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Abstract

Whereas the literature evaluating the effect of tort reforms has focused on the impact of reforms on insurers' reported incurred losses, this article examines the ultimate effects of reforms using the developed losses from a comprehensive sample of insurers writing medical malpractice insurance from 1984 to 2003. Noneconomic damages caps are particularly influential in reducing medical malpractice losses and increasing insurer profitability. The long-run effects of these reforms are greater than insurers' expected effects; for example, 5- and 7-year developed loss ratios are below the initially reported incurred loss ratios for those years following the enactment of noneconomic damages caps. Analyses of reported losses consequently understate the ultimate effects of tort reforms. The quantile regressions show that reforms have the greatest effects for the firms that are at the high end of the loss distribution.

Introduction

Since the 1970s, the medical malpractice insurance industry has experienced several periods in which profits have declined rapidly, premiums have risen, and medical providers have reported problems with availability and affordability. To reduce the costs of insurance, many states have enacted a variety of tort reform measures that will reduce award and settlement amounts. There have been three distinct "rounds" of tort reform—the mid-1970s, the mid-1980s, and the late 1990s. The influence of such reforms on the medical malpractice insurance industry is of renewed interest because there are increased pressures for additional reform efforts. Medical malpractice reform headed the Bush administration's tort reform agenda, though no national reform legislation has been enacted.

The focus of the reform efforts has been on various measures that will reduce the amount of losses incurred by the insured. Whether such reforms are desirable from

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a social policy standpoint is beyond the scope of this study. We should note that a decrease in the amount of losses borne by the insurer typically implies that less money will be paid to injured parties. Tort reform is generally not strictly a zero sum game, as reduced medical malpractice losses will affect insurance premiums, the costs of care, and physician behavior. However, it is important to recognize that the "savings" from decreased losses are not necessarily efficiency gains as they may largely reflect reduced transfers to injured patients. This article does not address the overall social desirability of specific tort reforms but is concerned with the more narrowly framed empirical issue of whether the reforms did ultimately reduce losses, which was their primary intent.

The empirical novelty of our analysis is that it is the first study to assess the longer-term effects of the reforms on losses. Previous studies of the effect of tort reforms on insurance markets have focused on the effects based on initial reported losses. Insurance companies estimate the ultimate losses associated with premiums earned in given year based on the incurred and reported losses associated with these policies as well as on their expectation of the losses that will ultimately be incurred for the policies written. Over time insurers update their loss estimates as additional claims are resolved. These developed loss figures reflect greater experience with how the insurance policy has performed. If tort reforms alter the tort liability landscape so that use of previous experience as a guide will make initial projections of losses too high, then one would expect to find a greater effect of tort reforms on ultimate losses than on initial losses. The main focus of this article is on the contrast between the effect of tort reforms on the initially reported losses rather than developed losses after 5, 7, and 10 years.

By considering the effects over this "longer term," the period of time considered should be long enough for: (1) the losses to have been nearly fully developed and (2) the insurer to correspondingly adjust premiums to reflect the changes in expected losses. The insurance-related studies of malpractice crises to date have mainly found effects in terms of the shorter-term results of tort reform, looking at how insurer losses and loss ratios vary across states with different sets of reforms. These studies use reported losses in calculating the influence of the reform variables and thus capture the influence of the reforms as "perceived" by the insurer (Barker, 1992; Viscusi et al., 1993; Viscusi and Born, 2004, 2005; Born and Viscusi, 1998). The results of these studies indicate, among other things, that the most influential malpractice reform measures are caps on noneconomic damages, which have reduced incurred losses and loss ratios.

These findings are further substantiated by the results of a line of research that focuses on the effects of the reforms on insurance company closed claim data (Danzon, 1984, 1986; Sloan et al., 1989; Zuckerman et al., 1990; Yoon, 2001). These studies indicate that caps on damages reduce mean payments in medical malpractice cases, which in turn should be reflected in insurer losses. Several studies have assessed the effects of malpractice tort reforms on award payments in court cases (Pace, Zakaras, and Golinelli, 2004; Studdert et al., 2004). These studies indicate that caps on noneconomic damages did, in fact, result in reduced payments to plaintiffs in medical malpractice cases in which the jury had awarded noneconomic damages in excess of the maximum allowable amount. Although of course this result is unsurprising, it does confirm that

caps do have an impact on tried cases.[1] Although examination of court awards is interesting, focusing on court awards alone ignores the effect of caps on settlements and on the selection of cases for litigation, which in turn will affect award levels. As a result, it provides an incomplete picture of tort reforms' effects that is also possibly tainted by changes over time in the selection of cases for trial. Our analysis of insurer losses will assess the full effects of tort reforms, as variations in insurer losses reflect changes in the number of cases filed as well as award amounts.

Studies of the effects of liability regimes on medical malpractice premiums yield similar results. Danzon, Epstein, and Johnson (2004) focus on the effect of reforms on medical malpractice insurance premiums, as do Kilgore, Morrisey, and Nelson (2006), who consider premiums for three major medical specialties. Noneconomic damages caps, particularly low caps, reduce premiums.

The studies in the literature of current effects on insurance markets and ultimate effects on claims have not examined the potentially differing magnitudes of the current and long-run effects. Analyzing current and long-run effects across different data sets and medical malpractice samples would not provide a meaningful basis of comparison because of the different mix of claims and differences in the structure of the data. Our study tracks the performance of a set of firms' medical malpractice policies over time. The data are drawn from completed insurance forms in which the firm is required by the National Association of Insurance Commissioners (NAIC) to track the loss performance of its premiums over time to justify the appropriateness of the reserve amounts.

Our analysis of the longer-term effect of the tort reforms will also provide a more accurate and complete perspective on the reform effects. If tort reforms did not alter the temporal profile of losses, then analyses based on reported losses would be an accurate reflection of the reform effects. However, reforms may also alter the time path of subsequent losses associated with the policy, given the long tail of medical liability insurance and the time it takes for reforms to have their full effect on court awards. An assessment of the ultimate effects of the tort reforms on losses requires analysis of the developed losses, which capture the actual court and settlement outcomes as influenced by the reforms. Furthermore, the analysis of the reforms over a longer period of time will illustrate whether the effects of some types of reforms take longer

[1] Sharkey (2005) argues that much of the research on the impact of damages caps has ignored the unintended consequences of the caps, such as possible "anchoring" by the jury (jurors may learn of the existence of the cap from the news media), and the "crossover effect" in which plaintiffs lawyers work harder to increase economic damages in states in which noneconomic damages are capped (Baker, 1998). She studied the relationship between damages caps and awards in tried cases using a sample of cross sectional data obtained from the National Center for State Courts and the Bureau of Justice Statistics. Although both the mean and median award were lower in states with damage caps, when she controlled for injury severity, county characteristics, litigant characteristics, and whether judges are elected or appointed, she found that the relationship was not significant (although the direction and magnitude of the effect in her regression equation was consistent with the differences in the means). Tried cases represent a selected sample of all claims, whereas our analysis of insurance market data is more comprehensive and not subject to selection effects.

to be manifested if, for example, they affect how cases are handled generally so that case law must develop before the effects are realized.

In this article, we use a combination of ordinary least squares (OLS) and quantile regression models to assess the relationships between various tort reform measures and insurer losses. To the extent that the results differ from earlier studies based on contemporaneous measures of losses and loss adjustment expenses, it is because we have additional information on (1) the true impact of the malpractice reforms on insurer underwriting performance and (2) the extent to which perceived effects of the reforms were actually borne out in the legal system. We discuss the construction of our data set in the next section. This discussion is followed by an illustration of the substantial effect of loss development, which provides further motivation for our particular analytical approach. Our empirical approach and results of our analysis follow, along with our discussion and conclusions. We find that considering the effect of the reforms on losses using 5-, 7-, and 10-year development factors shows that the long-run effect of the reforms differs substantially from the short-run effects. Typically, the effects are greater in the long run, but the relative impact of the reforms and the distribution of the reform effects throughout the insurance market are influenced as well by our use of a longer-term perspective.

DATA AND METHODOLOGY

The empirical analysis uses the financial data that insurers submit annually to the NAIC. These statements contain detailed information about the insurer's underwriting experience, including by-line and by-state premiums and losses, overall reserves, and by-line developed losses incurred. For our analysis, we utilized information from all statements filed by insurers active in underwriting for medical malpractice liability between 1984 and 2003.

Premiums earned were drawn from the annual statements, Schedule P1 Part F. We took data on losses incurred and loss development from Schedule P2 Part F.[2] For each year in which premiums are earned, we obtained contemporaneous losses incurred and the revised estimates of losses incurred (i.e., development) in each of the next 9 years.

To avoid undue influence of small firm outliers on the results, we exclude from the analysis firms that wrote under $1 million in premiums in any given year. This exclusion did not alter the results in any appreciable manner. Table 1 summarizes the sample statistics, where the unit of observation is a firm's operations by year, aggregated across states. The mean value of premiums earned is $34 million, whereas losses averaged $38 million.

Additional variables drawn from the NAIC data pertain to the number of states in which the insurer operates and the insurer's organizational form. Considering the number of states in which the insurer operates helps to capture the degree to which the insurer is able to diversify operations across different regulatory and legal

[2] In the early 1990s, insurers began reporting separately their premium and loss information for two types of medical malpractice policies: claims made and occurrence. An insurer's business for the two types was simply added for this research project, but this distinction will be explored in subsequent research.

TABLE 1
Sample Means, 1984–2003 ($N = 2,117$)

Variable		Mean (Standard Deviation)
Premiums earned (in millions)		33.853
		(71.768)
Losses incurred—current year (in millions)		37.648
		(84.714)
Share of business in states with:	Modified joint and several liability	0.723
		(0.355)
	Modified collateral sources rule	0.705
		(0.349)
	Noneconomic damages cap	0.383
		(0.369)
	Punitive damages cap	0.312
		(0.356)
	Prior approval rate regulations	0.526
		(0.360)
Number of states in which insurer writes med mal		14.775
		(17.903)
Organizational form	Stock	0.679
		(0.467)
	Mutual	0.137
		(0.344)
	Reciprocal exchange	0.111
		(0.315)
	Lloyds	< 0.001
		(0.022)

Note: The sample includes only insurers that write more than $1 million in premiums. The number of insurers in the sample ranges from 33 to 162 per year.
Source: National Association of Insurance Commissioners.

environments. Organizational form is included in the analysis to reflect possible differentials in administrative costs and agency issues across the major forms of insurer ownership in medical malpractice: stocks, mutuals, and reciprocals.[3] The dominant insurance company form is that of stock companies, which account for 68 percent of the sample. The next largest category is that of mutual insurance companies, which account for 14 percent of the sample.

Insurer loss development data are only reported at the firm level and cannot reasonably be allocated to state operations. This aspect of the data complicates our analysis of the influence of state differences in tort reform activity and regulation on insurer performance. Following Born (2001), we created proxy variables to capture the state

[3] More recently, the share of industry premiums written by an alternative form of organization—risk retention groups—has risen to over 12 percent. However, we do not have enough years of development to assess performance among this group of firms, since a majority of these firms do not enter our data set until 2000.

differences in tort reform and rate regulation. For each insurer operating in one or more states, we created variables to capture the extent to which that insurer is exposed to business in states with a particular characteristic, e.g., a reform measure. Each of these variables was calculated in the same manner, using 853,048 firm/state/year-level observations on medical malpractice liability premiums written. For example, the joint and several liability variable for firm i in year t operating in states indexed by s is given by

$$\text{Equation 1} \qquad ShareJS_{it} = \frac{\sum_{i,s,t} (PremiumsWritten_{ist} * ModifiedJointSev_{st})}{\sum_{i,s,t} (PremiumsWritten_{ist})}, \tag{1}$$

where $ModifiedJointSev_{st} = 1$ for each state, s, with this reform in place in year t, and 0 otherwise. The average share values for the four reform measures increase through the sample period, indicating that the amount of business written in reformed environments increased, which is consistent with state reform activity. The average values for all insurer share variables in 1984, 1992, and 2003 are shown in Table 2.

The prevalence of the tort reform regimes differs across states. As indicated in Table 1, the average share of the business in states with modified joint and several liability is 72 percent, and the percentage with modified collateral source rules is 71 percent. The prevalence of caps on noneconomic damages and caps on punitive damages is 38 percent and 31 percent, respectively.

Of these various tort reform variables, the results in previous studies suggest that caps on noneconomic damages will be most influential. The magnigures of the effects are likely to be especially great because noneconomic damages constitute the largest component of compensation in medical malpractice cases. Based on closed claims

TABLE 2
Average Share of Insurer Business in States With Tort Reforms and Prior Approval Rate Regulation

Share Variable	Mean 1984	Mean 1992	Mean 2003
Modified joint and several liability	0.000	0.755	0.684
	(0.000)	(0.414)	(0.376)
Modified collateral source rule	0.153	0.727	0.746
	(0.235)	(0.406)	(0.337)
Noneconomic damages cap	0.108	0.345	0.332
	(0.201)	(0.371)	(0.353)
Punitive damages cap	0.000	0.245	0.430
	(0.000)	(0.339)	(0.387)
Prior approval rate regulation	0.413	0.524	0.539
	(0.320)	(0.353)	(0.370)

Source: Sources include the American Medical Association (2004), the American Tort Reform Association, and individual state statutes.

data from Florida and Texas, the noneconomic damages share of medical malpractice payments for claims involving adults age 18 and over is 0.84 for nonfatal cases and 0.75 for fatal cases (Hersch, O'Connell, and Viscusi, 2007). Given the prominence of noneconomic damages and reforms that cap these damages, this tort reform measure will be the main matter of interest.

The temporal shifts in the reform variables vary as well, as reflected in Table 2. In 1984 there were few of these limitations in place, whereas by 1992 over two-thirds of the insurer share of business was in states with modified joint and several liability and modified collateral source rules. By 2003, the average share of business in states with noneconomic damages caps was over one-third, and the average share in states with punitive damages caps was over 40 percent. The effect these various measures will have on losses will depend not only on their prevalence but also on the extent to which these various reforms impinge on the levels of damages that plaintiffs would otherwise receive.

Table 2 also provides information on the within-year variation in the tort reform and regulatory share variables. For noneconomic damages and punitive damages caps, the standard deviations exceed the mean values, whereas for the other variables the standard deviations within years fall just short of the level of the means. This substantial value of the within-year standard deviations relative to their mean effects indicates that the estimation of the effect of tort reforms is indentified not only through the temporal variation in these values but also through the variation across firms.

It should be noted that medical malpractice reforms will give rise to a complex set of effects, which may affect the estimated values and the interpretation of the results. We discuss these below. However, it should be emphasized that our focus is not on these various mechanisms per se but on whether the effects of tort reform on the developed losses associated with premiums written in a given year are greater than the reported loss values for that year. This contrast should not be greatly altered by such influences.

Some of the responses induced by tort reform will be in terms of changes in the behavior of physicians. Following standard economic reasoning and empirical work on defensive medicine (Kessler and McClellan, 2002), one would expect malpractice reforms that limit damages to lead doctors to take fewer precautions. There might also be entry into the tort reform states by higher risk physicians from other states. Consequently, the effects observed for reforms will be less than would be in the absence of behavioral responses or doctor selection effects. Alternatively, if good doctors are attracted to lower liability states, the effect of tort reforms per se might be overstated. Insurance data do not permit resolution of this issue.

An alternative possibility is that insurers exit high-loss states and select into more favorable states. Movement by insurers in and out of states was not especially difficult during this time period.[4] If insurers with poor underwriting performance migrated

[4] Our data indicate that more than half of the firms in the sample expanded operations into additional states or did not change the number of states in which they operated. Over a 10-year period, only 17 percent of the insurers reduced the number of states in which they operated. An assessment of the relationship between profitability and entry/exit decisions is beyond the scope of our study.

to reform states, the estimated effects of the reforms may be understated. However, Danzon, Epstein, and Johnson (2004) did not find any statistically significant effect of damages caps on exit behavior in the medical malpractice insurance market. The effect of migration on loss development is less clear. This is discussed further in the next section.

LOSS DEVELOPMENT

Earlier studies of the effects of tort reform on insurer performance made use of current year reported loss information. Reported incurred losses include losses paid and an estimate for losses reported but not yet paid, as well as for losses incurred but not yet reported. The reported figure represents an insurer's expectations of the ultimate payout for policies written in that year. This expectation is formed by past experience, whereby the insurer can use past payout history to estimate the ultimate losses if the book of business and types of risks borne by the insurer have not changed markedly.

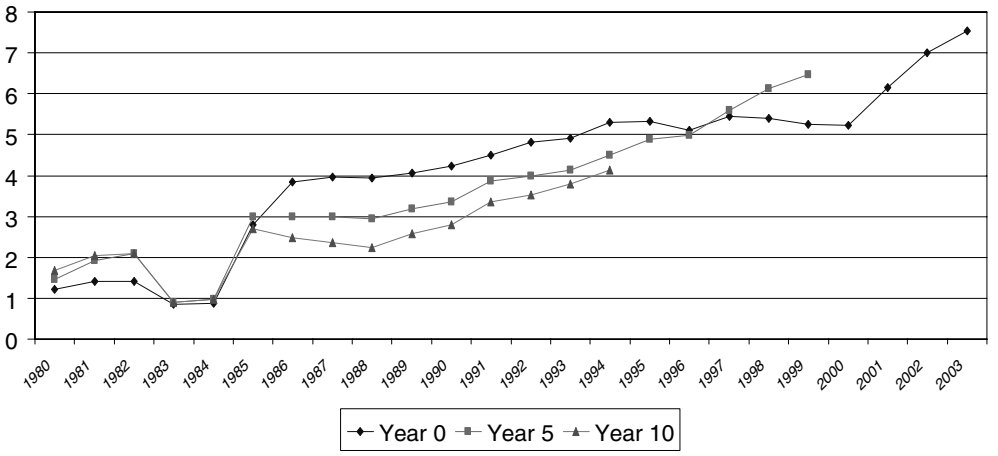
The annual statements filed by insurers include required disclosure of losses paid and incurred for previous policy years, and the corresponding amounts currently in reserve for losses that not yet been paid. This disclosure is especially useful for assessing the solvency of insurers. The adjustment, each year, of losses for previous years' business reflects a variety of errors in estimation. These errors arise from two primary factors: (1) delays in the reporting of claims, and (2) misjudgments in calculating the number or value of claims. As time passes, the number and value of claims for a particular policy year become more evident. To a great extent, the pattern of loss development can be estimated using past experience, and this projection is essential to the insurer's reserving for future losses.

The relationship between reported and developed losses has been the focus of several different lines of research. Several studies offer a behavioral perspective, suggesting that insurance company managers may intentionally misreport losses to achieve corporate or even personal objectives.[5] Unintentional misreporting results from unforeseen exogenous influences, such as a higher than expected inflation rate that causes higher than expected claims payments (Weiss, 1985). Others have suggested that during periods in which insurance markets are soft, firms tend to underprice insurance (Harrington and Danzon, 1994). Although there is evidence of underpricing of medical malpractice insurance in soft markets, as documented in Harrington, Danzon, and Epstein (2008), their companion analysis in Danzon, Epstein, and Johnson (2004) found that damages caps did restrain premiums.[6] Significant errors in loss estimates

[5] These errors have direct effects on the insurer's reported financial results, allowing managers to justify price increases (Nelson, 2000), manipulate tax payments, and smooth earnings over time (Grace, 1990). Overestimating reduces reported earnings, decreases reported capital surpluses, reduces tax liabilities, and can ward off regulatory scrutiny (Petroni, 1992; Gaver and Paterson, 1999).

[6] For our analysis, the underpricing effects are largely related to temporal factors, which will be captured by the year-specific dummy variables. In the absence of year effect controls, estimates of the effect of tort reforms may overstate the actual effects on insurance markets if they are enacted after the underpricing period. Estimates of the effect of differences in tort regimes across states should not be greatly affected by underpricing at different points in time.

FIGURE 1
Industry Losses Using Reported, 5- and 10-Year Developed Losses, 1980–2003



make it difficult to evaluate an insurer's true financial performance. The implications of misreported losses are especially important to reinsurers, who rely greatly on the insurer's estimates of loss development patterns. A recent study suggests that from 1983 to 1993 property–casualty insurers were systematically overstating their loss reserves (Bierens and Bradford, 2005). However, another recent study of insurer reserving from 1989 to 1999 indicates that insurer reserving errors are largely unbiased forecasts of future cash payments (Grace and Leverty, 2007). By including year fixed effects in the regression analyses, we control for any market-wide tendencies with a temporal component.

In the period we analyze, medical malpractice insurers' loss expectations must take into account the largely unknown effects of state tort reform activity on the legal outcomes for which the insurer may be liable. To the extent that past experience does not prove helpful in estimating reserves given the shift in the tort liability landscape, we expect that the level of incurred losses reported in a given year may be significantly different from the level reported for that same year of policies in subsequent years. These differences may be especially true for firms entering a reform state, possibly because managers perceive the environment to be more favorable than the other states in which they operate. Our analysis allows us the opportunity to evaluate whether insurers' perceptions of the reformed environment was accurate, all else equal.

Figure 1 shows the pattern of industry losses based on initial reports and subsequent development for the time period we analyze. The figure indicates the reported losses in each year as well as the developed losses after 5 and 10 years. Although the loss statistics follow a similar pattern of increases and decreases over time, the gap between reported losses and developed losses is quite different. In the early 1980s developed losses are higher than initially reported, which suggests that the long-run loss experience during that period was worse than insurers had predicted. The reverse is true from 1986 to 1997: developed losses are lower than amounts initially reported, and further development, i.e., from 5 to 10 years, results in additional reductions in

the loss amounts. Although development of losses since 1997 is not complete, the developed losses appear to be greater than reported losses.

Further investigation of the developed losses reveals that the pattern of loss development for medical malpractice insurers varies. Table 3 shows the distribution of the percentage change in losses from the initially reported value to the 10th year of development for each policy year in our sample. Loss development for the median firm is consistent with the industry loss development pattern described in Figure 1, but the table shows a wide range of loss development across insurers in each policy year. Although a large part of the variation in insurers' loss development is simply due to random, unforeseen, or misestimated losses, it also includes different perceptions of the effects of the reforms, which we assess further in our empirical analysis.

EMPIRICAL ANALYSIS OF THE EFFECTS OF TORT REFORMS

If the malpractice tort reforms are influential in affecting insurer performance, then these effects will be evident in the level of losses, controlling for the magnitude of insurance premiums. Insurer losses are reduced if these reforms have the intended effect of decreasing award and settlement amounts and the number of claims that are litigated. Analysis of the effect on losses consequently provides a direct test of the effect of the reforms. Below we also examine the effect on loss ratios, which is an inverse measure of insurance profitability. The more rapidly the effects of tort reforms are passed through to insurance purchasers through lower premiums, the more examination of loss ratios will understate the actual consequences of the tort reform. In addition, the central focus of the analysis is on the contrast between the effect of tort reforms on current losses and the effect on developed losses. The premium

TABLE 3
Distribution of the Percentage Change in Reported Losses: Initially Reported Versus 10th Year of Development, by Policy Year

Year	25th Percentile	Median	75th Percentile
1980	−7.73%	33.62%	111.71%
1981	−13.78%	45.29%	106.79%
1982	−7.38%	50.80%	121.16%
1983	3.26%	22.77%	45.46%
1984	−0.56%	13.43%	29.40%
1985	−16.00%	5.66%	31.45%
1986	−49.18%	−33.35%	−8.17%
1987	−51.07%	−38.61%	−15.99%
1988	−55.37%	−37.73%	−17.99%
1989	−50.75%	−35.97%	−15.78%
1990	−48.95%	−34.66%	−5.58%
1991	−39.93%	−28.50%	−6.26%
1992	−41.35%	−24.37%	−7.22%
1993	−43.65%	−25.49%	−4.96%
1994	−37.80%	−19.32%	−3.04%

Source: NAIC annual data tapes.

levels are the same in each instance. Our analysis of loss ratios effects yields results similar to and sometimes stronger than those found for losses.

We begin by presenting a baseline OLS regression equation to obtain estimates of the reform effects on reported losses.

$$\begin{aligned}\text{Ln}Lossesincurred_{it} = {} & \alpha_t + \beta_1 \text{Ln}PremimumsEarned_{it} + \beta_2 \text{Ln}ShareJS_{it} \\ & + \beta_3 \text{Ln}ShareCS_{it} + \beta_4 \text{Ln}SharePD_{it} + \beta_5 \text{Ln}ShareND_{it} \\ & + \beta_6 \text{Ln}Sharereg_{it} + \beta_7 \text{Ln}Num\ States_{it} + \beta_8 Mutual_i \\ & + \beta_9 Reciprocal_i + \varepsilon_{ijt},\end{aligned}$$

where $ShareJS_{it}$ was defined above in Equation (1), $ShareCS_{it}$ is the analogous collateral source reform share, $SharePD_{it}$ is the punitive damages share, $ShareND_{it}$ is the noneconomic damages share, $Sharereg_{it}$ is the state prior approval insurance regulation share, $NumStates_{it}$ is the number of states in which the firm sells medical malpractice insurance, $Mutual_{it}$ and $Reciprocal_{it}$ are organizational form dummy variables, and ε_{it} is a random error term.

The loss equation above, and all subsequent equations allow for time-specific fixed effects α_t. Influences common to specific years, such as effects of the underwriting cycle, consequently will be reflected in this set of year-specific fixed effects.[7]

Following the approach in most previous analyses of tort reform, we assume that endogeneity of tort reforms and either losses or premiums is not a major problem. Tort liability reform does not typically affect contemporaneous premium levels, as premiums are set based on the previous years' lost experience. California's recent effort to couple workers' compensation reform with lower premium levels is a rare exception. More common is the Texas medical malpractice experience in which the damages cap legislation enacted in 2003 led to a legislative proposal in 2005 (HR 1665) to commission a state insurance commission study of the effect of the noneconomic damages caps on premiums. Such effects involve policy responses that are not contemporaneous with tort reform. Analyses using lagged values of the reform variables, which by construction are predetermined, yielded similar results to those reported below. We also explored instrumental variables estimates using lagged values of the variables as instruments, but because of the absence of good instruments this approach was not successful. To the extent that there is an influence of endogeneity, our results will tend to overstate the effect of tort reforms on reported losses. However, our primary interest is not in the effect of tort reforms on reported losses but on the differential effect of reforms on developed losses as compared to reported losses, and the potential endogeneity concerns appear to be less pronounced for this comparison.

We present two different sets of OLS regressions. The first set presents estimates of the loss equation for which the standard errors are robust and clustered by firm. Because standard errors may be biased by the influence of serial correlation, we also report Newey–West (1987) standard errors for panel-based estimates, allowing for up to 2

[7] Similarly, if tort reforms are clustered in particular years, then inclusion of year effects may lead to estimates that understate the effect of the tort reforms. Some but not all previous studies of the effect of tort reforms on insurance market performance include such year effects.

years of within firm by year autocorrelation. In our second set of estimates we add firm-specific fixed effects. The model including firm effects takes the form:

$$\begin{aligned}\text{Ln}LossesIncurred_{it} = {} & \alpha_t + \sum \alpha_i\, Firm_i + \beta_1 \text{Ln}Premiums\, Earned_{it} + \beta_2 \text{Ln}ShareJS_{it} \\ & + \beta_3 \text{Ln}ShareCS_{it} + \beta_4 \text{Ln}SharePD_{it} + \beta_5 \text{Ln}ShareND_{it} \\ & + \beta_6 \text{Ln}Sharereg_{it} + \beta_7 \text{Ln}NumStates_{it} + \varepsilon_{ijt}.\end{aligned}$$

where $Firm_i$ is a 0–1 dummy variable for firm i ($i = 2, \ldots, N$), and the estimates of α_i capture the presence of any statistically significant group effects. Inclusion of the firm effects will capture influences that are specific to particular firms, such as organizational form, which do not change much over time. With 155 firms in the sample, the inclusion of firm effects and year effects leaves little residual variation and greatly increases the R^2 values.

The influence of the tort reforms may vary depending on the type of reform and the nature of the insurer's loss exposure. If the reforms work to limit award amounts, rather than completely eliminating them, then the effects of such measures should increase with the size of the financial stakes involved in the case. Likewise, we would expect little effect on cases that are very small. The reforms are therefore likely to be particularly influential in dampening the losses of firms that report losses at the high end of the loss distribution. To evaluate the potential differential influence on loss levels of the reform measures, we utilize a quantile regression analysis[8] and estimate the quantile regression counterpart of the modified version of our linear regression:

$$Quant_\tau(\text{Ln}Losses \mid x) = \beta_\tau' x,$$

where β_τ is the vector of coefficients for the explanatory variables x at the τth percentile.[9] More specifically, the estimates will determine the differential effects of the variables x at the 10th, 25th, 50th, 75th, and 90th percentiles of the log loss ratio distribution.[10] The estimator for our quantile regression model is

$$\underset{\beta}{\text{Min}} \frac{1}{n} \sum_{i=1}^{n} \left[\tau\rho(\text{Ln}Losses_i \geq \beta'\chi_i) + (1-\tau)\rho(\text{Ln}Losses_i \geq \beta'\chi_i)\right] \left|\text{Ln}Losses_i - \beta'\chi_i\right|,$$

where the sample size is n and ρ is an indicator function that assumes a value of 1 when the inequality holds; otherwise, it is 0. To estimate the asymptotic standard errors we use a bootstrapping technique.

[8] Estimates of the firm-specific fixed-effects model was not feasible for the quantile regressions.

[9] See Koenker and Bassett (1978, 1982) for a description of the approach.

[10] The quantile regression at, for example, the 90th percentile will fit an equation such that 90 percent of the sum of the absolute value of the residuals will involve negative errors and 10 percent will be positive. The large loss firms will tend to be captured at this high quantile. Because we include a measure of earned premiums in the equation, the "large loss" firms are those firms with high losses given their premiums; they are not necessarily the large firms.

Finally, we estimate the reform effects on loss ratios using the difference between developed and reported loss ratios, $LRDiff_{it}$, as our dependent variable. Specifically, we estimate the following equation for firm i at time t:

$$\begin{aligned} LRDiff_{it} = {} & \alpha_t + \beta_1 ShareND_{it} + \beta_2 SharePD_{it} + \beta_3 ShareJS_{it} + \beta_4 ShareCS_{it} \\ & + \beta_5 ShareREg_{it} + \beta_6 \text{Ln}PremsEarned_{it} + \beta_7 NumStates_{it} \\ & + \sum \alpha_i Firm_i + \sum \gamma_t Year_t + \varepsilon_{ijt}, \end{aligned}$$

where $ShareJS_{it}$ was defined above in Equation (1), $ShareCS_{it}$ is the analogous collateral source reform share, $SharePD_{it}$ is the punitive damages share, $ShareND_{it}$ is the noneconomic damages share, $Sharereg_{it}$ is the state prior approval insurance regulation share, Ln$PremsEarned_{it}$ is the firms' total premiums earned in medical malpractice, $NumStates_{it}$ is the number of states in which the firm sells medical malpractice insurance, $Firm_i$ and $Year_t$ represent firm and time fixed effects, and ε_{it} is a random error term. We estimate the equation three times, for the difference between reported loss ratios and the 5th-, 7th-, and 10th-year developed loss ratios, respectively.

Table 4 presents the equation estimates for reported losses. Panel A presents the OLS results, whereas Panel B presents the quantile regression estimates. The first equation in Panel A includes year fixed effects, whereas the second equation includes both year and firm fixed effects. The tests of statistical significance are similar using either robust and clustered standard errors (in parentheses) or Newey–West standard errors (in brackets). As expected, the contemporaneous value of premiums earned is strongly related to the insurer's reported loss experience for every set of results.[11] In the first specification, a 1 percent increase in premiums has an almost identical percentage effect on losses, and with the addition of firm fixed effects the relationship between premiums and losses is a bit less.

Two tort reform variables are most influential in reducing losses in the first equation in Panel A. Noneconomic damages caps have a significant negative effect on losses, which is in line with previous studies indicating the prominent influence of this aspect of tort liability regimes. Punitive damages caps likewise have a negative effect, but of somewhat smaller magnitude. Somewhat surprisingly, joint and several liability reform has a positive effect, which is consistent with the mixed performance of this reform type in previous studies. Prior approval rate regulation raises the value of losses in a significant manner. This influence is what one would expect if regulatory stringency boosts the expected level of losses for any given value of premiums. Neither noneconomic damages reforms nor punitive damages reforms reduce reported losses once firm fixed effects are added in the second equation in Panel A of Table 4. This result suggests that at least for reported losses, there is not enough within variation to estimate the effect of tort reforms. This limitation is not true generally, as the analysis of loss ratio differences below will indicate.

[11] Since the reform effects are evaluated using firm-level data, the estimated effects are not directly comparable to those obtained earlier using firm-state-level data. Nevertheless, the significant results are consistent with earlier findings (see Born and Viscusi, 1998).

TABLE 4
Regression Results. Dependent Variable = Log(Reported Losses)

Panel A. OLS Results		
	OLS w/Year Effects (Robust Std Errors) [Newey–West Std Errors]	OLS w/Year & Firm Fixed Effects (Robust Std Errors) [Newey–West Std Errors]
Ln(premiums earned)	1.079	0.861
	(0.009)***	(0.035)***
	[0.011]***	[0.040]***
Ln(share PW in states w/noneconomic damages cap)	−0.170	0.110
	(0.048)***	(0.097)
	[0.062]***	[0.102]
Ln(share PW in states w/punitive damages cap)	−0.114	0.053
	(0.043)***	(0.090)
	[0.050]**	[0.098]
Ln(share PW in joint/ several reformed states)	0.192	0.437
	(0.068)***	(0.195)**
	[0.074]***	[0.196]**
Ln(share PW in collateral source reformed states)	−0.109	0.079
	(0.073)	(0.115)
	[0.078]	[0.116]
Ln(share PW in states with prior approval)	0.106	0.093
	(0.051)**	(0.126)
	[0.064]*	[0.129]
Ln(number of states)	−0.031	0.065
	(0.009)***	(0.024)***
	[0.011]***	[0.026]***
Mutual	0.063	
	(0.042)	
	[0.061]	
Reciprocal	−0.020	
	(0.045)	
	[0.048]	
Intercept	−1.560	0.700
	(0.439)***	(0.364)*
	[0.443]***	[0.325]*
Adjusted R^{2a}	0.887	0.867

Panel B. Quantile Regression Results					
	10%	25%	50%	75%	90%
Ln(premiums earned)	1.118***	1.091***	1.082***	1.061***	1.023***
	(0.010)	(0.006)	(0.005)	(0.008)	(0.006)
Ln(share PW in states w/ noneconomic damages cap)	−0.076	−0.027	−0.059**	−0.105***	−0.179***
	(0.061)	(0.027)	(0.027)	(0.034)	(0.042)
Ln(share PW in states w/punitive damages cap)	−0.044	−0.102***	−0.080***	−0.098	−0.203***
	(0.045)	(0.043)	(0.025)	(0.037)	(0.059)
Ln(share PW in joint/several reformed states)	0.057	0.039	0.069*	0.058	0.076
	(0.088)	(0.039)	(0.039)	(0.039)	(0.066)

(Continued)

TABLE 4
Continued

Panel B. Quantile Regression Results					
	10%	25%	50%	75%	90%
Ln(share PW in collateral source reformed states)	−0.117	−0.053*	−0.047	−0.030	−0.066
	(0.073)	(0.038)	(0.033)	(0.045)	(0.069)
Ln(share PW in states with prior approval)	−0.026	0.038	0.023	0.069*	0.185***
	(0.052)	(0.027)	(0.024)	(0.040)	(0.039)
Ln(number of states)	−0.023**	−0.034***	−0.041***	−0.037***	−0.031***
	(0.009)	(0.005)	(0.006)	(0.008)	(0.009)
Mutual	−0.011	0.104***	0.028	−0.030	−0.020
	(0.055)	(0.023)	(0.018)	(0.033)	(0.059)
Reciprocal	0.009	0.089***	0.043**	−0.025	−0.079*
	(0.050)	(0.030)	(0.020)	(0.040)	(0.034)
Intercept	−5.569***	−3.439***	−0.853	0.656***	1.126**
	(0.853)	(0.716)	(0.875)	(0.186)	(0.426)
Pseudo R^{2a}	0.682	0.750	0.773	0.766	0.741

[a]Specification includes indicator variables for each firm in sample.
*, **, and *** denote significance of the coefficients at the 90%, 95%, and 99% levels.

The quantile regression effects results in Panel B of Table 4 provide a different perspective in that these results make it possible for us to analyze the incidence of the reform effects across different percentiles of the loss distribution. To the extent that tort reforms have differential effects on firms with varying levels of losses, estimates from OLS regressions, which capture the effects on the *average* firm, may miss potentially significant influence of the reforms. Consider the effect of noneconomic damages cap limits. Those firms with losses at the upper end of the loss distribution benefit the most from tort reforms, as this variable has an increasingly negative effect beginning at the median loss quantile and peaking at the 90th percentile. Punitive damages camps likewise are not statistically significant at the 10th percentile but begin to have an effect at the 25th percentile, which becomes increasingly great at the 90th percentile. The effects of joint and several liability and collateral damages reforms are more mixed across the quantiles. Overall, any restraining effect of the reforms appears to be largely concentrated at the upper tail.

Similarly, the role of regulatory restrictions in terms of prior approval state insurance regulatory regimes is also greatest for the high loss quantiles. At the 75th and 90th percentiles, rate regulation of this type significantly raises losses.

The largest effects of the reforms directed at limiting damages are consistently for firms that would otherwise have experienced the largest losses. To the extent that these firms are the same firms from year to year, tort reforms benefit the firms with the highest risk portfolios, which perhaps are also the most inefficient firms. However, if the large losses stem from unreasonably high outlier medical malpractice awards—an assumption upon which much tort reform is based—then the effects of tort reform across the distribution of losses have a more favorable interpretation. More simply, to the extent that many tort reform measures are structured to eliminate very large losses

by capping the noneconomic damages component of awards, almost tautologically there will be an effect in reducing the awards that otherwise would have been much larger.

The reported losses that are the basis for the analysis thus far are largely estimated but provide a baseline for assessing whether the actual loss experiences is in accord with insurers' expectations. By evaluating the effects of the reforms on developed losses, we can assess whether their expectations regarding the effects of reforms were correct. Moreover, analysis of developed losses provides a more accurate picture of the ultimate effects of the reform measures. Tables 5 and 6 present the results of estimating the developed loss equations, where the dependent variables are losses developed to the 5th year and losses developed to the 10th year, respectively. Although Table 4 contains all insurers writing medical malpractice insurance between 1984 and 2003, the time periods covered in Table 5 (1984–1999) and Table 6 (1984–1994) necessarily reduce the sample of insurers analyzed. Reducing the number of years of observations by half for the 10th year developed losses equations not only decreases the number of observations but also omits the influence of the most recent wave of tort liability reforms.

The effects of the tort reforms on losses tend to be greater in the 5th year developed loss estimates in Table 5, as one might expect if the reforms reduced not only initial reported losses but also the subsequent temporal distribution of losses. One would also expect the influence of loss development to diminish over time as the resolution of claims by the 5th year as compared to the first year will embody a greater contrast than a comparison of the 10th year with the 5th year.

The most pronounced effect of considering developed losses is with respect to the key noneconomic damages reform variable. The point estimate for this coefficient in the OLS equations is consistently greater for the 5th-year developed losses. Although the joint and several liability reform variable maintains its positive effect for 5th-year developed losses, punitive damages caps do not have a statistically significant effect. The absence of an effect is not surprising given the traditionally small role of punitive damages in medical malpractice cases. Collateral source reforms also significantly lower 5th-year developed losses. For the quantile regressions for 5th-year developed losses reported in Table 5, the noneconomic damages cap begins to have a statistically significant negative effect on losses at an earlier quantile than for reported losses. The largest effects of this variable are at the 90th percentile.

The results for the 10th-year developed losses in Table 6 are consistent with the previous results but weaker in terms of statistical significance because of the different, shorter time period for this sample. For the OLS results in Panel A of Table 6, the tort reform variables have effects quite similar to those for the 5th-year developed losses.

The quantile regressions continue to show the largest effects of the noneconomic damages caps for the 75th and 90th percentiles. For these and all previous quantile estimates, analysis of the developed loss experience as analyzed using quantile regressions indicates an effect of reforms that is concentrated among the firms that would otherwise have exhibited the worst loss experience. The estimates for the 10-year developed losses indicate that a 10 percent increase in the share of business in states with noneconomic damages caps is associated with a reduction in losses of 4 percent at the 90th percentile. The value of losses at the 90th percentile is $95 million.

TABLE 5
Regression Results. Dependent Variable = Log(Developed Losses, 5th Year)

Panel A. OLS Results		
	OLS w/Year Effects (Robust Std Errors) [Newey–West Std Errors]	OLS w/Year & Firm Fixed Effects (Robust Std Errors) [Newey–West Std Errors]
Ln(premiums earned)	1.093	0.844
	(0.016)***	(0.054)***
	[0.023]***	[0.056]***
Ln(share PW in states w/ noneconomic damages cap)	−0.247	0.029
	(0.066)***	(0.094)
	[0.084]***	[0.092]
Ln(share PW in states w/punitive damages cap)	−0.004	0.002
	(0.064)	(0.095)
	[0.079]	[0.104]
Ln(share PW in joint/ several reformed states)	0.305	0.308
	(0.107)***	(0.164)*
	[0.118]**	[0.167]*
Ln(share PW in collateral source reformed states)	−0.284	−0.129
	(0.0106)***	(0.175)
	[0.120]**	[0.171]
Ln(share PW in states with prior approval)	0.214	0.086
	(0.066)***	(0.204)
	[0.084]***	[0.208]
Ln(number of states)	−0.009	0.078
	(0.015)	(0.042)*
	[0.021]	[0.044]*
Mutual	0.004	
	(0.091)	
	[0.142]	
Reciprocal	−0.027	
	(0.060)	
	[0.071]	
Intercept	−1.505	0.288
	(0.428)***	(0.592)
	[0.443]***	[0.734]
Adjusted R^{2a}	0.728	0.806

Panel B. Quantile Regression Results					
	10%	25%	50%	75%	90%
Ln(premiums earned)	1.200***	1.115***	1.075***	1.022***	0.981***
	(0.017)	(0.012)	(0.015)	(0.012)	(0.013)
Ln(share PW in states w/ noneconomic damages cap)	−0.123	−0.207***	−0.208***	−0.243***	−0.371***
	(0.072)	(0.050)	(0.052)	(0.046)	(0.052)
Ln(share PW in states w/punitive damages cap)	−0.040	−0.049	0.005	0.025	0.146
	(0.137)	(0.070)	(0.064)	(0.076)	(0.082)
Ln(share PW in joint/several reformed states)	0.407*	0.119	0.105	0.007	0.205**
	(0.201)	(0.087)	(0.073)	(0.100)	(0.103)

(Continued)

TABLE 5
Continued

Panel B. Quantile Regression Results					
	10%	25%	50%	75%	90%
Ln(share PW in collateral source reformed states)	−0.515*** (0.213)	−0.173** (0.073)	−0.075 (0.072)	0.004 (0.103)	−0.181 (0.116)
Ln(share PW in states with prior approval)	0.125 (0.106)	0.121*** (0.042)	0.179*** (0.050)	0.209*** (0.069)	0.403*** (0.070)
Ln(number of states)	−0.029 (0.022)	−0.006 (0.010)	−0.003 (0.014)	0.006 (0.009)	0.034* (0.019)
Mutual	−0.103 (0.110)	0.073 (0.055)	0.084 (0.049)	0.017 (0.052)	0.119 (0.059)
Reciprocal	0.050 (0.059)	0.110** (0.052)	0.038 (0.047)	−0.002 (0.043)	−0.031 (0.053)
Intercept	−5.838*** (1.084)	−3.197*** (0.592)	−1.119*** (0.977)	0.968*** (0.253)	1.359*** (0.256)
Pseudo R^2	0.606	0.659	0.683	0.688	0.669

[a]Specification includes indicator variables for each firm in sample.
*, **, and *** denote significance of the coefficients at the 90%, 95%, and 99% levels.

The other tort reform variables often have different effects for the 5th- and 10th-year developed loss equations, which suggests that the effects observed for reported losses may be spurious. The observed effects of punitive damages caps on reported losses largely are the result of initial loss reports and insurer expectations rather than the actual loss experience. Punitive damages are awarded in under 3 percent of all medical malpractice cases that plaintiffs win after a jury trial (Hersch and Viscusi, 2004), so that the absence of any significant effect of the punitive damages cap variable on losses accords with the legal structure. Joint and several liability reforms often have a positive effect, which appears to be spurious. The collateral source reform variable is more consistently significant in both the 5th- and 10th-year developed loss equations than in the reported loss equations. However, based on the quantile results, these effects are concentrated in the lower quantiles and do not affect the larger stakes upper quantiles.

The role of the prior approval regulation follows the opposite pattern of the noneconomic damages variable. Prior approval regulation leads to higher losses, where these losses are concentrated at the 25th percentile and above in Tables 5 and 6. The greatest effects of prior approval regulation are at the 90th percentile.

The most direct test of the differential effect of tort reforms on developed losses rather than initial losses is to analyze the determinants of the difference between the reported loss ratio and the developed loss ratio. Table 7 reports these results for the 5th-, 7th-, and 10th-year developed loss ratios. The 10th-year developed loss ratio sample is less than half that of the 7th-year developed loss ratio sample because the later reported loss ratio years in the sample often are not followed by enough subsequent data to analyze developed losses in the more distant future. That sample period also excludes the most recent wave of tort liability reforms. Perhaps because

TABLE 6
Regression Result. Dependent Variable = Log(Developed Losses, 10th Year)

Panel A. OLS Results		
	OLS w/Year Effects (Robust Std Errors) [Newey–West Std Errors]	OLS w/Year & Firm Fixed Effects (Robust Std Errors) [Newey–West Std Errors]
Ln(premiums earned)	1.087	0.778
	(0.021)***	(0.071)***
	[0.028]***	[0.076]***
Ln(share PW in states w/noneconomic damages cap)	−0.175	0.045
	(0.088)**	(0.169)
	[0.108]*	[0.162]
Ln(share PW in states w/punitive damages cap)	0.046	0.061
	(0.089)	(0.164)
	[0.110]	[0.170]
Ln(share PW in joint/several reformed states)	0.240	0.266
	(0.119)**	(0.233)
	[0.136]*	[0.239]
Ln(share PW in collateral source reformed states)	−0.334	−0.137
	(0.128)***	(0.234)
	[0.143]***	[0.225]
Ln(share PW in states with prior approval)	0.157*	0.150
	(0.092)	(0.371)
	[0.112]	[0.388]
Ln(number of states)	−0.001	0.257
	(0.018)	(0.062)***
	[0.024]	[0.071]***
Mutual	0.038	
	(0.097)	
Reciprocal	0.068	
	(0.082)	
Intercept	−1.339	0.716
	(0.444)***	(0.722)
	[0.466]***	[0.695]
Adjusted R^{2a}	0.802	0.680

Panel B. Quantile Regression Results					
	10%	25%	50%	75%	90%
Ln(premiums earned)	1.202***	1.133***	1.065***	0.988***	0.937***
	(0.028)	(0.022)	(0.015)	(0.018)	(0.017)
Ln(share PW in states w/ noneconomic damages cap)	−0.020	−0.202***	−0.127	−0.294***	−0.416***
	(0.154)	(0.078)	(0.108)	(0.052)	(0.083)
Ln(share PW in states w/ punitive damages cap)	0.075	0.044	−0.067	−0.063	−0.032
	(0.151)	(0.105)	(0.091)	(0.082)	(0.135)
Ln(share PW in joint/ several reformed states)	0.349**	0.103	0.065	−0.085	0.106
	(0.168)	(0.134)	(0.111)	(0.119)	(0.164)
Ln(share PW in collateral source reformed states)	−0.511***	−0.306***	−0.181**	−0.007	−0.232
	(0.175)	(0.095)	(0.074)	(0.092)	(0.210)

(Continued)

TABLE 6
Continued

Panel B. Quantile Regression Results					
	10%	25%	50%	75%	90%
Ln(share PW in states with prior approval)	0.088	0.106	0.123*	0.203***	0.268***
	(0.163)	(0.077)	(0.076)	(0.079)	(0.087)
Ln(number of states)	−0.032	0.015	0.008	0.001	0.008
	(0.029)	(0.013)	(0.018)	(0.017)	(0.018)
Mutual	−0.015	0.113**	0.061	−0.002	−0.007
	(0.148)	(0.049)	(0.062)	(0.051)	(0.102)
Reciprocal	0.211***	0.185***	0.147***	0.101**	0.025
	(0.099)	(0.056)	(0.053)	(0.050)	(0.043)
Intercept	−4.799***	−3.393***	−0.814	1.282***	1.903***
	(1.247)	(0.542)	(0.888)	(0.300)	(0.281)
Pseudo R^{2a}	0.562	0.607	0.633	0.649	0.637

[a]Specification includes indicator variables for each firm in sample.
*, **, and *** denote significance of the coefficients at the 90%, 95%, and 99% levels.

of these limitations, there is no significant effect of the noneconomic damages cap variable for this equation. All the equations reported in Table 7 also include fixed effects for and firm. Unlike the fixed firm effects results reported in Tables 4–6, there is a significant negative effect of the noneconomic damages cap variable on 5th- and 7th-year developed loss ratios, notwithstanding the inclusion of the fixed firm effects. No other tort reforms have as consistent negative effect on the loss ratio gap. Consistent with our interpretation of Figure 1 and the earlier results for losses, tort reforms alter the liability insurance landscape in a manner that is not consistent with firms' expectations, leading to a spread between reported loss ratios and developed loss ratios that reflects an unanticipated effect on loss performance due to the reforms.

CONCLUSION

Earlier work suggested that certain malpractice tort reforms have the intended effect of reducing malpractice losses reported by insurance companies. Examination of initial reported losses provides a mixed picture with respect to the influence of tort reform. Noneconomic damages and punitive damages reforms have a negative effect on losses, but joint and several liability reforms have a positive effect. The effects of the reforms on the distribution of initially reported losses are also mixed.

By shifting the focus of the analysis to the effect on developed losses, the patterns on influence become much more narrowly focused. The most consistently influential tort reform of consequence is the cap on noneconomic damages. The effect of a cap is greatest at the higher loss quantiles, with the greatest effect at the 90th percentile. Developed losses after 5 and 10 years embody the actual loss experience to a much greater extent than do reported losses. Thus, they provide a much more accurate reflection of the actual consequences of tort reforms on paid losses as opposed to insurers' expectations of what these losses may be. The empirical trade-off is that

TABLE 7
Ordinary Least Squares Regression Results

Dependent Variable = Difference Between Reported Loss Ratio and Developed Loss Ratio at 5th, 7th, and 10th Year			
	5-Year Dev.	7-Year Dev.	10-Year Dev.
Share PW in states w/ noneconomic damages cap	−0.101	−0.115	−0.010
	(0.053)*	(0.054)**	(0.077)
	[0.056]*	[0.055]**	[0.084]
Share PW in states w/punitive damages cap	0.123	0.112	−0.046
	(0.080)	(0.064)*	(0.115)
	[0.091]	[0.070]	[0.128]
Share PW in joint/ several reformed states	−0.019	0.004	−0.077
	(0.060)	(0.054)	(0.080)
	[0.067]	[0.057]	[0.089]
Share PW in collateral source reformed states	−0.067	−0.071	−0.229
	(0.067)	(0.060)	(0.114)**
	[0.072]	[0.061]	[0.116]**
Share PW in states with prior approval rate regulation	−0.026	0.173	0.037
	(0.101)	(0.076)**	(0.158)
	[0.103]	[0.078]**	[0.160]
Ln(premiums earned)	−0.054	−0.046	0.147
	(0.090)	(0.115)	(0.154)
	[0.094]	[0.117]	[0.166]
Number of states	0.004	0.001	0.002
	(0.003)	(0.003)	(0.004)
	[0.003]	[0.003]	[0.004]
Intercept	1.102	0.622	−0.807
	(0.872)	(1.029)	(1.430)
	[0.762]	[0.932]	[1.256]
N	1561	1657	815
R^2	0.126	0.059	0.084

Note: All regressions include year and firm effects, not shown. Standard errors in parentheses are adjusted for clustering on code; brackets contain Newey–West standard errors, allowing for up to 2 years of autocorrelation and a heteroskedastic error structure.
*, **, and *** denote significance of the coefficients at the 90%, 95%, and 99% levels.

examining developed losses reduces the sample size and, in the case of the 10th-year developed losses, eliminates the most recent wave of liability reform from the analysis.

In much the same manner, insurance regulation has a differential effect as well, with the greatest effect of prior approval regulation being a boosting of loss levels for the upper loss quantiles. However, unlike the tort reform measures, this effect of prior approval regulation is consistent whether one examines reported losses or developed losses. This similarity is not surprising because there is little change across the sample period in the fraction of business subject to prior approval regulation, as it increased from 0.41 to 0.54 from 1984 to 2003. In the absence of changes with respect to the insurance regulation regime, insurers' historically based expectations as embodied in reported loss levels should be more in line with actual loss patterns. In contrast, the fraction of business affected by noneconomic damages caps rose from 0.11 to 0.33.

Expectations regarding losses that are governed by experiences before the presence of the caps will understate the effect that the caps will have. Reported loss ratios exceed developed loss ratios in a manner in which the gap is generated by economic damages caps so that the effect of tort reforms on firm profitability will be understated by focusing on the short-run performance only. Developed losses show a greater effect of noneconomic damages caps on the upper end of the loss distribution than does the analysis of reported losses. Actual developed loss patterns provide a more accurate and in many respects more narrowly focused and quite different perspective on the effects of tort liability reforms on medical malpractice insurance markets.

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