 13	48	0.770	0.178	0.462	0.697	0.808	0.895	0.941

Note.-- Estimated conditional survival probability, $S(t \mid t_0)$, is the probability of tort reform survival past time t, given survival past time t_0, the year that the tort reform is instituted.

TABLE 7

Panel A: Ordinary Least Squares (OLS) Regressions of the Effects of Tort Reform on Insurance Markets Using Tort Reform Indicator Variables

	Dependent Variable:			
	Log Econ. Loss Ratio	Log PV(Losses)	Log Premiums	Log Loss Volatility
Variable	(1)	(2)	(3)	(4)
Intercept	-0.270 ***	-0.755 ***	0.528 ***	1.625 ***
	(0.027)	(0.159)	(0.094)	(0.283)
Log Economic Loss Ratio$_{t-1}$	0.428 ***			
	(0.055)			
Log Premiums		0.679 ***		
		(0.044)		
Log PV(Losses)$_{t-1}$		0.344 ***		
		(0.043)		
Log Premiums$_{t-1}$			0.976 ***	
			(0.005)	
Log Loss Volatility$_{t-1}$				0.894 ***
				(0.019)
Collateral Indicator Variable	-0.127 ***	-0.127 ***	0.064 ***	0.005
	(0.03)	(0.028)	(0.021)	(0.029)
Joint Indicator Variable	-0.017	-0.017	-0.008	-0.015
	(0.02)	(0.021)	(0.017)	(0.024)
Punitive Indicator Variable	0.042	0.032	0.014	0.057 **
	(0.032)	(0.032)	(0.019)	(0.027)
Nonecon Indicator Variable	-0.090 ***	-0.079 ***	-0.003	-0.090 ***
	(0.027)	(0.029)	(0.022)	(0.033)
Observations	1020	1020	1020	1020
R^2	0.241	0.949	0.965	0.807

Note.-- Standard errors adjusted for heteroskedasticity (White (1980)) and state clustering are in parentheses. All variable definitions are available in Appendix A. ***,**, and * denote significance at the 1, 5, and 10 percent level.

TABLE 7

Panel B: OLS Regressions of the Effects of Tort Reform on Insurance Markets Using Conditional Survival Probability of Tort Reform

	Dependent Variable:							
	Log Econ. Loss Ratio		Log PV(Losses)		Log Premiums		Log Loss Volatility	
Variable	(1)		(2)		(3)		(4)	
Intercept	-0.308 ***		-0.739 ***		0.579 ***		1.728 ***	
	(0.033)		(0.159)		(0.093)		(0.305)	
Log Economic Loss Ratio$_{t-1}$	0.428 ***							
	(0.054)							
Log Premiums			0.676 ***					
			(0.041)					
Log PV(Losses)$_{t-1}$			0.345 ***					
			(0.04)					
Log Premiums$_{t-1}$					0.976 ***			
					(0.005)			
Log Loss Volatility$_{t-1}$							0.889 ***	
							(0.021)	
Collateral (Survival Probability)	-0.029	[-0.007]	-0.073 **	[-0.017]	-0.044 ***	[-0.01]	0.004	[0.001]
	(0.028)		(0.032)		(0.014)		(0.04)	
Joint (Survival Probability)	0.054 **	[0.022]	0.053 **	[0.021]	-0.040 ***	[-0.016]	-0.054 *	[-0.022]
	(0.023)		(0.026)		(0.012)		(0.032)	
Punitive (Survival Probability)	0.090 ***	[0.011]	0.093 ***	[0.011]	0.016	[-0.016]	0.066	[0.008]
	(0.026)		(0.028)		(0.019)		(0.04)	
Nonecon (Survival Probability)	-0.110 ***	[-0.013]	-0.121 **	[-0.014]	-0.044 **	[-0.005]	-0.128 ***	[-0.015]
	(0.04)		(0.046)		(0.019)		(0.045)	
Observations	1020		1020		1020		1020	
R^2	0.227		0.949		0.965		0.808	

Note.-- Standard errors adjusted for heteroskedasticity (White (1980)) and state clustering are in parentheses. Elasticities are in brackets. Estimated conditional survival probability, $S(t \mid t_0)$, is the probability of tort reform survival past time t, given survival past time t_0, the year that the tort reform is instituted. All variable definitions are available in Appendix A. ***,**, and * denote significance at the 1, 5, and 10 percent level.