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# *The Distribution of the Insurance Market Effects of Tort Liability Reforms*

THE MID-1980S marked a period of tremendous escalation in liability insurance premiums, particularly for medical malpractice, product liability, and environmental liability.[1] Whereas some insurance lines, such as automobile insurance, were comparatively stable, premiums for general liability and medical malpractice insurance doubled from 1984 to 1986.[2] Increased prices were accompanied by problems with insurance availability and insurance rationing. Many observers suggested that these substantial price increases had widespread economic effects. Motels removed diving boards from their swimming pools, pharmaceutical firms stopped innovation for products with high liability risks such as those for pregnant women, and entire industries, such as the private aircraft industry, were seriously threatened.

The irony of these effects, many critics suggested, was that increased liability was not making lives safer because potentially health-enhancing products, such as new prescription drugs and other innovations, were prevented from reaching the market. The rise in medical malprac-

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1. For discussion of the liability crisis, see Abraham (1987); American Law Institute (1991); Dewees, Duff, and Trebilcock (1996); Huber (1998); Huber and Litan (1991); Litan and Winston (1988); Priest (1987); Schuck (1991); Schwartz (1988); Viscusi (1991); Weiler (1991); and Weiler and others (1993).

2. These data are drawn from Insurance Information Institute (1992, pp. 28–29).

tice liability raised similar concerns. The high insurance costs seem to have led to a decrease in the proportion of doctors in obstetrics, anesthesiology, and other specialties with very high insurance costs, although such conclusions are based largely on case study evidence.

Another observation was that rising medical malpractice costs led to defensive medicine. Physicians ordered unnecessary tests or procedures that might ultimately affect liability but did not significantly help in treating patients.[3] Much of the debate in the 1990s over increased health care costs focused on medical malpractice insurance as potentially contributing to the rising cost of medical care in the U.S. economy.

This study does not concentrate on the causes of the liability crisis or its economic ramifications. Rather, its emphasis is on the effects on the insurance market of states' response to this medical insurance crisis—the tort reform measures enacted during the mid- and late 1980s. What was the character of these reforms, and how did they affect the functioning of liability insurance markets?

The occurrence of an insurance liability crisis and a reform response is not unique in the history of the insurance industry. Similar reforms were initiated in response to the medical malpractice liability crisis of the 1970s.[4] The wave of liability reforms in the 1980s is of particular interest from two standpoints. First, what was the overall effect of the reforms on insurance market performance? Did the reforms in fact reduce losses, premium costs, and profitability as expected? Second, did these effects differ according to different segments of the insurance market? What was the distribution of the effects across the market? Were the benefits primarily concentrated among the largest insurance firms, the most profitable ones, or the least efficient ones?

To assess the insurance market effects, we used a very detailed microeconomic data set, the complete ratemaking files of the National Association of Insurance Commissioners, where the unit of observation is each insurance company writing medical malpractice or general liability coverage in each state by year. This is the largest database that has ever been employed in any study of effects on general liability or

3. See Danzon, Pauly, and Kington (1990); Weiler (1991); and Weiler and others (1993).

4. Danzon (1985) addressed these reform issues. A more recent discussion of medical malpractice reform generally appears in Weiler and others (1993). For product liability, see Viscusi (1991).

medical malpractice, and our study has been carried out in greater detail than any other in the literature.[5]

Our analysis identifies the nature and extent of the consequences of the reforms. What were the reforms, and did they have a significant effect on premiums, losses, loss ratios, and litigation patterns? We do not inquire into whether these effects are desirable. Many of the consequences of the reform efforts have been to decrease medical malpractice or general liability costs. Bringing liability costs under control was clearly important, especially in a period of insurance market instability that had ramifications for many economic activities. These reforms reduced uncertainty not only for insurance companies, but also for their customers. Assessing the character of the reforms and whether they in fact improved the efficiency of the tort liability system also is a consideration in any overall assessment of efforts to restrain liability costs.[6]

The most interesting and distinctive aspect of the analysis is its inquiry into the distributional consequences of the reform efforts. Which insurers benefited the most from the liability reforms? Were they the large firms or the least profitable firms, or were the effects equally distributed across all insurers? We were particularly interested in whether the reforms conferred the greatest benefits on the least profitable companies, those that were likely doing a poor job of choosing the risks they insured. Consequently, caps on damages would have reduced the penalties for poor underwriting practices. We used quantile regression methodology to assess the potential differential effects of the reforms across insurer profitability and size distributions.

Considering the effects on both medical malpractice and general liability insurance offers several advantages. First, the character and timing of the reform efforts differed across the two types of insurance, so additional information can be gained by examining both sets of reform efforts. Second, the markets themselves differed in their scale, the companies offering the coverage, and the entities purchasing insurance. Third, the reform efforts targeted firms in markets that performed

5. The principal predecessors of this study are Barker (1992); Danzon (1985); Hughes and Snyder (1989); Viscusi (1990); Viscusi and Moore (1993); Viscusi and Born (1995); Viscusi and others (1993); and Zuckerman, Bovbjerg, and Sloan (1990).

6. Numerous studies have discussed the rationale for different kinds of reform and the strengths and limitations of different reform proposals. See American Law Institute (1991).

somewhat differently in the period just before the reform efforts. The percentage change in liability premiums for general liability insurance was somewhat higher than for medical malpractice. Moreover, as we show, the profitability of the insurance also differed, with general liability insurance tending to be less profitable.

## An Overview of Tort Liability Reforms

The reform efforts enacted by the states were diverse. Table 1 summarizes the types of reform efforts by state and year (1985, 1986, or 1987) for efforts affecting amounts of damages. Some states legislated strict caps on damages. Others limited the value of noneconomic damages, principally for pain and suffering and the loss experienced by survivors after the death of a family member. Unfortunately, the wide variety of restrictions in the reform efforts and the varying circumstances in which the restrictions became applicable prevented construction of a single quantitative index of the stringency of the overall reform effort.

Laws designed to limit the circumstances in which damages may be awarded took a variety of forms. In 1987 Idaho required plaintiffs to prove "oppressive, fraudulent, wanton, malicious, or outrageous conduct" in a plea for punitive damages. Missouri bifurcated the trial process in 1987, so that actions involving punitive damages first involve determining the defendant's liability for all damages sought without regard to the amount of punitive damages. In the second part of the trial, the jury determines the amount of the punitive damages. Still other reform efforts restricted punitive damages or attempted to alter the character of the liability rules applied to physician behavior. Most of the caps on compensatory (economic and noneconomic) damages for medical malpractice and general liability cases fell between $225,000 in Michigan and $875,000 in New Hampshire. Punitive damages were generally capped at a lower level, ranging from $100,000 in Alabama to $250,000 in Georgia. In two states, West Virginia and Wisconsin, where compensatory damage caps were imposed specifically on medical malpractice cases, the cap was set at $1,000,000.

Despite the flurry of activity, there has been considerable doubt about the efficacy of the reform efforts in altering the liability landscape and

**Table 1. States Enacting Damages Limitations, 1985–87**

| | *Medical malpractice* | | *General liability* | |
|---|---|---|---|---|
| *Year* | *State* | *Type of limitation* | *State* | *Type of limitation* |
| 1985 | Florida | 3 | Illinois | 1 |
| | Illinois | 4 | Montana | 3 |
| | Kansas | 1,3 | Rhode Island | 1 |
| | South Dakota | 1 | | |
| 1986 | Kansas | 2,5 | Alaska | 2 |
| | Massachusetts | 2 | Colorado | 1 |
| | Michigan | 2 | Florida | 2,3 |
| | Missouri | 2 | Illinois | 3 |
| | South Dakota | 2 | Maryland | 2 |
| | Utah | 2 | Minnesota | 2 |
| | West Virginia | 5 | New Hampshire | 2 |
| | Wisconsin | 2 | Oklahoma | 1 |
| | | | Washington | 2 |
| 1987 | Alabama | 5 | Alabama | 1 |
| | | | California | 3 |
| | | | Georgia | 1,3 |
| | | | Hawaii | 1 |
| | | | Idaho | 3 |
| | | | Indiana | 3 |
| | | | Iowa | 3 |
| | | | Kansas | 3 |
| | | | Missouri | 3 |
| | | | Montana | 3 |
| | | | North Dakota | 3 |
| | | | Ohio | 3 |
| | | | Oregon | 2,3 |
| | | | South Carolina | 2,3 |
| | | | Texas | 1 |
| | | | Virginia | 1 |

Source: See text. Key: 1. monetary cap on punitive damages; 2. monetary cap on noneconomic damages; 3. limitations on circumstances in which damages may be awarded; 4. punitive damages barred in medical malpractice actions; 5. monetary cap on all medical malpractice damages.

in affecting insurance costs.[7] One potential reason for skepticism is that damage caps pertain only to the highest awards. Perhaps because these tend to be the most publicized, the public's perception of the frequency

7. For example, in 1993 the chairman of the American Bar Association's Working Group on Health Care Reform expressed his skepticism by claiming that "caps on noneconomic damages have not had the dramatic impact that supporters think." See Clifford D. Stromberg, Health Line American Political Network, August 12, 1993.

of million dollar verdicts is far greater than their actual occurrence.[8] Indeed, overpayment of small economic losses is greater than large economic losses, for which the replacement rate (the ratio of payment to the dollar value of economic loss) tends to be less. The award cap also may not bind juries if they adjust other components of the award to avoid the constraint imposed by a damage limit. Whether such compensating jury behavior is consequential has not been determined.

This study extends our work reported in Viscusi and Born (1995) in which we focused primarily on case studies of the medical malpractice reforms in Michigan and Wisconsin, coupled with exploratory analysis of national data. In this study we consider the same types of reforms that were the focus of that paper, but the statistical analysis of the insurance consequences is much more extensive here. In addition, we examine the effects of these reforms on general liability insurance markets. Although both medical malpractice and general liability reforms were generally selected from a similar menu of reform efforts, the states that chose to make these reforms differed. Moreover, the type of reforms picked by particular states varied either in timing or character. For example, in 1985 Florida adopted limitations on the circumstances in which damages may be awarded for medical malpractice cases. The state then enacted similar restrictions for general liability in 1986 but also imposed a monetary cap on noneconomic damages. As is indicated in the breakdowns in table 1, many more states adopted general liability reforms over the pivotal reform years of 1985–87 than adopted reforms pertaining only to medical malpractice.

Table 1 distinguishes reforms that affected medical malpractice specifically from general liability reforms. The empirical analysis pools these reform efforts in its analysis of medical malpractice. Overall, eleven states enacted medical malpractice reforms, with most occurring in 1986, which was the last year of the 1984–86 surge in medical malpractice insurance premiums. In the case of general liability reforms, 1986 was a prominent year, but 1987 featured a greater number—sixteen states enacted reform laws then.

A particularly striking aspect about the reform efforts is the strong correlation among them. The correlation within states is reflected in patterns such as that in Kansas. That state enacted two medical malpractice

8. See Viscusi (1991).

reforms in 1985 (a monetary cap on punitive damages and limitations on circumstances in which damages may be awarded), and followed with two more medical malpractice reforms in 1986 (a monetary cap on noneconomic damages and one on all medical damages). These efforts were once again amended by a general liability reform in 1987 (a limitation on the circumstances in which damages may be awarded).

There is an additional correlation among the kinds of damage reforms enacted in any given period. Of the nine medical malpractice reforms enacted in 1986, six involved a monetary cap on noneconomic damages. Similarly, of the eighteen general liability reforms enacted in 1987, twelve limited the circumstances in which damages may be awarded. An interesting empirical question is whether these different waves of political reform activity significantly affected the functioning of the liability system.

Because of the substantial similarities among various reform efforts, it is not feasible to estimate reliably the effect of each effort. Our focus instead is on two categorizations of reforms: a zero-one categorical variable for whether a damage cap was imposed; and a zero-one categorical variable for whether some other kind of reform was enacted. Further refinement of the categorizations did not yield stable empirical estimates. Both medical malpractice and general liability reforms are pooled for this analysis of medical malpractice insurance, whereas only the general liability reforms is used in the general liability insurance analysis.

The zero-one categorical variable approach to characterizing the reforms captures the average effect of the reform efforts on the liability system. This variable does not enable one to determine whether a liability cap of $300,000 is more effective than a liability cap of $500,000, for example. Ideally, it would be useful to be able to categorize all the various reform variables in some quantitative fashion so that one would have a continuous quantitative scale for measuring the stringency of the reform. In addition to the monetary value of the cap, however, there are also qualitative restrictions placed on the award or accompanying the reform character of the liability rules. Because of this diversity, the most feasible empirical approach is to assess whether there was a shift in behavior after the advent of the reforms.

Our focus is solely on the 1980s reform efforts. As we mentioned, many states undertook similar reform efforts in the 1970s. Potentially these could also have influenced subsequent behavior, as indicated by

Danzon.[9] Our analysis of the 1970s reforms showed no long-term influence on the performance of the liability system.[10] One reason for this failure to find an effect stems from the structure of the econometric analysis. In addition to examining the effect across states, we are also concerned with the effect over time. Each equation includes in the baseline the lagged value of the dependent variable. Separate estimates in which the lagged dependent variable is not included also appear. Thus the focus is on whether liability reforms affect change in insurance market performance over time. To the extent that the 1970s reforms have already exhibited their influence through the current history of insurance premiums, their effects are already captured through the lagged dependent variable.

We proceed with our analysis on the assumption that the reforms are likely to influence insurer performance through their influence on potential and actual court case outcomes. That is, we assume that insurers in reform states operate in an environment in which a more well-defined legal liability system reduces underwriting uncertainty. Thus the reforms influence the underwriting profitability of the insurer. This assumption is potentially an issue if the causality is reversed: instead of reform efforts leading to improved performance, performance levels may lead to further reform activity. In other words the performance of the insurers in a state may be a primary determinant of states' willingness or motivation to enact reforms. If our assumption is not valid, the potential bias of our results is minimal, given the firm-level nature of our data and the large number of firms in each state.[11]

## Sample Descriptions

To undertake the analysis, we have used the complete insurance financial data files compiled by the National Association of Insurance Commissioners. These data include information on every insurance

9. Danzon (1985).

10. Viscusi and Born (1995).

11. Past individual firm profitability (the loss ratio) was not found to be a significant determinant of state reform efforts. We also investigated the relationship between state reform efforts and several other measures of past performance in the state, including the average loss ratio and the upper quantiles (seventy-fifth and ninetieth percentiles) of the state loss ratio distribution but did not find any consistent significant relationships.

company writing medical malpractice insurance, general liability insurance, or both, by state and by year for the United States. Specific data elements include premiums earned and losses incurred, by line of business, for these insurers, reported separately for each state in which the insurer operates. It is the most complete data set of insurance company financial information available. For 1984–91 the sample contains more than 8,000 observations for medical malpractice insurers and 67,000 observations for general liability insurers. In our analyses with lagged dependent variables, our panel is limited to 1985–91.

Table 2 summarizes the medical malpractice insurers' sample characteristics and the general liability insurance company data. For simplicity, we present the sample means and standard deviations for two particular years in the data. The 1985 data are for the middle of the 1984–86 liability crisis and coincide with the first year in which some states enacted liability reforms. The 1991 statistics reflect the performance of insurers several years after the reforms were implemented.

An overall shift in performance of the medical malpractice insurance industry during the period is evident. Although premiums earned rose by 46 percent during the period, losses actually declined by 5 percent. The net effect is that the ratio of losses to premiums, the loss ratio, dropped from 1.6 to 1.0. If one ignores the interest earned on premiums before losses are paid, 1.0 is the break-even loss ratio amount.

The experience in the general liability insurance industry was equally striking. Premiums earned rose 24 percent while losses declined by 14 percent. The net effect is that the loss ratio dropped from 1.8 to 1.3. The loss performance and profitability of insurers writing medical malpractice and general liability insurance clearly improved dramatically over the period.

These improvements in underwriting performance overstate the improvement in profitability, however, because of interest that is earned on premiums. Because losses are paid out after premiums are paid, in periods of high interest rates such as the early 1980s, interest rates may be sufficiently high that writing insurance can be profitable even with loss ratios below 1.0. As table 2 shows, the real (inflation-adjusted) Treasury bill rate dropped from 3.7 percent in 1985 to 1.8 percent in 1991. Insurance premiums were more profitable from an investment standpoint in 1985, thus making it more feasible to write insurance coverage with more unfavorable expected loss ratios. An improvement

**Table 2. Sample Statistics, Medical Malpractice and General Liability, 1985, 1991**

| Variable | 1985 Mean | 1985 Standard deviation | 1991 Mean | 1991 Standard deviation |
|---|---|---|---|---|
| Medical malpractice | | | | |
| *Premiums and losses (in millions)* | | | | |
| Premiums earned | 2.408 | 10.600 | 3.515 | 14.600 |
| Premiums written | 2.763 | 11.800 | 3.554 | 14.400 |
| National premiums written | 38.100 | 82.100 | 31.900 | 53.200 |
| Losses | 2.733 | 13.600 | 2.598 | 11.300 |
| Loss ratio | 1.603 | 2.287 | 1.029 | 1.995 |
| *Reform and regulation variables* | | | | |
| Damages | 0.124 | 0.329 | 0.653 | 0.476 |
| Other | 0.338 | 0.473 | 0.847 | 0.360 |
| Rate regulation | 0.267 | 0.442 | 0.291 | 0.455 |
| *Firm characteristics* | | | | |
| Lloyds | 0.003 | 0.052 | 0.001 | 0.030 |
| Mutual | 0.066 | 0.248 | 0.083 | 0.276 |
| Rciprocal | 0.022 | 0.147 | 0.043 | 0.203 |
| Return on equity | −0.056 | 0.525 | 0.173 | 0.745 |
| *Other controls* | | | | |
| Four-firm concentration ratio (state) | 0.794 | 0.104 | 0.683 | 0.130 |
| Real state aggregate income (in thousands) | 90.026 | 95.391 | 109.984 | 115.503 |
| Real Treasury bill rate | 3.730 | 0 | 1.750 | 0 |
| Sample size | 1,091 | . . . | 1,119 | . . . |

*continued*

in overall performance is evident in the change in the average firm's return on equity, a measure that reflects the firm's performance in both underwriting and investment activities.[12] Average return on equity was negative in 1985 but improved to an average of 0.17 in 1991.

Table 2 provides additional information on the exposure of the malpractice insurers to liability reforms and rate regulation. The principal reform variables included in the analysis are zero-one categorical variables for whether the state imposed a damage cap or undertook some other reform (affecting joint and several liability, frivolous suits, struc-

12. The return on equity is defined as the sum of total investment and underwriting gains divided by the firm's total equity. This measure is calculated from a firm-level data set that contains income statement and balance sheet information for all firms in our sample.

**Table 2. Sample Statistics, Medical Malpractice and General Liability, 1985, 1991** (*continued*)

| | *1985* | | *1991* | |
|---|---|---|---|---|
| *Variable* | *Mean* | *Standard deviation* | *Mean* | *Standard deviation* |
| | General liability | | | |
| *Premiums and losses (in millions)* | | | | |
| Premiums earned | 1.405 | 5.704 | 1.749 | 7.841 |
| Premiums written | 1.608 | 7.120 | 1.976 | 9.426 |
| National premiums written | 56.600 | 123.000 | 68.100 | 217.000 |
| Losses | 1.584 | 6.393 | 1.358 | 6.161 |
| Loss ratio | 1.833 | 5.044 | 1.302 | 3.889 |
| *Reform and regulation variables* | | | | |
| Damages | 0.202 | 0.401 | 0.595 | 0.491 |
| Other | 0.678 | 0.467 | 0.917 | 0.276 |
| Rate regulation | 0.276 | 0.447 | 0.277 | 0.448 |
| *Firm characteristics* | | | | |
| Lloyds | 0.003 | 0.051 | 0.003 | 0.057 |
| Mutual | 0.126 | 0.331 | 0.116 | 0.321 |
| Rciprocal | 0.013 | 0.114 | 0.018 | 0.134 |
| Return on equity | −0.103 | 1.000 | 0.132 | 0.202 |
| *Other controls* | | | | |
| Four-firm concentration ratio (state) | 0.231 | 0.071 | 0.268 | 0.060 |
| Real state aggregate income (in thousands) | 89.475 | 95.684 | 103.964 | 111.245 |
| Real Treasury bill rate | 3.730 | 0 | 1.750 | 0 |
| Sample size | 8,363 | . . . | 8,628 | . . . |

Source: See text.

tured payments, attorneys' fees, collateral source rules, and liability limits). The prevalence of each kind of reform increased dramatically. For example, only 12 percent of all medical malpractice insurers' operations were affected by damage caps in 1985, but 65 percent of the companies wrote coverage in 1991 in states where damage caps were applicable. The presence of other reforms more than doubled in importance during that time as well. The proportion of firms operating in states with strict rate regulation was fairly stable, rising from 27 percent to 29 percent.

Measures for rate regulation structures for the states were consistently insignificant in our exploratory regressions. Both general liability insurance and medical malpractice insurance tend to be purchased by

corporate and institutional entities rather than by individuals, so states do not regulate pricing in these lines, whereas regulation is binding for consumer-oriented lines such as auto insurance.

The empirical analysis also includes measures of insurance firm characteristics, that is, whether the firm was a stock company, a mutual company, a reciprocal, or Lloyd's. These organizational forms may have different incentives due to the structures of the agency relationships that vary with organizational form. The dominant organizational structure for medical malpractice insurance was stock companies, which accounted for roughly 90 percent of the sample during the period. In exploratory analyses we also examined the interactive influence of stock companies and the reform variables, but these effects were not statistically significant.

We include national premiums written in our analysis to control for the size of the overall insurance organization and capture the potential for economies of scale to be reflected in the performance of the insurer at the state level. As table 2 indicates, average national premiums written fell from $38 million to about $32 million in this period.

The final set of control variables pertains to market structure and state characteristics. In particular, we take into account the four-firm concentration ratio as a measure of industry concentration and also include the value of real state aggregate income. This final variable may have many types of influences, such as reflecting the preferences of voters in the state as well as being an index of the magnitude of the financial loss associated with the lost earnings component of a medical malpractice suit.

Table 2 also shows statistics for the general liability insurance sample. The prevalence of each kind of reform also increased dramatically for these insurers. For example, only 20 percent of the general liability insurers' operations were affected by damage caps in 1985, while in 1991 about 60 percent of these companies wrote coverage in states that had caps. The presence of other reforms increased from 68 percent to 92 percent. The proportion of firms operating in states with strict rate regulation remained stable at about 28 percent throughout the period. Table 2 also indicates that stock companies are the dominant organizational structure for general liability insurers. A consistent 87 percent of all general liability insurers were stock companies.

Contrary to the trend in medical malpractice, the average national

premiums written by general liability insurance companies increased, from about $57 million to $68 million. Industry concentration, at 0.24 to 0.27, was much lower than in the medical malpractice industry, where concentration fell slightly from 0.79 to 0.68. Overall profitability measured by the return on equity improved from −0.10 in 1985 to 0.13 in 1991.

Ideally, if liability reforms have their intended effect, they should decrease losses, subsequently decrease premiums charged for coverage, and improve insurance company profitability. 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 restore companies to their precrisis level of profitability and to a more normal level of competitive profits. Because our analysis distinguishes between states that imposed damage caps and those that did not, we are able to assess whether the rise in premiums was particularly great in states where no reforms were enacted, which is what one would expect.

Although examining the effect of liability insurance on premiums, losses, and loss ratios is instructive, it is the loss ratio that is the main index of insurance market performance. The ratio is the inverse of ex post insurance profitability and the central measure of interest, whereas the cost and premium results show the mechanisms of interest.[13]

In a competitive insurance market, firms enter and exit the industry until the loss ratio for a new entrant is just sufficient to provide a normal level of profitability. If liability reforms improve profitability, competition will ensure that the industry returns to a normal level of profitability in the long run. Even in the absence of reforms, competition will lead to long-run normal profits. The main differences are the timing of the return to profitability and possibly the mix of firms writing coverage. A reduction in premium rates could achieve such a pass-through. If all firms are identical, have similarly risky portfolios, and are affected in the same way by liability reforms, profitability will be unaffected by the cost reductions generated by the reforms. Insurance purchasers will be the principal beneficiaries of the reform effort.

13. One potential problem with the loss ratio measure is that it is derived using losses incurred, which to some extent is an estimated value. During this period it is possible that insurers' estimates of losses were not accurate, but we have no reason to believe the inaccuracies would differ across states with and without reforms.

This idealized result may not hold because of the characteristics of insurance markets. Suppose, for example, that firms differ in their level of profitability and that reforms benefit only the less profitable firms. In such cases there would be no postreform premium competition from the more profitable firms or new entrants who likewise would not benefit from the reforms. Thus the character of the reform effort and the distribution of its consequences have a fundamental effect on who benefits from the liability reforms.

Because we are concerned with the potential differential effect of liability reforms on firms that are less profitable, it is instructive to examine the stability of firm profitability over time. That is, we ask whether firms in the highest quantiles of the loss ratio distribution (the least profitable in their underwriting performance) are consistently located in the highest quantiles or if the relative performance of the insurers is variable. We expect stability over time, but we rely on some variability to add credence to the empirical analysis. Without variation, our quantile regression results reflect only the unique characteristics of the companies in the quantile (see appendix A for our quantile regression methodology).

Table 3 shows a cross-tabulation of the number of observations on medical malpractice firms by their position in the loss ratio distribution for 1985 (row) and 1991 (column). For example, the table indicates that four firms from the highest quantile in 1985 fell to the 50–75 percent range of the distribution in 1991. The bulk of observations on the diagonal suggests general stability among the firms, but the off-diagonal cells indicate a substantial amount of variation in relative performance.

The stability of performance among general liability insurers is evident. The bulk of observations is, again, located on the diagonal or in cells adjacent to the diagonal. The off-diagonal cells, however, indicate variability in relative performance among these insurers as well. There is also little evidence to suggest that firms in the highest quantiles (worst performance) are unable to recover. Interestingly, among the firms that remain in the sample for all seven years, none of the medical malpractice firms holds a position in the lowest quartile (less than the twenty-fifth percentile) for more than six years straight, and only twelve occupy the lowest quartile for three years. Similarly, only two general liability

**Table 3. Performance Stability: Medical Malpractice and General Liability Loss Ratios**

| *1985 quantile* | *1991 quantile* | | | | | |
|---|---|---|---|---|---|---|
| | *0–10* | *10–25* | *25–50* | *50–75* | *75–90* | *90–100* |
| Medical malpractice insurers[a] | | | | | | |
| 0–10 | 5 | 3 | 2 | 0 | 0 | 1 |
| 10–25 | 7 | 7 | 5 | 9 | 7 | 4 |
| 25–50 | 9 | 19 | 14 | 17 | 13 | 7 |
| 50–75 | 5 | 12 | 17 | 26 | 13 | 12 |
| 75–90 | 4 | 3 | 8 | 11 | 8 | 3 |
| 90–100 | 1 | 0 | 2 | 4 | 7 | 1 |
| General liability insurers[b] | | | | | | |
| 0–10 | 56 | 60 | 89 | 86 | 45 | 23 |
| 10–25 | 50 | 77 | 171 | 180 | 76 | 44 |
| 25–50 | 70 | 152 | 275 | 274 | 168 | 82 |
| 50–75 | 64 | 113 | 209 | 296 | 176 | 112 |
| 75–90 | 24 | 40 | 87 | 135 | 106 | 82 |
| 90–100 | 23 | 28 | 32 | 57 | 54 | 45 |

Source: See text. Each cell denotes the number of firms that fell in quantile $x$ in 1985 (row) and quantile $y$ in 1991 (column).

a. N = 266 (firm-state level).

b. N = 13,330 (firm-state level).

insurers occupied the lowest quintile (less than the tenth percentile) for the seven years used in the analysis.

## The Effect of Liability Reforms on Insurance Company Loss Ratios

The most prominent variable of interest in the empirical insurance literature is the loss ratio. Insurance premiums reflect the combined influence of the price of insurance and the quantity of insurance sold. Similarly, loss values will be higher if more coverage is written. The loss ratio, which is the ratio of losses incurred to premiums earned for policies written in year $t$ serves as a measure of the ex post price of insurance. This variable simultaneously recognizes the influence of price and quantity in driving premium levels and attempts to serve as a measure of insurance company profitability. The high loss ratios—well above 1.0—experienced among malpractice and general liability insur-

ers in the mid-1980s served as a primary impetus for many of the tort liability reform efforts.

Appendix B presents comparable results for premiums and losses. Total premiums earned is not the ideal measure for tracking the efforts of liability reforms because the number reflects the combined influence of price and quantity. No price or quantity information, such as the number of policies written or the extent of coverage, is available to disentangle these components, however.

The character of the reforms is such that they will first exert their influence by reducing the size of damage awards and their frequency. Insurance losses should be the first to reflect the reforms' effects. Once the effect on losses becomes apparent, insurance companies will revise their premium levels, but for institutional reasons, such as the need to obtain regulatory approval of rate changes, this revision occurs with a lag. Given this lag structure, there will be an improvement in firm profitability as reflected in lower loss ratios. Any reduction in premiums as a result of this enhanced profitability will lag behind the reductions in the loss ratio.

If firms were at a competitive rate of profitability before the tort liability reforms, we would expect any diminishing of loss levels to lead to a reduction in premiums. To the extent that the loss ratio is a valid index of insurance company profitability, one would expect competition to adjust so that the loss ratios would be unaffected by the reform efforts.[14] In contrast, if loss ratios were excessive, reforms restraining tort liability could accelerate insurance companies' return to profitability, particularly in states in which regulatory authorities impose limits on raising premiums.

We use a quantile regression model to assess the effects of the liability reforms on the loss ratios of medical malpractice and general liability insurers. In particular, instead of focusing on the average effects of the covariates on the loss ratio, we explore the potential differential effects across the distribution of loss ratios. Specifically, we focus on the determinants of whether the loss ratio lies within a particular quantile of the overall loss ratio distribution. Using the quantile regression methodology, we can obtain estimates of the influence of our

14. The loss ratio excludes, for example, the administrative costs and variations in the rate of return earned on premium investments.

covariates at any point of the distribution of the dependent variable. The most common form of quantile regression model is the median regression, which is very similar to ordinary least squares (OLS) regression except that the method involves minimizing the sum of the absolute residuals rather than the sum of the squares of the residuals. Unlike OLS, quantile regressions do not impose normality distributional assumptions on the error term. Because we are interested in the effects of the reforms across the distribution, we supplement median regression analysis with generalized quantile regressions estimated at the tenth, twenty-fifth, seventy-fifth, and ninetieth percentiles. To control for possible heteroscedastic errors, we use a bootstrap resampling technique to obtain standard errors. The quantile regression methodology is discussed in more detail in appendix A.

Tables 4 through 11 report the quantile regression results in which we assess the effects of the liability reforms on loss ratios. For each of the two samples of insurers, we estimate these effects following two functional forms, beginning with a standard autoregressive formulation in which the lagged dependent variable is included in the vector $x$. That is: $x = f(\text{loss ratio}_{t-1}$, zero-one indicators for damage reform and other reform, zero-one indicators for organizational form, national premiums written, four-firm industry concentration ratio, zero-one indicator for restrictive rate filing regulation, real state aggregate income, U.S. Treasury bill rate).

We also estimate a counterpart to this equation including a variable to capture the effect of the 1986 tax reforms. That is: $x = f(\text{loss ratio}_{t-1}$, zero-one indicators for damage reform and other reform, zero-one indicators for organizational form, national premiums written, tax reform 1986 $\times$ return on equity, four-firm industry concentration ratio, zero-one indicator for restrictive rate filing regulation, real state aggregate income, U.S. Treasury bill rate).

Because these reforms will have the greatest benefit for the more profitable firms, the variable used is the interaction between the 1986 (and thereafter) dummy variable and the return on equity, which we measure by the underwriting and investment gains divided by total equity. Unfortunately, the timing of the tax reforms coincides with the middle of the reform period from 1985 to 1987, making it very difficult to disentangle the two types of policy influences. In the subsequent results the damage cap reform variable is consistently influential for

both medical malpractice and general liability, but the other reform variable is more unstable in the general liability regression results.

We then proceed with the estimation of these two equations without the lagged dependent variable, which allows us to assess the long-run effects of the reforms. Each of the tables reports five sets of quantile regression results for different fractiles of the loss ratio distribution. Thus it is possible to ascertain the differential effect of liability reforms on the less profitable firms at the upper end of the loss ratio spectrum as opposed to firms at the low end. The estimated coefficients indicate the influence of the covariate at that particular portion of the distribution. Thus, by looking across the estimated quantiles, we can infer whether the influence of a covariate gets greater, or smaller, or is unvarying across the distribution.

### *Medical Malpractice Loss Ratios*

Tables 4 through 7 pertain to the medical malpractice sample. In table 4 the importance of examining the effects of the liability reforms on different segments of the distribution is evident when one compares the estimates obtained at each of the quantiles. The results indicate that most segments of the profitability distribution are significantly affected by the reforms. Most striking is the effect of the damage cap variable—it increases steadily in terms of its coefficient size as one moves from the lower quantiles to the higher loss ratio values, where these effects are statistically significant in all cases. The other reform variable likewise is most consequential at the upper end of the loss ratio spectrum. Beginning at the median loss ratio through a remarkably high influence at the ninetieth percentile, the other reform variable decreases the value of the loss ratio substantially. The combined effect of these reform variables based on the point estimates is $-0.25$ at the seventy-fifth percentile and $-0.41$ at the ninetieth percentile. Given the mean loss ratio values of 1.60 in 1985 and 1.0 in 1991 for the sample characteristics in table 2, it is apparent that effects of this magnitude represent a substantial influence on the profitability of insurance company operations.

It is somewhat striking that the net influence of the lagged value of the loss ratio increases to a remarkable degree as one moves to the least profitable firms. For firms at the low end of the loss ratio distribution,

**Table 4. Medical Malpractice, Quantile Regression Results, Model 1, Dependent Variable = Loss Ratio**

Bootstrapped standard errors in parentheses

| | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| *Variable* | *10* | *25* | *50* | *75* | *90* |
| Intercept | 0.157*** | 0.308*** | 0.494*** | 0.787*** | 1.083** |
| | (0.045) | (0.055) | (0.049) | (0.118) | (0.454) |
| Loss ratio ($t-1$) | 0.026*** | 0.089*** | 0.275*** | 0.668*** | 1.353*** |
| | (0.006) | (0.014) | (0.028) | (0.044) | (0.059) |
| Damage reform | −0.027*** | −0.029* | −0.062*** | −0.095*** | −0.127* |
| | (0.009) | (0.017) | (0.010) | (0.024) | (0.074) |
| Other reform | 0.007 | −0.013 | −0.051*** | −0.158*** | −0.290** |
| | (0.012) | (0.013) | (0.017) | (0.049) | (0.113) |
| Mutual | −0.025*** | −0.072*** | −0.072*** | −0.116*** | −0.114 |
| | (0.007) | (0.017) | (0.024) | (0.033) | (0.121) |
| Lloyds | −0.059 | 0.236 | 0.428 | 3.228 | 2.626 |
| | (0.190) | (0.272) | (0.316) | (2.585) | (7.425) |
| Reciprocal | −0.008 | −0.019 | −0.022 | −0.076*** | −0.244 |
| | (0.016) | (0.024) | (0.025) | (0.027) | (0.173) |
| National premiums written | 3.2E-10*** | 2.9E.10*** | 6.9E-11 | −1.9E-10 | −1.6E-9*** |
| | (4.9E-11) | (5.0E-11) | (6.1E-11) | (1.3E-10) | (1.6E-10) |
| Four-firm concentration ratio | −0.014 | 0.037 | −0.028 | −0.015 | 0.306 |
| | (0.044) | 0.033 | (0.054) | (0.117) | (0.316) |
| Rate regulation | −0.003 | −0.000 | 0.008 | 0.018 | −0.057 |
| | (0.010) | 0.011 | 0.015 | 0.025 | (0.064) |
| Real state income | 1.3E-7*** | 1.2E-7*** | 2.6E-8 | 4.0E-8 | −3.5E-7 |
| | (4.0E-8) | (6.6E-8) | (5.7E-8) | (1.7E-7) | (3.1E-7) |
| Treasury bill rate | 0.003 | −0.003 | 0.006 | −0.008 | 0.003 |
| | (0.003) | (0.005) | (0.005) | (0.010) | (0.035) |

Source: Authors' calculations.

*Significant at the 90 percent confidence level, two-tailed test.

**Significant at the 95 percent confidence level, two-tailed test.

***Significant at the 99 percent confidence level, two-tailed test.

the last-period loss ratio has very little influence on current loss ratio levels. Firms at the seventy-fifth and ninetieth percentiles, however, exhibit a very strong relationship across time, which is suggestive of a consistently risky and unprofitable portfolio of insurance policies written.

Table 5 reports very similar results when we include our control for the Tax Reform Act of 1986. The effects of the two reform variables are virtually unchanged, and although the new variable is only significant at the median and seventy-fifth percentiles, it has the expected negative effect on loss ratios.

Tables 6 and 7 explore the robustness of these results with regression estimates of the model without the lagged dependent variable. Apart from a substantial decrease in explanatory power, the results are similar to those in tables 4 and 5. In both models, damage reforms have a consistent significant effect in reducing loss ratios, with effects at the ninetieth percentile being more than three times as great as those for the median firm. It is the most unprofitable firms that benefit most from the damage reforms. The magnitude of the effect is slightly larger for firms above the median when the lagged dependent variable is omitted, indicating a larger long-run influence on loss ratios for the more unprofitable firms. The other reforms variable performs in a same manner, with the point estimates following the same general pattern in the upper quantiles.

### *General Liability Loss Ratios*

The experience among general liability insurers is reported in tables 8 through 11. Here again, the quantile regression results indicate that most segments of the profitability distribution are significantly affected by the damage reforms. In each table the effect increases in magnitude as one moves from the lower quantiles (about $-0.01$ at the tenth percentile) to the higher loss ratio values ($-0.2$ to $-0.3$ at the ninetieth percentile, depending on the specification). Given the mean loss ratio values of 1.8 in 1985 and 1.3 in 1991 for the sample characteristics in table 2, the results in all four tables suggest damage reforms had a substantial influence on the profitability of insurance company operations. The other reform variable is found to be generally insignificant

**Table 5. Medical Malpractice, Quantile Regression Results, Model 2, Dependent Variable = Loss Ratio**

Bootstrapped standard errors in parentheses

| | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| *Variable* | *10* | *25* | *50* | *75* | *90* |
| Intercept | 0.164*** | 0.337*** | 0.493*** | 0.834*** | 1.074*** |
| | (0.037) | (0.046) | (0.060) | (0.133) | (0.399) |
| Loss ratio ($t-1$) | 0.026*** | 0.088*** | 0.274*** | 0.663*** | 1.352*** |
| | (0.006) | (0.019) | (0.031) | (0.054) | (0.071) |
| Damage reform | −0.027*** | −0.033*** | −0.060*** | −0.095*** | −0.116* |
| | (0.009) | (0.013) | (0.012) | (0.028) | (0.069) |
| Other reform | 0.008 | −0.010 | −0.042** | −0.146*** | −0.289*** |
| | (0.012) | (0.013) | (0.019) | (0.044) | (0.087) |
| Mutual | −0.017** | −0.052** | −0.049*** | −0.086*** | −0.105*** |
| | (0.009) | (0.024) | (0.018) | (0.039) | (0.175) |
| Lloyds | −0.061 | 0.241 | 0.417 | 3.227 | 2.616 |
| | (0.218) | (0.217) | (0.712) | (1.998) | (8.346) |
| Reciprocal | 0.006 | 0.001 | −0.010 | −0.087** | −0.266 |
| | (0.016) | (0.029) | (0.038) | (0.040) | (0.165) |
| National premiums written | 3.5E-10*** | 3.4E-10*** | 1.4E-10** | −1.1E-10 | −1.6E-9*** |
| | (5.8E-11) | (5.2E-11) | (6.0E-11) | (7.4E-11) | (1.4E-10) |
| Tax reform 86* ROE | −0.036 | −0.092 | −0.154*** | −0.141** | −0.049 |
| | (0.036) | (0.059) | (0.050) | (0.070) | (0.179) |
| Four-firm concentration ratio | −0.017 | 0.041 | −0.029 | 0.041 | 0.352 |
| | (0.036) | (0.058) | (0.066) | (0.126) | (0.344) |
| Rate regulation | −0.003 | 0.004 | −0.003 | 0.015 | −0.059 |
| | (0.008) | (0.010) | (0.012) | (0.028) | (0.080) |
| Real state income | 1.4E-7*** | 1.4E-7*** | 5.7E-8 | 5.2E-8 | 3.3E-7 |
| | (4.4E-8) | (4.4E-8) | (6.3E-8) | (2.1E-7) | (2.8E-7) |
| Treasury bill rate | 0.002 | −0.007 | 0.007 | −0.012 | −0.001 |
| | (0.003) | (0.006) | (0.005) | (0.013) | (0.033) |

Source: Authors' calculations.

*Significant at the 90 percent confidence level, two-tailed test.

**Significant at the 95 percent confidence level, two-tailed test.

***Significant at the 99 percent confidence level, two-tailed test.

**Table 6. Medical Malpractice, Quantile Regression Results, Model 1, Dependent Variable = Loss Ratio, Model without Lagged Dependent Variable**

Bootstrapped standard errors in parentheses

| | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| *Variable* | *10* | *25* | *50* | *75* | *90* |
| Intercept | 0.187*** | 0.387*** | 0.590** | 1.286*** | 2.404*** |
| | (0.032) | (0.048) | (0.076) | (0.183) | (0.785) |
| Damage reform | −0.026** | −0.037*** | −0.091*** | −0.217*** | −0.344*** |
| | (0.011) | (0.012) | (0.021) | (0.040) | (0.122) |
| Other reform | 0.007 | −0.021 | −0.079*** | −0.196*** | −0.244* |
| | (0.013) | (0.013) | (0.022) | (0.031) | (0.137) |
| Mutual | −0.036*** | −0.092*** | −0.124** | −0.166*** | −0.378** |
| | (0.008) | (0.012) | (0.021) | (0.064) | (0.172) |
| Lloyds | −0.051 | 0.295 | 0.504 | 3.101 | 11.576** |
| | (0.171) | (0.267) | (1.924) | (5.738) | (5.736) |
| Reciprocal | −0.015 | −0.031 | −0.058* | −0.221*** | −0.555*** |
| | (0.021) | (0.019) | (0.034) | (0.044) | (0.142) |
| National premiums written | 3.2E-10*** | 2.9E-10*** | 6.9E-11 | −1.9E-10 | −1.6E-9*** |
| | (4.7E-11) | (4.4E-11) | (6.1E-11) | (1.3E-10) | (1.6E-10) |
| Four-firm concentration ratio | −0.026 | 0.046 | 0.115 | 0.227* | 0.844 |
| | (0.037) | (0.037) | (0.070) | (0.116) | (0.642) |
| Rate regulation | −0.005 | −0.006 | 0.006 | −0.022 | 0.038 |
| | (0.009) | (0.009) | (0.012) | (0.029) | (0.081) |
| State income | 1.3E-7*** | 1.2E-7* | 2.6E-8 | 4.0E-8 | −3.5E-7 |
| | (4.9E-8) | (6.3E-8) | (5.7E-8) | (1.5E-7) | (3.1E-7) |
| Treasury bill rate | 0.002 | −0.005 | 0.009 | −0.020 | −0.068 |
| | (0.003) | (0.005) | (0.006) | (0.018) | (0.063) |

Source: Authors' calculations.

*Significant at the 90 percent confidence level, two-tailed test.

**Significant at the 95 percent confidence level, two-tailed test.

***Significant at the 99 percent confidence level, two-tailed test.

**Table 7. Medical Malpractice, Quantile Regression Results, Model 2, Dependent Variable = Loss Ratio, Model without Lagged Dependent Variable**

Bootstrapped standard errors in parentheses

| | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| *Variable* | *10* | *25* | *50* | *75* | *90* |
| Intercept | 0.199*** | 0.420*** | 0.594*** | 1.278*** | 2.457*** |
| | (0.051) | (0.048) | (0.052) | (0.139) | (0.611) |
| Damage reform | −0.027*** | −0.041*** | −0.094*** | −0.198*** | −0.324*** |
| | (0.008) | (0.017) | (0.015) | (0.041) | (0.096) |
| Other reform | 0.010 | −0.012 | −0.066*** | −0.182*** | −0.257 |
| | (0.011) | (0.020) | (0.018) | (0.036) | (0.161) |
| Mutual | −0.031** | −0.069*** | −0.101*** | −0.160*** | −0.383* |
| | (0.013) | (0.016) | (0.031) | (0.038) | (0.145) |
| Lloyds | −0.051 | 0.292 | 0.492 | 3.099 | 11.573** |
| | (0.286) | (0.269) | (0.732) | (3.867) | (5.216) |
| Reciprocal | −0.004 | −0.013 | −0.048 | −0.196*** | −0.632*** |
| | (0.019) | (0.021) | (0.031) | (0.047) | (0.137) |
| National premiums written | 3.4E-10*** | 3.2E-10*** | 1.3E-10** | −4.7E-11 | −2.1E-9*** |
| | (5.9E-11) | (5.2E-11) | (5.4E-11) | (1.4E-10) | (2.0E-10) |
| Tax reform 86* ROE | −0.032 | −0.110* | −0.128** | −0.193** | −0.074 |
| | (0.042) | (0.062) | (0.052) | (0.075) | (0.083) |
| Four-firm concentration ratio | −0.034 | 0.045 | 0.102** | 0.283** | 0.807 |
| | (0.047) | (0.044) | (0.045) | (0.112) | (0.660) |
| Rate regulation | −0.005 | −0.001 | −3.9E-4 | −0.035 | 0.033 |
| | (0.010) | (0.010) | (0.013) | (0.026) | (0.126) |
| Real state income | 1.5E-7*** | 2.0E-7*** | 1.5E-7* | 3.2E-7 | −3.7E-7 |
| | (5.6E-8) | (5.6E-8) | (6.8E-8) | (1.4E-7) | (5.4E-7) |
| Treasury bill rate | 0.002 | −0.010 | 0.010** | −0.023 | −0.069 |
| | (0.005) | (0.006) | (0.008) | (0.013) | (0.045) |

Source: Authors' calculations.

*Significant at the 90 percent confidence level, two-tailed test.

**Significant at the 95 percent confidence level, two-tailed test.

***Significant at the 99 percent confidence level, two-tailed test.

except at the upper quantiles, where it has a surprising positive effect, which may reflect the fact that not all liability reforms reduce costs.

As shown in tables 8 and 9, the lagged value of the loss ratio exhibits a much less striking pattern of influence among general liability insurers than among the medical malpractice insurers. Except at the tenth percentile, the coefficients are all statistically significant, but are considerably less significant in magnitude. Again, this result is suggestive of consistently risky and unprofitable underwriting portfolios.

Tables 10 and 11 explore the robustness of the results in tables 8 and 9 with regression estimates of the model without the lagged dependent variable. Damage reforms remain a consistently significant determinant of loss ratios, and the influence is greatest among the firms with the highest ratios. The estimated effect at the ninetieth percentile is five times as great as for the median firm. Unlike the results obtained for the medical malpractice insurers, the magnitude of the effects of the damage reform do not increase relative to those obtained for the model that includes the lagged dependent variable. This result suggests that the damage reforms have led to permanent long-run reductions in loss ratios. The other reforms variable performs less consistently and, once again, exhibits a positive influence at the upper quantiles.

## The Effect of Liability Reforms on Insurance Company Premiums and Losses

We also estimated the effects of the liability reform efforts on insurance company premiums and losses, the two components of the loss ratio. Because the most frequently cited index of the liability crisis is the surge in insurance premiums that took place in the mid-1980s, we were interested in the influence of the reform efforts on the level of insurer premiums. As before, we estimated the effects of the liability reforms following two functional forms: the autoregressive formulation that includes the lagged dependent variable in the vector $x$, and the same model without the lagged dependent variable. In these analyses the quantile regression results allow us to examine any differential effect of the reforms on smaller firms, at the lower end of the premium

**Table 8. General Liability, Quantile Regression Results, Model 1, Dependent Variable = Loss Ratio**

Bootstrapped standard errors in parentheses

| | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| *Variable* | *10* | *25* | *50* | *75* | *90* |
| Intercept | 0.126*** | 0.247*** | 0.479*** | 0.874*** | 1.906*** |
| | (0.012) | (0.017) | (0.024) | (0.057) | (0.199) |
| Loss ratio ($t-1$) | 1.6E-7 | 8.0E-9 | −2.6E-7*** | −7.9E-7*** | −2.3E-6*** |
| | (5.0E-9) | (6.6E-9) | (9.6E-9) | (2.5E-8) | (9.8E-8) |
| Damage reform | −0.013*** | −0.025*** | −0.050*** | −0.109*** | −0.300*** |
| | (0.003) | (0.004) | (0.005) | (0.014) | (0.050) |
| Other reform | 0.004 | 0.007 | −0.008 | 0.016 | 0.189*** |
| | (0.004) | (0.006) | (0.008) | (0.019) | (0.068) |
| Mutual | −0.058*** | −0.096*** | −0.108*** | −0.197*** | −0.655*** |
| | (0.004) | (0.005) | (0.008) | (0.019) | (0.067) |
| Lloyds | 0.033 | 0.132*** | 0.095* | 0.141 | 0.219 |
| | (0.026) | (0.037) | (0.054) | (0.131) | (0.443) |
| Reciprocal | −0.044** | −0.083*** | −0.103*** | −0.304* | −0.907 |
| | (0.010) | (0.014) | (0.020) | (0.049) | (0.173) |
| National premiums written | 1.2E-10*** | 1.2E-10*** | 5.8E-11*** | −1.2E-10*** | −5.7E-10*** |
| | (7.1E-12) | (8.7E-12) | (1.1E-11) | (2.7E-11) | (1.2E-10) |
| Four-firm concentration ratio | 0.022 | 0.007 | −0.077* | −0.084 | −0.062 |
| | (0.022) | (0.030) | (0.044) | (0.108) | (0.386) |
| Rate regulation | −0.007** | −0.007 | −0.003 | −0.007 | 0.037 |
| | (0.003) | (0.004) | (0.006) | (0.015) | (0.052) |
| Real state income | 2.3E-7*** | 3.6E-7*** | 5.1E-7*** | 8.1E-7*** | 1.5E-6*** |
| | (1.4E-8) | (1.8E-8) | (2.6E-8) | (6.4E-8) | (2.3E-7) |
| Treasury bill rate | −0.003** | −8.5E-5 | 0.004 | 0.019*** | 0.038 |
| | (0.001) | (1.9E-3) | (0.003) | (0.007) | (0.023) |

Source: Authors' calculations.

*Significant at the 90 percent confidence level, two-tailed test.

**Significant at the 95 percent confidence level, two-tailed test.

***Significant at the 99 percent confidence level, two-tailed test.

**Table 9. General Liability, Quantile Regression Results, Model 2, Dependent Variable = Loss Ratio**

Bootstrapped standard errors in parentheses

| | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| *Variable* | *10* | *25* | *50* | *75* | *90* |
| Intercept | 0.137*** | 0.270*** | 0.540*** | 0.994*** | 2.094*** |
| | (0.012) | (0.016) | (0.023) | (0.050) | (0.205) |
| Loss ratio ($t-1$) | 1.5E-7*** | −3.1E-9*** | −2.9E-7*** | −8.4E-7*** | −2.3E-6*** |
| | (4.9E-9) | (6.4E-9) | (9.5E-9) | (2.1E-8) | (1.0E-7) |
| Damage reform | −0.012*** | −0.020*** | −0.041*** | −0.079*** | −0.218*** |
| | (0.003) | (0.004) | (0.006) | (0.012) | (0.052) |
| Other reform | 0.005 | 0.008 | 0.013 | 0.034** | 0.239*** |
| | (0.004) | (0.005) | (0.008) | (0.017) | (0.070) |
| Mutual | −0.061*** | −0.101*** | −0.118*** | −0.210*** | −0.617*** |
| | (0.004) | (0.005) | (0.008) | (0.017) | (0.069) |
| Lloyds | 0.027 | 0.126*** | 0.108** | 0.180 | 1.240 |
| | (0.026) | (0.036) | (0.053) | (0.114) | (0.456) |
| Reciprocal | −0.039*** | −0.079*** | −0.095*** | −0.304*** | −0.898*** |
| | (0.010) | (0.014) | (0.020) | (0.043) | (0.177) |
| National premiums written | 1.3E-10*** | 1.2E-10*** | 6.8E-11*** | −8.7E-11*** | −4.9E-10*** |
| | (7.1E-12) | (8.6E-12) | (1.1E-11) | (2.4E-11) | (1.2E-10) |
| Tax reform 86* ROE | −0.056*** | −0.109*** | −0.285*** | −0.706*** | −1.641*** |
| | (0.002) | (0.003) | (0.004) | (0.008) | (0.031) |
| Four-firm concentration ratio | 0.035 | 0.025 | −0.023 | −0.026 | 0.231 |
| | (0.021) | (0.029) | (0.043) | (0.094) | (0.394) |
| Rate regulation | −0.007** | −0.005 | −0.001 | −0.003 | 0.048 |
| | (0.003) | (0.004) | (0.006) | (0.013) | (0.054) |
| Real state income | 2.2E-7*** | 3.5E-7*** | 4.9E-7*** | 7.3E-7*** | 1.5E-6*** |
| | (1.3E-8) | (1.8E-8) | (2.6E-8) | (5.6E-8) | (2.4E-7) |
| Treasury bill rate | −0.004*** | −0.002 | −0.002 | 0.008 | 0.010 |
| | (0.001) | (0.002) | (0.003) | (0.006) | (0.024) |

Source: Authors' calculations.

*Significant at the 90 percent confidence level, two-tailed test.

**Significant at the 95 percent confidence level, two-tailed test.

***Significant at the 99 percent confidence level, two-tailed test.

**Table 10. General Liability, Quantile Regression Results, Model 1, Dependent Variable = Loss Ratio, Model without Lagged Dependent Variable**

Bootstrapped standard errors in parentheses

| | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| *Variable* | *10* | *25* | *50* | *75* | *90* |
| Intercept | 0.114*** | 0.235*** | 0.467*** | 0.786*** | 1.769*** |
| | (0.011) | (0.014) | (0.021) | (0.052) | (0.203) |
| Damage reform | −0.012*** | −0.022*** | −0.041*** | −0.097*** | −0.259*** |
| | (0.003) | (0.003) | (0.005) | (0.013) | (0.051) |
| Other reform | 0.002 | 0.007 | 0.012 | 0.032* | 0.209*** |
| | (0.004) | (0.005) | (0.007) | (0.018) | (0.071) |
| Mutual | −0.057*** | −0.102*** | −0.116 | −0.182*** | −0.591*** |
| | (0.004) | (0.005) | (0.007) | (0.018) | (0.070) |
| Lloyds | 0.010 | 0.029 | 0.073 | 0.111 | −0.707 |
| | (0.025) | (0.031) | (0.047) | (0.115) | (0.454) |
| Reciprocal | −0.038*** | −0.076*** | −0.090 | −0.257*** | −0.830*** |
| | (0.010) | (0.012) | (0.018) | (0.045) | (0.176) |
| National premiums written | 1.3E-10*** | 1.3E-10*** | 7.1E-11*** | −1.1E-10*** | −5.8E-10*** |
| | (7.7E-12) | (8.5E-12) | (1.1E-11) | (2.7E-11) | (1.4E-10) |
| Four-firm concentration ratio | 0.023 | 0.011 | −0.028 | 0.043 | 0.443 |
| | (0.021) | (0.026) | (0.040) | (0.099) | (0.396) |
| Rate regulation | −0.005 | −0.006 | −0.001 | −0.007 | 0.029 |
| | (0.003) | (0.004) | (0.005) | (0.014) | (0.053) |
| Real state income | 1.9E-7*** | 3.3E-7*** | 4.6E-7*** | 8.0E-7*** | 2.0E-6*** |
| | (1.3E-8) | (1.6E-8) | (2.4E-8) | (5.9E-8) | (2.4E-7) |
| Treasury bill rate | −0.002 | 0.001 | 0.003 | 0.022*** | 0.031 |
| | (0.001) | (0.002) | (0.002) | (0.006) | (0.024) |

Source: Authors' calculations.
*Significant at the 90 percent confidence level, two-tailed test.
**Significant at the 95 percent confidence level, two-tailed test.
***Significant at the 99 percent confidence level, two-tailed test.

**Table 11. General Liability, Quantile Regression Results, Model 2, Dependent Variable = Loss Ratio, Model without Lagged Dependent Variable**

Bootstrapped standard errors in parentheses

| | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| *Variable* | *10* | *25* | *50* | *75* | *90* |
| Intercept | 0.124*** | 0.255*** | 0.518*** | 0.901*** | 1.901*** |
| | (0.011) | (0.015) | (0.020) | (0.046) | (0.196) |
| Damage reform | −0.013*** | −0.020*** | −0.037*** | −0.071*** | −0.191*** |
| | (0.003) | (0.004) | (0.005) | (0.012) | (0.049) |
| Other reform | 0.005** | 0.008 | 0.020** | 0.051*** | 0.270*** |
| | (0.004) | (0.005) | (0.007) | (0.016) | (0.068) |
| Mutual | −0.061*** | −0.106*** | −0.123*** | −0.198*** | −0.573*** |
| | (0.004) | (0.005) | (0.007) | (0.016) | (0.067) |
| Lloyds | 0.006 | 0.040 | 0.097** | 0.169 | 0.648 |
| | (0.024) | (0.032) | (0.044) | (0.103) | (0.435) |
| Reciprocal | −0.036*** | −0.070*** | −0.082*** | −0.261*** | −0.863*** |
| | (0.009) | (0.012) | (0.017) | (0.040) | (0.169) |
| National premiums written | 1.3E-10*** | 1.3E-10*** | 8.0E-11*** | −8.7E-11*** | −5.1E-10*** |
| | (7.4E-12) | (8.8E-12) | (1.0E-11) | (2.4E-11) | (1.3E-10) |
| Tax reform 86* ROE | −0.043*** | −0.098*** | −0.235*** | −0.624*** | −1.538*** |
| | (0.002) | (0.003) | (0.004) | (0.008) | (0.033) |
| Four-firm concentration ratio | 0.019 | 0.021 | 0.004 | 0.115 | 0.845 |
| | (0.020) | (0.027) | (0.037) | (0.088) | (0.379) |
| Rate regulation | −0.005 | −0.004 | −0.001 | −0.003 | 0.042 |
| | (0.003) | (0.004) | (0.005) | (0.012) | (0.051) |
| Real state income | 1.8E-7*** | 3.2E-7*** | 4.4E-7*** | 7.1E-7*** | 1.8E-6*** |
| | (1.3E-8) | (1.6E-8) | (2.2E-8) | (5.3E-8) | (2.3E-7) |
| Treasury bill rate | −0.002* | −0.001 | −0.002 | 0.011** | 0.009 |
| | (0.001) | (0.002) | (0.002) | (0.005) | (0.023) |

Source: Authors' calculations.

*Significant at the 90 percent confidence level, two-tailed test.

**Significant at the 95 percent confidence level, two-tailed test.

***Significant at the 99 percent confidence level, two-tailed test.

distribution, as opposed to firms writing a high volume of premiums. A summary of our results is presented in appendix B.

Among medical malpractice insurers, we find that the damage reform variable is most influential in the models we estimate, and again has a differential effect across the distribution of firm premiums. When the lagged dependent variable is included in either model, the estimated effect rises steadily in magnitude from a 4 percent reduction in total premiums for firms at the twenty-fifth percentile to 13 percent at the ninetieth percentile. At the ninetieth percentile this represents a reduction of more than $1,000,000 in premiums for these firms. The effect of the other reform tort liability variable is not statistically significant when the lagged dependent variable is included in either model. Interestingly, when we omit the lagged dependent variable, the damage reform variable is less significant in each model and no longer follows the pattern exhibited in the first equation. Also, the other reform variable exerts a positive effect across the distribution.

For general liability insurers, damage reforms reduce premiums from 5.8 to 8.4 percent depending on the model specification. The estimated effects of the other reform variable are insignificant at the lower quantiles, and positive and significant at the seventy-fifth and ninetieth percentiles. When the lagged dependent variable is omitted from either model, damage reform is no longer a consistent determinant of premiums across the distribution, but the other reform variable is associated with higher total premiums. The results suggest little correlation between the size of the general liability insurer and the effects of the liability reforms.

The analysis of insurer premiums suggests that when the pertinent aspects of other factors that drive premium amounts are controlled, the damage reforms had some success in controlling premium levels. Although the initial intent of the reforms is to affect loss amounts, the ultimate economic mechanism at work should involve a pass-through of the decreased loss levels to insurance customers in the form of lower premiums. There does appear to be such a pass-through effect; the damage reforms did substantially reduce medical malpractice and general liability insurance premiums, but the effects of the other reforms and the longer-term effects of the damage reforms are less clear.

Our analysis suggests that the liability reforms reduced loss levels

for a given level of premiums. We noted earlier, however, that the damage reforms had a significant effect on premiums as well. Next, we explicitly tested the effects of the reforms on loss levels using the same basic models but including contemporaneous premiums as an independent variable. These results, when compared to those obtained for the premium equations, allow us to tell a more complete story about how the reform efforts are influencing overall performance.

Among medical malpractice insurers, the two liability reform variables each indicate that the reforms were successful in restraining the level of losses. In each model estimated, the effect of these reforms on different segments of the loss distribution is fairly consistent in percentage terms in the case of the damage cap variable. For that reform measure, the decrease in losses runs from 17 percent to 24 percent and is consistently significant throughout all loss levels. As in the case of premiums, the greatest effect of the reforms is at the upper end of the distribution. Given a value of $4.7 million at the ninetieth percentile, the effect at this point of the distribution represents a reduction in losses of nearly $900,000 for these firms.

When we omit the lagged dependent variable from either model, we find that the estimated effects of the liability reform variables are virtually unaffected, suggesting that the liability reforms have led to consistent long-term reductions in the level of losses. The uniformity of the effect across the loss distribution is consistent with our earlier findings regarding premiums: there is little correlation between the size of the firm and the effects of the liability reforms.

The effect of the liability reforms on loss levels is equally striking among general liability insurers. The two variables each indicate that the reforms were successful in restraining the level of losses. In all four equations we estimated, the magnitude of the reduction is fairly consistent throughout the loss distribution, falling from 11 percent to 6 percent as one moves to the upper quantiles.

When the lagged dependent variable is omitted from the models, the estimates on the damage reform variable continue to have a negative effect on losses that is significant across the distribution and is roughly the same magnitude at all quantiles. The damage reform is largest at the tenth percentile, $-0.113$, and falls to $-0.06$ at the median. The other reform variable exhibits a significant positive effect on losses that rises as one moves to the upper quantiles.

## Additional Considerations

In the preceding analysis we raised a few concerns that limit the quality of our results. Thus, we undertook steps to evaluate the robustness of the estimates we obtained, steps that address particular concerns with the theoretical and empirical approach. First we considered the possibility of omitted firm characteristics that may have biased our results. Then, we considered the possible endogeneity of the reform efforts in our analysis of loss ratios. Finally, we noted that our quantile regression approaches, viewed in unison, tell a reasonable story about the effects of the liability reforms.

Our quantile regression estimates of the effects of the liability reforms on premiums, losses, and loss ratios reveal several instances in which the effects are not uniform across the distribution. We can be fairly certain that these effects are not being driven by any particular firms in each quantile because there was substantial variability in performance over this period, as is evident in table 3. Still, it is possible that our effects are being driven by other firm characteristics that we overlooked, including firms' persistence in operating in particular types of markets or holding particular types of underwriting portfolios.

To assess the possibility that our reform variables are not simply capturing these other characteristics, we incorporated individual firm fixed-effects variables into a variant of our model.[15] Our results are consistent with those obtained in the quantile regression analysis, so we can reasonably assume that individual firm effects are not important. The results of our analysis are presented in appendix C.

We assumed in our analysis that the liability reforms were exogenous in the loss ratio equation. This assumption is reasonable given the number of firms and level of concentration in each state; it is not likely

15. For several reasons we had to adjust the equations we estimated previously. Most important, we had to omit any variables that were specific to the firm for the entire time period, which required us to drop the organizational form variables. In addition, the estimates would be biased if we included the lagged dependent variable among the regressors, so it was omitted. Although outliers in the loss ratio distribution were not a problem in the quantile regression, we chose to estimate the effects of the reforms in a logarithmic form. Finally, with more than 1,500 firms in the general liability sample, we encountered a limitation in our statistical software package: a maximum of 800 variables is allowed in any estimation procedure. We decided to take a random sample of one-half of the companies (769 to be exact), which consequently lowered the number of observations to just over 30,000 for this sample.

that any one firm's experience is the motivation for a state's reform efforts. Still, it is possible that states with the poorest insurance experience, on average, would be more likely to enact reforms than states with good experience. To explore the possible endogeneity of the reform and firm performance, we estimated several simultaneous equation models and performed Hausman specification tests, all of which suggested that one insurer's performance does not make a significant incremental contribution to the enactment of tort reform. If there is any endogeneity, it will tend to reduce the effect of the liability reforms. Enactment of reforms will reduce loss ratios. This improved profitability will decrease the impetus for additional liability reforms if there is such a simultaneous relationship.

Having identified large and significant effects of the liability reforms on loss ratios, we are particularly interested in the mechanisms behind this result, namely, the relative magnitudes of the estimated liability reform effects on losses versus premiums. In comparing the findings from our analyses of premiums and losses (see table 5), we find that the damage reforms reduce losses by about twice as much as the percentage effect on premiums. This result is consistent with the findings reported in the loss ratio table (see table 4)—that the liability reforms improve insurer profitability. Where significant, the effects of the reforms on the losses and premiums of the general liability insurers suggest the same pattern. We found, however, that the effect of the damage reform is much less uniform across the distribution of losses for the general liability insurers than for the medical malpractice insurers. Insurers with smaller loss levels are found to have been more affected by the reforms than those with larger losses. If the correlation between losses and premiums were stronger, we would have expected a corresponding strong negative effect on the lower portion of the loss ratio distribution, since we found no strong differential effects across the premium distribution. Because we did not, we suspect that a firm's relative position in the premium distribution is not strongly related to its position in the loss distribution.

## Economic Implications of the Liability Reforms

The states enacted the tort liability reform efforts in response to the liability insurance crisis in the early to mid-1980s. The purpose of this

paper was to assess whether these efforts were successful in promoting their intended objective. To do this we analyzed detailed data for every company in every state writing medical malpractice or general liability insurance coverage.

The impetus for these various reform efforts was the surge in losses and increases in premiums that occurred in the 1980s, which were accompanied by a decrease in insurer profitability. These adverse effects were largely concentrated among insurance lines such as general liability and medical malpractice rather than lines such as automobile insurance. The changes led to fears that America was undergoing a "liability crisis." These assessments were based largely on the magnitudes of the changes from the status quo and the decrease in firms' profitability. Change, however, is not necessarily bad. If, for example, the previous level of liability was too low, additional liability burdens would be warranted. Nonetheless, there was a general sense, supported in large part by anecdotal evidence, that the rise in liability was in fact depressing innovation and causing the withdrawal of vital products and services from the market.

As a result of this surge in liability, the states sought to restrain the insurance costs imposed on firms and physicians. During 1984–87 eleven states adopted damage reforms pertaining to medical malpractice and twenty-six states adopted damage reforms pertaining to general liability. The focus of the empirical inquiry was on whether these reforms improved profitability and restrained losses and premiums. Thus we took as the valid objective of these reforms the intent to reduce the overall liability burden and to bolster the profitability of the insurance firms, which at the time of the crisis were highly unprofitable.

To carry out our analysis we assembled what is by far the largest data set that has yet been used to assess the effect of the liability reforms. For the 1984–91 period we have information by state and firm for every company writing medical malpractice coverage and every company writing general liability coverage, leading to more than 1,000 observations a year for medical malpractice and 8,000 observations for general liability. Analyzing the effect of the liability reforms on both lines of insurance is instructive because these two lines were at the center of the liability crisis. Moreover, state legislatures sought to restrain each of these types of liability costs. These markets, however, are not identical, and the reforms also differed in their timing and their

character, so there is additional variation in these efforts and in their performance that provides a fuller empirical framework for assessing the potential effects of liability reform.

Despite the wide variety of statistical explorations undertaken, the result is a remarkably uniform picture of the effect of the reforms. Damage caps and the other reforms helped control insurance company costs, which in turn led to a decrease in premiums. The profitability of writing medical malpractice and general liability insurance also increased. Viewed in the narrow terms of attempting to restrain liability costs, the reforms certainly were a success.

The most interesting aspect of these effects is the different distributional consequences of the reforms across the market. Who benefits from the liability reforms? Is it the large firms, the least profitable firms, or are the effects equally distributed? Our empirical results indicated substantial variation.

The greatest differences in the distribution of the consequences were observed for the loss ratio effects. Firms with relatively high loss ratios experienced the greatest effect of the damage reforms. Thus, the least profitable firms reaped the greatest benefits. The reforms bolstered their profitability and were not passed through in their entirety to insurance purchasers. Because the least profitable firms achieved this dubious status by writing insurance coverage for which the losses are far in excess of the premiums, the reform efforts may have conferred the greatest benefits on the firms that were least able to choose carefully the risks they insured Consequently, damage caps reduce the penalties for poor underwriting practices. It should be noted that although the profitability of firms varies considerably over time, many firms tend to remain in the same relative profitability position from year to year, which would reflect a persistence in their underwriting practices and portfolio mix.

The distribution of the reform variable effects for premiums and losses was less pronounced. Unlike the results for the loss ratios, there is no evident increase in the consequences of the liability reforms as one moves across the distribution of losses and premiums. These results indicate that it is not simply the large firms in the market that benefited from the liability reforms. Indeed, there is no systematic size-related difference in the findings. Rather, the benefits were concentrated among those firms that would have suffered the greatest decrease in profitabil-

ity as a result of the large damage awards that would have been made had it not been for the restraining effect of the reforms.

Nor did the character of the reforms follow the usual textbook case in which savings are passed through to insurance purchasers with no improvement in profitability. Although all groups of firms benefited to some extent, firms with the least profitable insurance portfolios reaped the overwhelming share of the cost savings. This result may be due to the character of damage reforms.

## Appendix A: Quantile Regression Methodology

The quantile regressions estimate the effect of the vector of explanatory variables $x$ on the conditional distribution of the loss ratio, which we designate by $LR$. Following Koenker and Bassett, we will characterize the $\tau$th as a quantile of $LR$ given $x$ is linear and can be characterized by

$$\text{Quant}_{\tau}\,(LR|x) = \beta_{\tau}'x, \tag{1}$$

where $\beta_{\tau}$ is the pertinent vector of coefficients for the $\tau$th quantile.[16] Thus, this analysis enables one to determine the differential effect of the explanatory variable vector $x$ on loss ratios at different quantiles. The quantile regressions were estimated using an estimator that can be characterized by

$$\min_{\beta} \frac{1}{n} \sum_{i=1}^{n} [\tau\rho(LR_i \geq \beta' x_i) + (1 - \tau)\rho(LR_i \geq \beta' x_i)]|LR_i - \beta' x_i|, \tag{2}$$

where $n$ is the sample size, $i$ is the sample, and $\rho$ is an indicator function that takes on a value of one if the event characterized by the specified inequality holds and a value of zero if it does not. The vector $x$ in our analysis includes the two reform variables, rate regulation, organizational form, national premiums written, four-firm concentration ratio, real state aggregate income, and the U.S. Treasury bill rate. Following Koenker and Bassett, we also assume that the conditional density of $y$ given $x$ in the $\tau$th quantile is independent of $x$. We use a bootstrapping technique to obtain the value of the asymptotic standard errors.[17]

16. Koenker and Bassett (1978, 1982).
17. Chamberlain (1991).

## Appendix B: Summary of Other Quantile Regression Results

The variables that enter our premium equation are similar to those in the loss ratio equation. The dependent variable is the log of premiums earned, where the logarithmic form diminishes the role of outliers and also converts all the coefficients of the continuous variables, which are also in log form, into elasticities. As before, we estimate the effects of the liability reforms following four functional forms: the autoregressive formulation that includes the lagged dependent variable in the vector $x$, the same model without the lagged dependent variable, and the same two models repeated with the tax reform 1986 control variable (*TR86*). Table B-1 summarizes the quantile regression results for premiums for the two samples of insurers.

The top section of the table pertains to our medical malpractice insurance sample. Our quantile regression analyses of the effects of the liability reforms on premiums allow us to examine any differential effect of the reforms on smaller firms, at the lower end of the premium distribution, as opposed to larger firms at the high end. The damage reform variable is most influential in the models with the lagged dependent variable. Although there is no significant effect for firms at the bottom tenth percentile of premiums, the effect of the damage cap rises steadily from a 4 percent reduction for firms at the twenty-fifth percentile to a high value of 12 percent at the ninetieth percentile. Damage caps do not appear to have a uniform effect across the distribution of premiums. Instead, they have a differential incidence in affecting premiums at the firms writing a high volume of premium amounts. The effect of the "other reform" tort liability variable is not statistically significant.

We examine the robustness of the damage reform effects on premiums by estimating the equation without the lagged dependent variable. As in the loss ratio equations, the omission of the lagged dependent variable reduces the explanatory power. Interestingly, the effect of the damage reform on premiums no longer follows the pattern exhibited in the first equation, and the estimated coefficients are significant only at the median and seventy-fifth percentile. The other reform variable takes on a surprising significant positive effect that is uniform across the distribution. Thus, in contrast to the results in the models with the

**Table B-1. Summary of Other Quantile Regression Results: Medical Malpractice and General Liability Premiums**

Bootstrapped standard errors in parentheses

| *Variable* | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| | *10* | *25* | *50* | *75* | *90* |
| | | | Medical malpractice | | |
| Model 1 with lagged dependent variable | | | | | |
| Damage reform | −0.000 | −0.043*** | −0.063*** | −0.101*** | −0.121*** |
| | (0.019) | (0.011) | (0.016) | (0.029) | (0.055) |
| Other reform | −0.008 | 0.001 | −0.025 | −0.024 | 0.038 |
| | (0.026) | (0.013) | (0.019) | (0.029) | (0.054) |
| Model 1 without lagged dependent variable | | | | | |
| Damage reform | −0.113 | −0.062 | −0.088*** | −0.157* | −0.119 |
| | (0.108) | (0.065) | (0.035) | (0.086) | (0.091) |
| Other reform | 0.156 | 0.250*** | 0.173*** | 0.334*** | 0.312*** |
| | (0.129) | (0.045) | (0.057) | (0.088) | (0.053) |
| Model 2 with lagged dependent variable | | | | | |
| Damage reform | 0.004 | −0.041*** | −0.061*** | −0.095*** | −0.130*** |
| | (0.026) | (0.010) | (0.009) | (0.025) | (0.041) |
| Other reform | −0.009 | 0.001 | −0.020 | −0.030 | 0.040 |
| | (0.024) | (0.015) | (0.018) | (0.025) | (0.051) |
| Model 2 without lagged dependent variable | | | | | |
| Damage reform | −0.088 | −0.069 | −0.090* | −0.156** | −0.116 |
| | (0.082) | (0.079) | (0.048) | (0.070) | (0.074) |
| Other reform | 0.139** | 0.271*** | 0.166*** | 0.317*** | 0.288*** |
| | (0.066) | (0.064) | (0.041) | (0.072) | (0.095) |
| | | | General liability | | |
| Model 1 with lagged dependent variable | | | | | |
| Damage reform | −0.016 | −0.027*** | −0.033*** | −0.022*** | 0.019 |
| | (0.012) | (0.006) | (0.006) | (0.008) | (0.015) |
| Other reform | −0.034 | −0.033*** | −0.043*** | −0.042*** | −0.015 |
| | (0.022) | (0.007) | (0.011) | (0.014) | (0.020) |
| Model 1 without lagged dependent variable | | | | | |
| Damage reform | 0.427*** | 0.428*** | 0.458*** | 0.560*** | 0.568*** |
| | (0.042) | (0.033) | (0.023) | (0.024) | (0.028) |
| Other reform | 0.052 | 0.017 | −0.002 | 0.079** | 0.165*** |
| | (0.057) | (0.042) | (0.032) | (0.031) | (0.039) |
| Model 2 with lagged dependent variable | | | | | |
| Damage reform | −0.058*** | −0.056*** | −0.069*** | −0.084*** | −0.068*** |
| | (0.011) | (0.006) | (0.005) | (0.007) | (0.012) |
| Other reform | 0.005 | 0.002 | 0.009 | 0.029*** | 0.060*** |
| | (0.015) | (0.008) | (0.007) | (0.010) | (0.017) |
| Model 2 without lagged dependent variable | | | | | |
| Damage reform | −0.055 | −0.042** | −0.016 | 0.047*** | 0.087*** |
| | (0.034) | (0.019) | (0.014) | (0.014) | (0.021) |
| Other reform | 0.303 | 0.283*** | 0.340*** | 0.315*** | 0.354*** |
| | (0.049) | (0.027) | (0.019) | (0.019) | (0.030) |

Source: Authors' calculations.

*Significant at the 90 percent confidence level, two-tailed test.

**Significant at the 95 percent confidence level, two-tailed test.

***Significant at the 99 percent confidence level, two-tailed test.

lagged dependent variables, these results are less powerful in suggesting a relationship between firm size and the effects of the liability reforms.

The bottom section of table B-1 pertains to the premiums in our general liability insurance sample. The covariates are similar to those included in the loss ratio equations. However, three variables were omitted from the regression due to problems with the estimation in the quantile regressions: log national premiums written, the log four-firm concentration ratio, and log state aggregate income. The results in the table indicate that both reform measures were influential. In the models with the lagged dependent variable, damage reforms are negative wherever they are significant, and have a fairly uniform effect across the distribution. The size of the effect differs between the two models, with a larger effect found in the model that controls for the influence of *TR86*. The estimated effects of the other reform variable are inconsistent across the models. Also, the effect of the damage reform becomes positive when the lagged dependent variable is omitted. These positive relationships may be an indication of a long-run influence of damage reform on the general size of firms operating in reform states. These results also suggest little correlation between the size of the general liability insurer and the effects of the liability reforms.

The results in tables B-1 suggest that when the pertinent aspects of other factors that drive premium amounts are controlled, the tort liability reforms had some success in controlling premium levels. Although the initial intent of the reforms was to affect loss amounts, the ultimate economic mechanism at work involved a pass-through of the decreased loss levels in lower premiums. There appears to be such a pass-through effect because the reforms did substantially reduce medical malpractice and general liability insurance premiums, but the longer-term effects among general liability insurers are less clear.

The statistical model analyzing the effect of the liability reforms on levels of insurance losses is similar to that for premiums. The main difference is that each model also includes the current value of premiums earned as an explanatory variable. The amount of losses should vary with the extent of insurance coverage written, and this variable captures the presence of this relationship.

Table B-2 shows the quantile regression results for losses for the sample of medical malpractice and general liability insurers for each of the four models. The top section of the table pertains to the medical

**Table B-2. Summary of Other Quantile Regression Results: Medical Malpractice and General Liability Losses**

| *Variable* | *Quantile (percent)* | | | | |
|---|---|---|---|---|---|
| | *10* | *25* | *50* | *75* | *90* |
| | | | Medical malpractice | | |
| Model 1 with lagged dependent variable | | | | | |
| Damage reform | −0.211*** | −0.169*** | −0.187*** | −0.241*** | −0.186*** |
| | (0.040) | (0.036) | (0.022) | (0.031) | (0.047) |
| Other reform | −0.006 | −0.028 | −0.131*** | −0.188*** | −0.095** |
| | (0.051) | (0.041) | (0.027) | (0.042) | (0.044) |
| Model 1 without lagged dependent variable | | | | | |
| Damage reform | −0.208*** | −0.168*** | −0.171*** | −0.254*** | −0.231*** |
| | (0.042) | (0.035) | (0.026) | (0.028) | (0.049) |
| Other reform | −0.016 | −0.061** | −0.170*** | −0.181*** | −0.093** |
| | (0.045) | (0.033) | (0.033) | (0.046) | (0.040) |
| Model 2 with lagged dependent variable | | | | | |
| Damage reform | −0.210*** | −0.166*** | −0.174*** | −0.232*** | −0.181*** |
| | (0.038) | (0.023) | (0.024) | (0.045) | (0.044) |
| Other reform | −0.018 | −0.027 | −0.113*** | −0.176*** | −0.093* |
| | (0.064) | (0.028) | (0.029) | (0.043) | (0.051) |
| Model 2 without lagged dependent variable | | | | | |
| Damage reform | −0.210*** | −0.168*** | −0.180*** | −0.238*** | −0.226*** |
| | (0.050) | (0.039) | (0.026) | (0.034) | (0.039) |
| Other reform | −0.018 | −0.046 | −0.150*** | −0.182*** | −0.079 |
| | (0.055) | (0.045) | (0.031) | (0.035) | (0.051) |
| | | | General liability | | |
| Model 1 with lagged dependent variable | | | | | |
| Damage reform | −0.115*** | −0.080*** | −0.082*** | −0.060*** | −0.043*** |
| | (0.024) | (0.013) | (0.009) | (0.012) | (0.018) |
| Other reform | −0.057* | −0.047*** | −0.048*** | −0.029* | −0.019 |
| | (0.031) | (0.022) | (0.016) | (0.017) | (0.025) |
| Model 1 without lagged dependent variable | | | | | |
| Damage reform | −0.150*** | −0.114*** | −0.085*** | −0.093*** | −0.055** |
| | (0.019) | (0.014) | (0.010) | (0.015) | (0.022) |
| Other reform | −0.028 | −0.021 | −0.042*** | −0.028 | −0.011 |
| | (0.032) | (0.025) | (0.015) | (0.020) | (0.031) |
| Model 2 with lagged dependent variable | | | | | |
| Damage reform | −0.111*** | −0.083*** | −0.085*** | −0.083*** | −0.059*** |
| | (0.025) | (0.013) | (0.011) | (0.013) | (0.018) |
| Other reform | 0.012 | 0.020 | 0.016 | 0.033* | 0.059** |
| | (0.035) | (0.019) | (0.016) | (0.018) | (0.025) |
| Model 2 without lagged dependent variable | | | | | |
| Damage reform | −0.113*** | −0.081*** | −0.059*** | −0.072*** | −0.085*** |
| | (0.023) | (0.012) | (0.009) | (0.013) | (0.020) |
| Other reform | 0.054 | 0.060*** | 0.064*** | 0.094*** | 0.186*** |
| | (0.034) | (0.017) | (0.014) | (0.018) | (0.028) |

Source: Authors' calculations.
*Significant at the 90 percent confidence level, two-tailed test.
**Significant at the 95 percent confidence level, two-tailed test.
***Significant at the 99 percent confidence level, two-tailed test.

malpractice sample. The two liability reform variables each indicate that the reforms were successful in restraining losses. In each of the four models the effect of the damage reforms on different segments of the loss distribution is fairly consistent, ranging from 17 percent to 25 percent, and is consistently significant throughout all loss levels. By contrast, the other reform variable is statistically significant in the quantile regression results for losses at the median loss level or higher. The combined effect of both tort liability reform variables is greatest at the seventy-fifth percentile, with the second largest effect being at the median. The influence at the ninetieth percentile is not significantly different from that at the median loss level. As in the case of premiums, the greatest effect of the reforms is at the upper end of the distribution. However, the extreme outliers at the upper right tail (ninetieth percentile) do not exhibit a relatively greater influence than do the high-end loss levels in the quantiles just below at that amount. Our most striking finding is that the estimated effects of the liability reform variables are virtually unaffected when the lagged value of log losses is omitted from the model, suggesting that the liability reforms have led to consistent long-term reductions in the level of losses. The uniformity of the effect across the loss distribution is consistent with our earlier findings with regard to premiums: there is little correlation between the size of the firm and the effects of the liability reforms.

The effect of the liability reforms on loss levels is equally striking when we examine their influence among general liability insurers (see the bottom section of table B-2). The results for the first model indicate that both damage and other reforms were successful in restraining losses. In the case of damage reforms, the loss effects are consistently significant across the loss distribution and are fairly consistent throughout the distribution, falling slightly from 15 percent to 4 percent as one moves to the upper quantiles. The results for the other reform variable with the lagged dependent variable are significant only in the quantile regression results below the ninetieth percentile. When the lagged dependent variable is omitted, both liability reform variables remain negative, except for the other reform variable at the ninetieth percentile; they are fairly close in magnitude to the estimates in the previous models. In the first model the other reform variable has a significant effect only at the median, where its effect is estimated at about $-0.05$. Interestingly, although the damage cap has a similar effect in the two

models, the other reform has a positive effect in the second model. This finding is consistent with the results obtained in the premiums regressions, and may be capturing changes in the size of firms operating in states that enact these measures.

## Appendix C: Fixed-Effects Analysis

To assess the possibility that our reform variables are not simply capturing these other characteristics, we complete our analysis by incorporating individual firm fixed-effects variables into our model. For several reasons we had to adjust the equations we estimated previously. Most important, we had to omit any variables that were specific to the firm for the entire time period, which required us to drop the organizational form variables. In addition, the estimates would be biased if we included the lagged dependent variable among the regressors, so it is omitted. Although outliers in the loss ratio distribution were not a problem in the quantile regression, we chose to estimate the effects of the reforms on our three key variables in logarithmic form. Finally, with more than 1,500 firms in the general liability sample, we encountered a limitation in our statistical software package: a maximum of 800 variables is allowed in any estimation procedure. We took a random sample of one-half of the companies (769 to be exact), which consequently lowered the number of observations to just over 30,000 for this sample.

Specifically, we use ordinary least squares methodology to estimate the following equations:

$$
\begin{aligned}
&\textit{Log Loss Ratio}_{ijt} = \\
&\quad \alpha + \beta_1\, \textit{Damages Reform}_{jt} + \beta_2\, \textit{Other Reform}_{jt} \\
&\quad + \beta_3\, \textit{Log National Premiums}_{it} + \beta_4\, \textit{Number of States}_{it} \\
&\quad + \beta_5\, (\textit{TaxRef'86* ROE})_{it} + \beta_6\, \textit{Log Concentration Ratio}_{jt} \\
&\quad + \beta_7\, \textit{Rate Regulation}_{jt} + \beta_8\, \textit{Log State Income}_{jt} \\
&\quad + \beta_9\, \textit{Log Treasury Bill Rate}_{t} + \sum_{i=1}^{N-1} \varphi_j\, \textit{Firm}_i + \varepsilon_{ijt}
\end{aligned}
\tag{3}
$$

$$
\begin{aligned}
&\textit{Log Premium Earned}_{ijt} = \\
&\quad \alpha + \beta_1 \textit{ Damages Reform}_{jt} + \beta_2 \textit{ Other Reform}_{jt} \\
&\quad + \beta_3 \textit{ Log National Premiums}_{it} + \beta_4 \textit{ Number of States}_{it} \\
&\quad + \beta_5 (\textit{TaxRef'86* ROE})_{it} + \beta_6 \textit{ Log Concentration Ratio}_{jt} \\
&\quad + \beta_7 \textit{ Rate Regulation}_{jt} + \beta_8 \textit{ Log State Income}_{jt} \\
&\quad + \beta_9 \textit{ Log Treasury Bill Rate}_{t} + \sum_{i=1}^{N-1} \varphi_j \textit{ Firm}_i + \varepsilon_{ijt}
\end{aligned} \tag{4}
$$

$$
\begin{aligned}
&\textit{Log Losses Incurred}_{ijt} = \\
&\quad \alpha + \delta_1 \textit{ Log Premiums}_{ijt} + \beta_1 \textit{ Damages Reform}_{jt} \\
&\quad + \beta_2 \textit{ Other Reform}_{jt} \\
&\quad + \beta_3 \textit{ Log National Premiums}_{it} + \beta_4 \textit{ Number of States}_{it} \\
&\quad + \beta_5 (\textit{TaxRef'86* ROE})_{it} + \beta_6 \textit{ Log Concentration Ratio}_{jt} \\
&\quad + \beta_7 \textit{ Rate Regulation}_{jt} + \beta_8 \textit{ Log State Income}_{jt} \\
&\quad + \beta_9 \textit{ Log Treasury Bill Rate}_{t} + \sum_{i=1}^{N-1} \varphi_j \textit{ Firm}_i + \varepsilon_{ijt}
\end{aligned} \tag{5}
$$

for firm $i$ in state $j$ at time $t$.

The results for the medical malpractice sample, presented in the top section of table C-1, indicate a strong negative effect of the damage reform on the log loss ratio. The effects of this reform variable on premiums and losses are consistent with this finding in that the downward effect on losses is almost three times as great as the negative effect on premiums. The other reform variable is not significant in the loss ratio equation, while it appears to have a positive effect on average premiums and a negative (though insignificant) effect on loss levels.

The results for the general liability sample are fairly similar to those for the medical malpractice sample (see the bottom section of table C-1). Interestingly, the effect of the damage reform on the log loss ratio is very close to the effect found among the medical malpractice insurers, an effect that suggests a 9 to 10 percent reduction in loss ratios due to

**Table C-1. Fixed-Effects Regression Results: Medical Malpractice and General Liability 50 Percent Sample**[a]

Standard errors in parentheses

| | *Dependent variable (N = 6,982)* | | |
|---|---|---|---|
| *Variable* | *Log loss ratio* | *Log premiums earned* | *Log losses incurred* |
| | Medical malpractice | | |
| Intercept | 2.726*** | −2.610* | 2.877*** |
| | (0.886) | (1.378) | (0.899) |
| Log premiums (t) | . . . | . . . | 0.946*** |
| | | | (0.008) |
| Damages | −0.097*** | −0.056 | −0.152*** |
| | (0.025) | (0.039) | (0.025) |
| Other reform | 0.001 | 0.151*** | −0.036 |
| | (0.028) | (0.044) | (0.029) |
| Log national premiums written | −0.095*** | 0.547*** | −0.066*** |
| | (0.018) | (0.028) | (0.019) |
| Log number of states of operation | 0.112*** | −0.507*** | 0.112*** |
| | (0.028) | (0.043) | (0.028) |
| Tax reform 1986 ROE | −0.078*** | −0.003 | −0.095*** |
| | (0.023) | (0.038) | (0.023) |
| Log four-firm concentration ratio | −0.136* | −0.931*** | −0.382*** |
| | (0.074) | (0.116) | (0.076) |
| Rate regulation | −4.2E-4 | −0.166*** | −0.019 |
| | (0.025) | (0.039) | (0.025) |
| Log state income | 0.009 | 0.844*** | 0.045*** |
| | (0.012) | (0.019) | (0.014) |
| Log Treasury bill rate | −0.039 | −0.067 | −0.195 |
| | (0.046) | (0.072) | (0.047) |
| Adjusted $R^2$ | 0.226 | 0.745 | 0.902 |
| | General Liability 50 percent Sample | | |
| Intercept | 15.636*** | 0.408** | −1.740*** |
| | (0.304) | (0.178) | (0.142) |
| Log premiums (t) | . . . | . . . | 0.896*** |
| | | | (0.005) |
| Damages | −0.099*** | 0.012 | −0.052*** |
| | (0.008) | (0.019) | (0.016) |
| Other reform | −0.571*** | 0.300*** | 0.129*** |
| | (0.011) | (0.028) | (0.022) |
| Log national premiums written | −1.400*** | 4.9E-22 | 8.7E-22 |
| | (0.023) | (2.6E-21) | (2.1E-21) |
| Log number of states of operation | 0.834*** | 0.082*** | −0.030 |
| | (0.040) | (0.025) | (0.020) |
| Tax reform 1986 ROE | 0.380*** | −0.005 | −0.089*** |
| | (0.016) | (0.028) | (0.023) |
| Log four-firm concentration ratio | 0.977*** | 0.239*** | 0.023 |
| | (0.021) | (0.041) | (0.033) |
| Rate regulation | −0.653*** | −0.051** | 0.055*** |
| | (0.010) | (0.020) | (0.016) |
| Log state income | 0.209*** | 0.971*** | 0.182*** |
| | (0.006) | (0.009) | (0.009) |
| Log Treasury bill rate | −0.505*** | −0.066* | −0.053* |
| | (0.022) | (0.036) | (0.029) |
| Adjusted $R^2$ | 0.417 | 0.620 | 0.809 |

Source: Authors' calculations.

a. Medical malpractice equations include a set of 264 firm dummy variables. General liability 50 percent sample equations include a set of 769.

*Significant at the 90 percent confidence level, two-tailed test.

**Significant at the 95 percent confidence level, two-tailed test.

***Significant at the 99 percent confidence level, two-tailed test.

the reform efforts. This result is surprising given the independent effects of the damage reform on premiums and losses. It is not inconsistent with the results we obtained in the quantile regression analysis, however, which may indicate a limited value in including the fixed effects in the model.

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# *Comment*

**Comment by Dennis W. Carlton:** This paper is a thorough and thoughtful empirical analysis of the consequences of certain reform measures introduced to deal with the insurance crisis of the 1980s. The authors are clear that the paper's focus is empirical, not theoretical. The findings are noteworthy and robust and should stimulate theoretical work to explain the phenomena of crises in insurance.

The crisis in medical malpractice and general liability insurance in the 1980s manifested itself in huge premium increases (medical malpractice premiums doubled in two years), widespread concern that products were not being offered for sale because of the unavailability of affordable insurance, and the unavailability of certain previously sold lines of insurance. Despite much litigation (plaintiffs sued on antitrust grounds in some states, alleging the cause of the crisis to be conspiracy) and study (academic articles plus studies by various government agencies), the reasons for the crisis as well as our understanding of it merit more attention. It is clear that some enormous and well-publicized damage awards created uncertainty in the industry, but it is not so clear how to link that uncertainty to price and unavailability, although some academic work, especially by George Priest and Ralph Winter, takes important steps in improving our understanding.[1] Nor is it clear how that uncertainty should affect the interpretation of Patricia Born and W. Kip Viscusi's findings, but I hope further work here is forthcoming.

Born and Viscusi's empirical findings seem (subject to some minor criticisms later) robust and striking. The reforms that some states adopted appear to have solved the crisis in the sense that the profitability

1. Priest (1987); Winter (1988).

of insurance companies (as measured by the loss ratio) has improved. Moreover, the reforms seem to have helped most those insurance companies that were the least profitable. This sounds as if the reforms were successful, but that conclusion is unwarranted, and Born and Viscusi are careful not to endorse it. How the reforms affected the long-run availability of insurance remains unclear.

The authors' results raise the issue of how long it takes for long-run equilibrium to be achieved in the insurance sector. If the reforms still had such enormous effects in 1991—for example, the loss ratio for medical malpractice of the firm at the seventy-fifth percentile was about 26 percent lower in reform states than in nonreform states—what does that say about the long-run equilibrium in nonreform states? Either the long-run equilibrium has not yet been reached or insurance companies in nonreform states make a lot less money in long-run equilibrium. Moreover, if, as the paper finds, malpractice premiums are lower in reform states than in nonreform states, yet loss ratios are also lower in reform states (the ratio of premiums to loss is higher), doesn't that mean that a lot less insurance is sold in reform states? It is unclear what theory could generate the authors' results, and that is what is so good about this paper. It challenges researchers to improve their theories to explain the facts. Let me try to explain the theoretical challenge that the results in this paper pose.

### *Theoretical Comments*

In a simple model of insurance with identical firms ex ante, each firm sets premiums so as to cover expected losses (including costs of operations). Thus the expected loss ratio (expected costs divided by premiums) should equal one.[2] The actual loss ratio for any firm will of course depend on the firm's subsequent random loss experience. Identical firms ex ante will look very different ex post. When each firm writes a *new* policy, however, its expected loss ratio will equal one again. This means that, in long-run equilibrium, loss ratios should hover

2. Loss ratios raise a host of complicated accounting and economic problems. For example, one must calculate and discount to present value future costs caused by harms manifested many years after the premiums are written, and one must account for the interest earned on premiums. I will abstract from these important matters here to highlight the key theoretical points.

around one. In other words even if jury awards skyrocket as they did in 1984, firms would be harmed relative to their expectations and would suffer high loss ratios for policies already written, but absent regulatory constraints, they would not be harmed on the next new policy written. In the short run, reforms will benefit firms by limiting losses and preventing the loss ratio from being too high; but in the long run there should be no effect on the loss ratio. Mere cost increases should not cause a crisis of availability nor should they affect the profits of firms at all, and certainly not differentially. Yet that is what seems to be the description of the insurance crisis that the literature and this paper provide.

Because the simple model fails to explain the facts, the model must be too simple. Let me suggest two extensions. First, it must be that the increased uncertainty of awards (as distinct from the amount of the award) matters, either through firms' risk aversion (hard to believe) or because the uncertainty itself increases underwriting costs and the problems caused by the moral hazard of insureds so as to make certain lines unprofitable to write. Thus the reforms affect loss ratios through their effect on the uncertainty of loss.

Second, ex ante firms must have permanent profitability differences, and these differences must become worse during uncertain times. For example, suppose that in long-run equilibrium, firms have differential efficiency (for example, they experience systematically different loss ratios), perhaps because they have different expertise and specialize in different types of niche coverages. When uncertainty increases, the comparative costs of firms change because the underwriting costs in different niches change; thus there can be differential profit effects. The authors' results suggest that in response to the crisis in the 1980s the costs of low-profit firms rose relative to those of the marginal firm in each niche so that profits of low-profit firms got squeezed.

Although this is only one possible explanation for the results—and Born and Viscusi do not attempt to provide one—it can be tested. Indeed, the advantage of developing some theory to explain the results is precisely that the implications can be tested. For example, does the evidence show that the "availability" problem diminished in states enacting reforms compared with other states, as would be expected if loss uncertainty were reduced? Or did the reforms simply prevent some

insurance coverage from being written? Did loss ratio variability decline in reform states? For example, does the variance of the error in the loss ratio model in the appendix decline with reforms?

The differential efficiency of insurance firms is a key element of the results, as is the differential effect of reforms on these insurance firms. It would seem then that the enactment of the reforms should have large differential effects on the stock market value of different insurance companies. Can any event studies be done? Moreover, how stable can the long-run equilibrium be if it involves very different firms? Why don't the most profitable firms expand over a period of several years? Are there limits on special expertise in niche segments of insurance?

### *Econometric Comments*

I have some quibbles and comments with the econometrics, although given the robustness of the results, I would not expect major changes in empirical results to emerge if my concerns were addressed. First, the inclusion and exclusion of the lagged variable is not a choice between a short-run or long-run model. If the lagged variable belongs in, it should be there, and standard econometric procedures for dealing with possible error structures can be followed. The long-run equilibrium can be calculated in a standard way. To the extent that there is a lagged adjustment period, I would like to know why. What is preventing rapid price adjustment, and how do the reforms affect the speed of adjustment? Regulation should affect the speed of adjustment. Does it?

Second, I am not convinced that the endogenity of reform has been completely handled. If a state's decision to enact reform is driven by the unexpected loss of a large number of carriers in the state, then reform will occur in those states where many (low-profit) firms would be hurt. This would seem to strengthen the authors' results because the nonreform states are in a sense too good a benchmark to use to judge the effect of reform: if no reform were enacted in the reform states, the adverse results would have presumably been more severe than in nonreform states (where the results were not so severe as to merit reform laws).

Third, it is somewhat puzzling that even though the damage caps vary widely across reform states and therefore have large and different truncation effects, there is no empirical detection of such an effect.

Finally, if the differential efficiency of firms is, as the paper suggests, affected by tort reform, it is not obvious that a fixed-effects model will be appropriate. The firm's specific effect depends on the reform.

In conclusion, this is a fine piece of empirical work, and the findings should guide theoretical explanations for insurance crises and lead to a better understanding of these puzzling events.

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