

Insurance Market Responses to the 1980s Liability Reforms: An Analysis of Firm-Level Data

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ABSTRACT

This article examines the insurance market effects of the 1980s tort liability reforms on general liability insurance. Analysis of over 60,000 observations of insurance market variables by firm and by state from 1985 through 1991 indicates that tort reform had a restraining effect on losses and premiums, with a net positive effect on profitability (i.e., a negative effect on loss ratios). The stabilizing effect on insurance market profitability was manifested, in part, by reducing the effect on current loss ratios of the high loss ratios of the mid-1980s in the reform states.

Introduction

One of the most salient policy events in recent U.S. insurance market history is the liability insurance crisis of the mid-1980s. Premiums soared, and there was widespread anecdotal evidence of major insurance market disruptions. General liability and medical malpractice insurance were particularly affected by this surge in liability costs.

During the crisis period, insurers reported policy losses well in excess of premiums. Insureds also began to experience substantial disruption, as cases of denials of insurance coverage to entities such as municipal playgrounds were highly publicized. Coney Island temporarily discontinued the Cyclone ride because of insurance market difficulties, motels removed diving boards from swimming pools, and research on new contraceptive products in the United States was all but eliminated (see National Academy of Sciences, 1990, for a discussion of the effect of liability on contraceptive product research).

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The two-year period between 1984 and 1986 saw a concentrated surge in general liability premiums, which increased almost threefold. By almost any standard, the effect on insurance market operations merited the "crisis" designation. Although the rise in interest rates and possible performance of reinsurance markets no doubt were instrumental,¹ this crisis also stemmed in part from long-run shifts in tort liability, which, in turn, were reflected in premiums. Over the 1958 through 1968 period, general liability premiums rose by 6.5 percent per year. Over the next decade, from 1969 through 1978, premiums increased by 19.1 percent annually; from 1979 through 1988, premiums increased by 11.4 percent annually. The liability crisis was not confined to the 1980s, as the major surge in liability costs began in the 1970s. What distinguished the 1980s was the highly concentrated increase in general liability premiums during a two-year period (1985-1986). The coupling of the price signals of escalating costs with anecdotes pertaining to quantity rationing suggested that the insurance market was in disarray.

One factor contributing to the rise in liability premiums was an expansion in the scope of tort liability (see, among others, Viscusi, 1991a, 1991b; Epstein, 1980; Priest, 1985, 1987; Schwartz, 1988; Stewart, 1987; and Winter, 1988). A variety of changes in liability doctrine contributed to the surge. In the 1960s, the courts expanded the range of circumstances under which firms could be held liable for accidents by introducing the strict liability doctrine. Strict liability broadened the circumstances under which defendants would be liable. The 1970s witnessed a rise in design defect and hazard warnings cases. At the end of the 1970s and in the 1980s, toxic tort litigation such as that over asbestos became a major player. Indeed, by the end of the 1980s, the majority of all cases in U.S. federal courts were asbestos-related.

Because of the expanded liability doctrine and the surge in premium costs, insurers and insured firms sought relief through product liability reform. These reforms sought to decrease the costs arising from tort liability.

In this article we will not question the wisdom of these reforms or explore their social desirability. Reform efforts decrease the costs of liability to insurers and policyholders, but they also decrease the amount of damage payments to parties who are injured. Judgments regarding the attractiveness of the reforms depend in large part on the optimality of the provisions of tort liability subject to reform. For example, the earlier tort liability regime may have been inadequate so that an expansion in liability was desirable. The fact that costs surged does not imply that the earlier low-cost liability regime was socially desirable. Similarly, not all policy "reforms" that decrease costs are necessarily desirable.

However, disruption in insurance markets and market conditions that lead to the denial of insurance coverage necessarily creates some inefficiencies. Wholly

¹ See Berger, Cummins, and Tennyson (1992). The behavior of reinsurance markets may be, to some extent, endogenous, as it may be affected by both the surge in liability costs and the drop in interest rates.

apart from one's judgments regarding the desirability of tort liability reform, soundly functioning insurance markets are preferable to market disfunctionality. To the extent that the liability reforms improved the functioning of insurance markets, they served a useful purpose.

This article focuses on the liability reform measures enacted by the great majority of states during the mid-1980s. Efforts to pass federal product liability reform measures were unsuccessful, but since tort liability is governed by common law that varies by state, state liability reform provided an appropriate locus for reform efforts. The main issue explored is whether state reform laws attained their objective of bringing stability to insurance market operations.

There have been a number of analyses of the structure of liability reform efforts and their effect on insurance markets (Viscusi, 1990; Blackmon and Zeckhauser, 1991; Viscusi et al., 1993; Weiler et al., 1993; Danzon, 1985; and Danzon and Lillard, 1982); the distinctive feature of our analysis is the use of data on individual insurance firms. Thus, rather than addressing only state averages or experiences within particular states, we rely on a large national sample of insurers, which we track over the periods both before and after the liability reform efforts, in order to assess the impact of the liability reforms.

After reviewing the liability reform efforts and the sample characteristics, we assess the effect of the liability reforms on loss ratios, premiums, and losses. The principal finding is that these reform efforts were generally successful in achieving their objective of enhancing insurance profitability.

Reform Measures

State Reform Efforts

The escalation of liability costs led to a wave of reform efforts in the mid-1980s. Table 1 lists the states that undertook major reforms in 1985, 1986, and 1987. In some states, such as New York, all of the reform efforts were concentrated in a single year. In other states, such as Colorado, the most significant reform measures were undertaken in one year, with relatively modest subsequent extensions.

As indicated in Table 1, there was a flurry of liability reform activity. The efforts considered here are those that pertain to general liability, which is the focus of our empirical analysis. Other reforms targeting lines of insurance such as medical malpractice also were undertaken but are beyond the scope of this article.

Legislatures responded swiftly to the rapid escalation of insurance premiums between 1984 and 1986. Twelve states enacted reform measures in 1985, and an additional 22 followed suit in 1986, including several of the most populous states, such as California, New York, and Florida. Twelve more states adopted reform measures in 1987. Only four states—Arkansas, Kentucky, North Carolina, and Pennsylvania—did not enact any reforms during this period.

Table 1
Summary of Reform Efforts, 1985-1987

<i>Reformed in 1985</i>	<i>Reformed in 1986</i>	<i>Reformed in 1987</i>	<i>No Reforms</i>
Colorado	Alabama	Idaho	Arkansas
Illinois	Alaska	Mississippi	Kentucky
Louisiana	Arizona	Nebraska	North Carolina
Maine	California	Nevada	Pennsylvania
Massachusetts	Connecticut	North Dakota	
Missouri	Delaware	Ohio	
Montana	Florida	Oregon	
New Jersey	Georgia	Rhode Island	
New Mexico	Hawaii	South Carolina	
South Dakota	Indiana	Texas	
Wisconsin	Iowa	Vermont	
Wyoming	Kansas	Virginia	
	Maryland		
	Michigan		
	Minnesota		
	New Hampshire		
	New York		
	Oklahoma		
	Tennessee		
	Utah		
	Washington		
	West Virginia		

Source: Alliance of American Insurers (1985-1987).

Note: Areas of reform include joint and several liability, punitive damages, collateral sources, frivolous suits, noneconomic damages, limits on liability, attorney fees, dramshop liability, and statute of limitations. Categories refer to the year in which reform legislation was enacted.

Quantifying Tort Reform

The main distinction in the empirical analysis is between the states that undertook reforms and those that did not. For those states that did undertake reforms, we explore how the timing of the reform affected the pattern of insurance market operations in that particular state. Thus, states differ in terms of whether a reform was in place in a given year, and there are differences within states in terms of the time pattern for enacting the reform measures.

For the purposes of the empirical analysis, the reform measures are coded using dichotomous dummy variables that take on a value of 1 for all years affected by the reform measure and a value of 0 for all of the pre-reform years. (To make the coding of the reform variable feasible, only the main reform effort is addressed.) This formulation allows us to estimate the average effect of the reforms across years and across types of reform.

Ideally, it would be desirable to assess the effect of different types of reform as opposed to simply the existence of a reform. A variety of factors impeded such an effort. First, the nature of the reform often does not lend itself to a quantitative metric, either in terms of characterizing the current liability

structure, the new liability structure, or the extent of the change in the liability structure. Thus, the criteria for determining liability may be altered in a way that cannot be captured by a continuous measure of the stringency of the liability regime or its change as a result of the reform.

The second complication is that the reform efforts comprise multiple components. The reforms are typically a complicated package of measures, and the diversity of these actions makes it difficult to reliably ascertain the effect of each component.

Rather than adopting procedures that have been influential in other countries, such as the English rule that requires the losing party to pay court costs, the reform measures were directed at limiting the circumstances under which firms could be found liable and at restricting the level of damages that could be awarded (see Snyder and Hughes, 1990). Reforms of joint and several liability, for example, were intended to restrict the degree to which a firm could be found liable for damages in situations in which there are multiple parties involved. Under joint and several liability, one firm may be liable for the entire loss if it is financially solvent and the other defendants are not, irrespective of the proportional share of the firms' responsibility for the accident.

The damage reforms generally attempted to constrain damage awards or impose limits on when certain types of damages could be awarded. Punitive damage provisions typically seek to impose caps on the amount of punitive damages. In some cases, this is through a specific numerical cap, but it may also take the form of limiting the circumstances under which punitive damages can be awarded.

Collateral source rule reforms focus on offset provisions for collateral damage payments. Plaintiffs often receive compensation from a variety of sources, including workers' compensation, private insurance, and government insurance programs. The collateral source provisions provide an offset for the damages award in circumstances when other types of compensation are received.

The noneconomic damage reforms are quite diverse. Important components of damages include compensation for losses other than medical costs and lost earnings, including pain and suffering, loss of consortium, and bereavement. Unfortunately, juries lack specific guidelines for determining noneconomic damages, leading many observers to believe that these damages are set in a random and capricious manner. Examination of actual liability cases suggests that the extreme critiques of noneconomic damages are excessive (see Viscusi, 1991b, for an analysis of the quantitative determinants of pain and suffering awards). The purpose of these reforms is usually to establish numerical limits, numerical guidelines, or more specific principles for the awarding of noneconomic damages.

In some cases, reform measures included provisions to limit liability. These measures were often undertaken on behalf of municipalities and other public entities who, under the reform provisions, would face lower possible damages and would pay off damages in more restrictive circumstances than would private parties.

Many states enacted restrictions on frivolous suits because of a belief that many of the liability claims being made were without foundation. These reforms attempt to impose costs on plaintiffs for bringing frivolous suits, thus establishing an economic incentive to restrain litigation in which the plaintiff does not have a high probability of success.

The reforms of attorneys' fees generally pertain to limitations on attorney fee amounts. Limiting attorney fees presents a disincentive for plaintiffs to bring tort litigation, thus decreasing the expected insurance cost. Plaintiffs who would otherwise have brought cases might choose not to do so in the presence of limits. This may not be a socially desirable outcome.

One specific class of industries—drinking establishments—received special attention. Many states enacted reforms dealing with dramshop liability—the set of liability rules specifically pertaining to this industry. For example, to what extent is an establishment that serves alcoholic beverages responsible for an ensuing accident involving a patron found guilty of drunk driving?

A final provision of the state reform efforts pertains to statutes of limitation, whereby parties may file suits only for a specified period. There are two main components of these statute of limitation reforms. First, the date at which the statute of limitation begins may vary; it might be the date at which the product is purchased, the date at which the injury occurs, or the date at which the injured party is aware that he or she has been injured by the product (often a key concern in the case of toxic torts). A second aspect of the statute of limitation reforms pertains to the period of time after the starting date during which the plaintiff can file a suit.

This review suggests that, because of the large number of reform efforts and the diverse character of the reforms, it generally is infeasible to establish a meaningful measure of the quantitative import of each of the reform efforts. One can construct separate dummy variables for each component of the reform that was enacted, but the strong correlation among the various reform components limited our efforts to obtain reliable estimates of the separate influence of each aspect. Moreover, to the extent that the enactment of a reform package rather than the particular elements of that package alter the liability climate, efforts to isolate the component influences will be impeded. As a result, the empirical analysis is restricted to assessing the effect of reform measures overall as opposed to disentangling the influence of each reform component. Estimates of only a single reform variable do, however, yield information on the average overall effect of reforms undertaken in the 1980s.

Sample Description

Data Set

The empirical analysis uses data from the National Association of Insurance Commissioners (NAIC). This extensive data base includes information on individual firms by state with respect to the main insurance variables of interest. The analysis focuses only on general liability insurance.

The data set covers the period 1984 through 1991, where all variables are on a calendar year basis. Because a lagged dependent variable is included in the regressions, the effective time period for the purposes of the analysis is 1985 through 1991. This data set provides the ability to analyze cross-sectional differences among states with and without reform efforts in 1985. Moreover, for firms that adopted reform efforts after 1985, the effect of the reforms can be assessed.

The NAIC data provide a very large sample for the pooled time series and cross-section analysis. Table 2 presents sample characteristics for the base year in the regressions, 1985, and the terminal year, 1991. The number of observations exceeds 8,500 in each of these two years, so that for the seven-year period of data analyzed there are 60,850 observations. Consequently, this sample provides many more degrees of freedom to estimate the effects of liability reform than is available with aggregate insurance data by state, which over the same period would lead to a data set of only 350 observations. By increasing the sample size by over two orders of magnitude, it is possible to estimate the effects of liability reform with considerably more precision.

The observations in the data set are independent. Insurers supply data on premiums and loss experience to state insurance commissioners. This information is reported separately for each line of insurance. Thus, the data were not constructed by multiplying the company's overall operations in a state by some factor intended to reflect the average general liability share.

Principal Variables

The principal measure of insurance coverage is the dollar value of premiums earned, which averaged \$1.4 million per firm in each state in 1985.² A comparison with the lagged value of this variable is instructive, as it indicates the substantial jump in 1985 premiums. By 1991, premium levels were \$1.7 million per firm per state.³ The value of the losses incurred pertains to developed losses, where the projections utilized the loss development factors for general liability estimated by A. M. Best (1992).

The relationship between losses and premiums, or the loss ratio, is generally taken as the main measure of insurance profitability. The loss ratio can be viewed as a measure of the *ex post* inverse price of insurance per dollar of losses that are paid (see Berger, Cummins, and Tennyson, 1992, for a theoretical discussion of this measure).⁴ Loss ratios in general liability grew throughout the early 1980s, and the industry-wide loss ratio exceeded 1.0 in 1983. By 1985, the loss ratios had grown to 1.37, thus providing an impetus

² Premiums earned and losses incurred are taken from the Insurer's Exhibit of Premiums and Losses, page 14 of the Annual Statement. The data is reported by state for each state in which the insurer operates.

³ A small number of observations with negative premiums were eliminated from the sample.

⁴ The loss ratio figures shown in Table 1 are premiums-weighted so that the effect of high-loss ratios for small firms will not distort the sample means.

Table 2
National Association of Insurance Commissioners
Sample Characteristics, 1985 and 1991

Variable	1985		1991	
	(N = 8560) Mean	S.D.	(N = 8793) Mean	S.D.
Premiums Earned _t	1,373,954.20	5,641,681.09	1,729,363.15	7,784,542.69
Premiums Earned _{t-1}	912,072.54	4,019,831.66	1,815,429.13	9,498,203.40
Losses Incurred _t	1,878,901.94	7,599,069.55	1,425,142.84	6,467,884.58
Losses Incurred _{t-1}	1,361,939.45	5,434,649.12	1,146,090.96	7,268,375.95
Loss Ratio _t	1.37	11.53	0.82	3.51
Loss Ratio _{t-1}	1.49	3.24	0.63	1.68
Liability Reform (Dummy Variable)	0.24	0.43	0.91	0.28
<i>Economic Conditions</i>				
State Aggregate Income	89,601.94	95,836.04	104,111.68	111,491.98
Treasury Bill Rate	7.47		5.38	
Four-Firm Concentration Ratio	0.23	0.07	0.27	0.06
<i>Insurance Price Regulation</i>				
Prior Approval or Modified Prior Approval	0.30	0.46	0.30	0.46
Flex Rating	0.12	0.32	0.11	0.31
File-and-Use or Use-and-File	0.53	0.50	0.53	0.50
<i>Ownership Structure</i>				
Mutual	0.13	0.11	0.12	0.32
Lloyd's	2.7E-3	0.05	3.0E-3	0.06
Reciprocal	0.01	0.11	0.02	0.13

Note: S.D. = standard deviation.

for general liability reform. The 1991 loss ratio averaged 0.82, reflecting the increased profitability of insurance.

The main empirical variable of interest is the reform variable, which is a 0-1 dummy variable. In 1985, 24 percent of the insurers in the sample were in states that had enacted liability reform measures, and by 1991, 91 percent of the insurers were in states that had enacted reforms.

The next set of variables pertains to economic conditions likely to affect losses and the pricing of insurance. States with higher aggregate income tend to have higher wages, raising insurer labor costs and, hence, premiums. Higher income levels also are expected to raise the dollar value of damages for lost earnings associated with accidents.⁵ The U.S. Treasury bill rate serves as the main index of financial market conditions. Higher interest rates enable firms to

⁵ Aggregate income data is from U.S. Bureau of Economic Analysis (1984-1991).

earn a higher rate of return on their portfolio and, consequently, tend to be associated with lower premium levels.⁶

Another economic condition variable is the four-firm concentration ratio for premiums written, capturing the degree of market concentration in the insurance industry in a state. Higher levels of concentration are expected to raise premium rates to the extent that collusion exists among insurers or monopolistic power is exercised.

The next three variables pertain to the nature of insurance price regulation in the particular state, where the omitted regulatory category is that of states with no regulation.⁷ Approximately one-third of all states have prior approval or modified prior approval regulation. Under prior approval regulation, rates must be filed and approved by the state insurance department. Under modified prior approval regulation, rate revisions involving a change in the expense ratio or rate relativity require prior approval. Under flex rating, prior approval of rates is required only if the rate changes exceed a certain percentage above (and sometimes below) the previously filed rates. The final category of regulation is file-and-use or use-and-file regulation, where rate filings are required either before or after their use with the state insurance department, which maintains the right to review and approve these rates.

The next set of variables are dummy variables representing different forms of ownership structure (see Mayers and Smith, 1988, for a detailed description of ownership form and conflicting incentives). Mutuals and reciprocals are like cooperatives, where the policyholder is also the owner. They differ in that reciprocals are unincorporated and are managed by an attorney-in-fact, whereas mutuals are incorporated and elect a board of directors to manage the company. Lloyd's associations are comprised of individual underwriters, with each member responsible for only that portion of a risk personally underwritten. The omitted dummy variable group is stock companies that are standard corporations. Stock insurers represent 86 percent of the sample.⁸

Effect of Reform on Loss Ratios

Methodology

One objective of liability reform was to increase insurance market profitability. During the early 1980s, loss ratios were high, as firms engaged in a period

⁶The interest rate used will be the real rate of return, except in the case of the loss ratio equation. Suppose that premiums are earned in year t and losses occur in year $t+1$. The loss ratio analysis could be undertaken using the real rate of return if losses and premiums were both in year t dollars. However, losses incurred in year $t+1$ are charged against policy year but not adjusted for inflation. Use of the nominal interest rate in the loss ratio equation in effect accounts for this discrepancy.

⁷State regulation data were obtained from the National Association of Insurance Commissioners (1984-1991).

⁸Stock insurers represent two-thirds of the industry. The larger representation of stock firms in our sample is due to the higher geographic concentration of mutuals.

of intense price competition spurred on by high interest rates. As interest rates declined and liability claims surged during the mid-1980s, general liability insurance became unprofitable. This led to pressures for liability reform and also led many insurers to curtail insurance availability. The resulting rate increases and denials of coverage attracted widespread public attention.

Our analysis is based on the assumption that the pricing of general liability insurance is independent of other lines. For example, the performance of the automobile insurance line does not affect pricing in the general liability market. In a competitive market, there will be no cross-subsidies across lines because firms that do not need to subsidize other lines will undercut the prices of firms that do.⁹

The econometric assessment of the influence of the liability reform efforts begins with the following autoregressive model:

$$\begin{aligned} \text{Log Loss Ratio}_{it} = & \alpha_1 + \beta_1 \text{Log Loss Ratio}_{it-1} \\ & + \gamma_1 \text{Reform}_{it} + \sum_{j=1}^N \delta_j X_{jit} + \varepsilon_{it}, \end{aligned} \quad (1)$$

where Loss Ratio_{it} = the ratio of losses incurred to premiums earned for company i in year t ,

Reform_{it} = 1 if state i had enacted tort reform by year t and 0 otherwise, and

X_{jit} = a vector of explanatory variables.

Use of a logarithmic rather than a linear dependent variable decreases the effect that the large outliers may have on the estimation results. The logarithmic specifications also had a much higher explanatory power than the linear version, as one might expect. Explanatory variables are in logarithmic terms as well. The log-log specification also offers an advantage in terms of interpretation, as the coefficients reflect the elasticity of the loss ratio with respect to the explanatory variable of interest—e.g., β_1 is the percentage change in the period $t-1$ loss ratio in response to a one percent change in the period $t-1$ loss ratio.

In particular, the loss ratio is treated as a function of its lagged value, a dummy variable shift term for product liability reforms, and a series of other variables. The lagged loss ratio term is included in equation (1) to reflect the fact that the main function of liability reforms is to shift the overall level of loss ratios for the particular firm-state combination. Including the lagged value of this term captures specific aspects of the risks associated with policies written by the firm in that state. Thus, these variables capture the mix of policies insured as well as the liability regime in the state. Each of these variables represents relatively fixed aspects of the environment that will

⁹ Insurance markets are not, of course, perfectly competitive, in part because of the existence of state regulations. The effect of such regulations on insurance pricing will be captured by the price regulation regime variables included in the analysis.

influence the profitability of insurance in the future period. Thus, one can view the lagged value of the dependent variable as capturing the role of the omitted characteristics that have a continuing influence on insurance market performance. A coefficient of 1.0 would indicate that loss ratios are relatively constant over time.

The liability reform variable is designed to capture a change in the constant term of the regression beginning in the year in which the reform was enacted. If the liability reforms achieved their intended objective, they would have enhanced insurance market profitability and, consequently, reduced the loss ratio. The coding of the liability reform variable begins at the start of the calendar year, whereas some reforms may have been enacted during the year. Matters are complicated further since the parties may have anticipated the reforms. Certainly, once the reforms were passed by the legislatures, there would be an effect on out-of-court settlements and even litigation patterns before the legislation became law, so that part of the effect of reform will be evident in the pre-reform period. These types of concerns will dissipate the observed effect of the liability reform variable to some extent so that the estimated reform effect will understate its actual impact. Concerns such as these are not unique to studies of liability reform but are also shared by econometric models of the effect of government regulation as well (see Viscusi, Vernon, and Harrington, 1992).

The effect of liability reform is also recognized through the lagged value of the dependent variable in equation (1). Liability reforms that improve the profitability of insurance by lowering the loss ratio in year t will have a subsequent effect on the loss ratio in year $t+1$. Using the estimated coefficient of the lagged dependent variable as well as the estimate of the direct effect of the liability reform variable in equation (1), one can calculate the long-run influence of liability reform on loss ratios.

An alternative approach to calculating this long-run effect is to estimate the reduced form version of the model in equation (1) directly by omitting the lagged dependent variable, yielding

$$\text{Log Loss Ratio}_{it} = \alpha_{lb} + \gamma_{lb} \text{Reform}_{it} + \sum_{j=1}^N \delta_{jb} X_{jit} + \varepsilon_{litb}. \quad (2)$$

The coefficient on the reform variable in equation (2) captures the direct short-term effect on the loss ratio as well as the long-run effect on loss ratios that takes place through the mechanism of the lagged value of the loss ratio, which has been omitted from this equation.

The specification of equations (1) and (2) assumes that the effect of reform is to alter the overall value of the log of the loss ratio. It may be that liability reform alters the structure of the equation as well as simply the loss ratio level. To analyze this possibility, let the coefficient of the lagged dependent variable vary with the loss regime, and let the influence of insurance price regulation variables included among the X_{jit} vary with the liability regime, yielding

$$\begin{aligned}
\text{Log Loss Ratio}_{it} = & \alpha_{lc} + \beta_{lc} \text{Log Loss Ratio}_{it-1} + \gamma_{lc} \text{Reform}_{it} \\
& + \sum_{j=1}^N \delta_{jc} X_{jit} + \xi_c \text{Reform}_{it} \times \text{Log Loss Ratio}_{it} \\
& + \sum_{k=1}^M \psi_{kc} \text{Reform}_{it} \times \text{Regulation}_{kit} + \varepsilon_{litc},
\end{aligned} \quad (3)$$

where $\text{Regulation}_{kit} = 1$ if state i had price regulation of type k in year t and 0 otherwise.

The lagged dependent variable continues to affect the current value of the loss ratio, but equation (3) permits the coefficient on this variable to differ for the post-reform period in those states that adopted liability reforms. Permitting the lagged dependent variable to have a different effect in the post-reform era reflects the fact that the past insurance performance may not have the same effect on future insurance profitability if the state has altered the tort liability landscape through reform. Past profitability rates may be a very imperfect predictor of future rates of profitability because liability reforms should lead to a downward shift in the loss ratios. Thus, one would expect the coefficient ξ_c of $\text{Reform}_{it} \times \text{Log Loss Ratio}_{it}$ to be negative.

Similarly, the insurance price regulation variables included among X_{jit} continue to enter the equation, but equation (3) also permits these regulatory variables to assume different values in states in which liability reforms were undertaken. The predicted signs of the coefficients of the insurance price regulation interactions are ambiguous because the interactive influence of state insurance regulation and liability reforms is difficult to predict.

Estimation Results: Basic Specifications

Table 3 summarizes the regression results based on equation (1). The first column in Table 3 provides ordinary least squares estimates of the basic loss ratio equation (1). Because of potential problems with heteroskedasticity arising from insurer size differences, Table 3 and all subsequent tables also report weighted least squares estimates, where the weights used are the natural log of the insurer's assets.¹⁰

The results reported in Table 3 are consistent with expectations. The lagged value of the loss ratio has the expected positive effect on the current value of the loss ratio. The coefficient is about 0.4 in both cases, so that there is a less

¹⁰ The natural log of the firm's assets proved to be a more reliable weighting scheme than a variable based on the level of the firm's assets, since firms with particularly large values of assets greatly distort the influence of the weights. Using the natural logarithm mutes the effect of these outliers on the weighting scheme. Other weights were also used in exploratory analyses. For example, weights based on premiums written, an approach similar to Cummins and Harrington's (1987), yield almost identical results.

Table 3
Log Loss Ratio Regression Results, 1985-1991

Variable	Ordinary Least Squares		Weighted Least Squares Ln(Assets)	
	Coefficient	S.E.	Coefficient	S.E.
Intercept	-0.341*	0.118	-0.334*	0.117
Log Loss Ratio _{t-1}	0.403*	0.004	0.400*	0.004
Liability Reform	-0.111*	0.014	-0.109*	0.014
<i>Insurance Price Regulation</i>				
Prior Approval or Modified Prior Approval	-0.014	0.026	-0.013	0.026
Flex Rating	-0.011	0.029	-0.013	0.029
File-and-Use or Use-and-File	-0.046*	0.025	-0.048*	0.025
<i>Economic Conditions</i>				
Log Treasury Bill Rate	-0.147*	0.039	-0.143*	0.039
Log National Premiums Written	2.7E-5	0.003	-0.001	0.003
Log State Aggregate Income	0.040*	0.005	0.040*	0.005
Log Four-Firm Concentration Ratio	0.061*	0.026	0.062*	0.026
<i>Ownership Structure</i>				
Mutual	-0.274*	0.017	-0.262*	0.017
Lloyd's	0.110	0.115	0.096	0.129
Reciprocal	-0.195*	0.043	-0.183*	0.042
$\bar{R}^2$	0.166		0.163	

Note: S.E. = standard error.

* Statistically significant at the 95 percent confidence level, one-tailed test.

than one-for-one relationship between the current loss ratio and the next period's loss ratio.

The main variable of interest is the liability reform measure, which is consistently statistically significant. The size of the coefficients indicates that the introduction of a liability reform has an 11 percent short-run effect on the firm's loss ratio in a particular state. With an average base loss ratio in the sample of 1.37, the short-run effect of liability reform is to reduce the loss ratio by 0.15. The long-run effect of liability reform on the log of the loss ratio also takes into account the impact of the lagged value of the log loss ratio. The long-term impact based on the estimates presented in Table 3 is greater than the short-term impact—almost 25 percent.

The next three variables in Table 3 pertain to different types of state insurance regulation. Although the public interest theory suggests that the effect of regulation should be to restrain prices, in long-run competitive equilibrium, firms will adjust so that the marginal loss ratios will be equalized across regulatory regimes. Under prior approval or modified prior approval regulation, a firm is required to obtain approval of its rates from the state regulatory

authorities before enacting them. This regulatory regime has a negative effect on loss ratios, but it is not statistically significant. Under flex rating, firms are regulated within particular ranges with respect to their rate changes. This regulatory variable is also not statistically significant. In the final category of regulation, file-and-use or use-and-file, the firm is required to notify regulatory officials of any rate changes either before or after introducing them. This regulatory regime variable is negative and statistically significant (at the 95 percent confidence level, one-tailed test) over the sample period.

Both variables pertaining to general economic conditions are statistically significant. Higher rates of interest enable firms to charge lower prices, thus decreasing premium amounts. However, as insurers alter their price, the mix of the risks insured may change as well, so the net effect is unclear. The results suggest that the net effect is to reduce loss ratios.

Higher values of national premiums written reflect insurance market conditions in which substantial amounts of insurance are sold. A larger insurance market may also lead insurers to insure risks with greater expected losses, but these firms would also be charged a higher price. On balance, this variable has no statistically significant effect.

Higher levels of state aggregate income reflect higher levels of wages and potential income loss, which should increase both premiums and losses. The results reveal that the loss effect appears to be dominant, as loss ratios are higher in states with high levels of aggregate income.

The effect of the four-firm concentration ratio is the opposite of what one would expect based on monopolistic concerns. Rather than being associated with highly profitable insurance, highly concentrated states are more likely to have high loss ratios. A variety of explanations for this phenomenon are possible, such as correlation between omitted state characteristics and the concentration ratio (e.g., small states are more likely to have high concentration ratios).

The last three variables in Table 3 pertain to firm characteristics that may affect profitability. In a competitive market, we would expect no differences in loss ratios across organizational forms (see Cummins and Harrington, 1987). However, we find that mutuals and reciprocals are associated with significantly lower loss ratios relative to stock companies, perhaps because our loss ratio variable is not adjusted for policyholder dividend payments.

Table 4 presents the estimation results based on equation (2), which omits the lagged value of the dependent variable. The results in Table 4 consequently provide a direct estimate of the long-run effect of liability reform on premiums. As expected, these estimates yield a higher estimate of the effect of liability reforms on insurance profitability, as the liability reform variable generates a 25 percent decline in the value of the loss ratio. This effect is quite substantial, and when compared with estimates in Table 3, these findings suggest that the long-run effects of liability reform on insurer profitability are more than twice as great as the direct short-run effects because of the influence of liability reforms on the history of insurer profitability and the subsequent influence of this history on future insurance market performance.

Table 4
 Direct and Long-Term Effects on Liability Reform on Loss Ratios:
 Log Loss Ratio Regression Results, 1985-1991

Variable	Ordinary Least Squares		Weighted Least Squares Ln(Assets)	
	Coefficient	S.E.	Coefficient	S.E.
Intercept	-1.221*	0.127	-1.199*	0.127
Liability Reform	-0.250*	0.015	-0.245*	0.015
<i>Insurance Price Regulation</i>				
Prior Approval or Modified				
Prior Approval	-0.032	0.028	-0.032	0.028
Flex Rating	-0.005	0.032	-0.008	0.031
File-and-Use or Use-and-File	-0.082*	0.027	-0.084*	0.027
<i>Economic Conditions</i>				
Log Treasury Bill Rate	-0.193*	0.043	-0.193*	0.042
Log National Premiums Written	0.024	0.003	0.023	0.003
Log State Aggregate Income	0.074*	0.006	0.074*	0.006
Log Four-Firm Concentration Ratio	0.028	0.028	0.033	0.028
<i>Ownership Structure</i>				
Mutual	-0.462*	0.019	-0.442*	0.019
Lloyd's	0.169	0.125	0.144	0.139
Reciprocal	-0.408*	0.047	-0.394*	0.046
$\bar{R}^2$	0.020		0.019	

Note: S.E.= standard error.

* Statistically significant at the 95 percent confidence level, one-tailed test.

Estimation Results: Interaction Effects

The results based on estimation of the third variant of the model, equation (3), are presented in Table 5. Here we permit the effect of the liability reform to consist not only of a constant term but also of a series of interactions with other variables of interest. Although the intercept shift variable for liability reform is no longer statistically significant, these regressions allow us to identify the mechanisms by which liability reforms exert their influence. In reform states, the lagged value of the loss ratio has a smaller coefficient than it otherwise would. In effect, the first way in which liability reforms enhance insurance profitability is by decreasing the influence that past high loss ratios have on current insurance pricing. This is exactly the expected result, since liability reforms should increase the overall profitability of insurance so that past periods of high unprofitability should be less predictive of future profitability.

Table 5
 Liability Reform in Interaction with Other Variables:
 Log Loss Ratio Regression Results, 1985-1991

Variable	Ordinary Least Squares		Weighted Least Squares <i>Ln(Assets)</i>	
	Coefficient	S.E.	Coefficient	S.E.
Intercept	-0.351*	0.142	-0.354*	0.141
Log Loss Ratio _{t-1}	0.420*	0.008	0.417*	0.008
Liability Reform	-0.065	0.098	-0.050	0.097
<i>Insurance Price Regulation</i>				
Prior Approval or Modified				
Prior Approval	0.057	0.097	0.071	0.096
Flex Rating	0.209*	0.105	0.216*	0.104
File-and-Use or Use-and-File	-0.019	0.096	-0.009	0.095
<i>Economic Conditions</i>				
Log Treasury Bill Rate	-0.158*	0.039	-0.154*	0.039
Log National Premiums Written	4.4E-5	0.003	-0.001	0.003
Log State Aggregate Income	0.040*	0.006	0.040*	0.006
Log Four-Firm Concentration Ratio	0.070*	0.026	0.071*	0.026
<i>Ownership Structure</i>				
Mutual	-0.274*	0.017	-0.262*	0.017
Lloyd's	0.109	0.115	0.095	0.129
Reciprocal	-0.196*	0.043	-0.183*	0.042
<i>Interactions</i>				
Reform x Log Loss Ratio _{t-1}	-0.022*	0.009	-0.022*	0.009
Reform x (Prior Approval or Modified Prior Approval)	-0.081	0.100	-0.096	0.100
Reform x Flex Rating	-0.250*	0.109	-0.259*	0.108
Reform x (File-and-Use or Use-and-File)	-0.023	0.099	-0.035	0.098
$\bar{R}^2$	0.166		0.163	

Note: S.E. = standard error.

* Statistically significant at the 95 percent confidence level, one-tailed test.

Another striking significant interaction in Table 5 is that liability reforms are particularly influential in decreasing loss ratios in flex rating states, as compared to the omitted regulatory group of states with no insurance regulation. The flex rating variable was not statistically significant in its own right in Tables 3 or 4, so it is not clear whether this effect represents an interaction with the nature of the insurance regulatory regime or simply reflects the fact that states with flex rating systems may have adopted liability reform

measures with a somewhat different character that, overall, enhanced profitability by a greater amount.

Effect on Losses

The main mechanism by which liability reform enhances insurance market profitability is by diminishing losses, either by decreasing the frequency with which plaintiffs are successful or by decreasing the size of the awards. Thus, one would expect liability reforms to restrain losses in some manner, where the extent of the pass-through of these loss reductions into lower premiums determines the ultimate effect on insurance profitability. The loss equation takes the form

$$\begin{aligned} \text{Log Losses}_{it} = & \alpha_3 + \beta_3 \text{Log Losses}_{it-1} + \psi_3 \text{Log Premiums}_{it} \\ & + \gamma_3 \text{Reform}_{it} + \sum_{j=1}^N \delta_j X_{jit} + \epsilon_{3it}. \end{aligned} \quad (4)$$

Equation (4) is similar in spirit to equation (1) except that, in addition to including the lagged value of the dependent variable, the equation also includes the contemporaneous value of the log of premiums. The scale of insurance sold will affect losses, as insurers with a high premium volume are expected to incur higher losses. Losses are experienced after premiums are written, so there is no problem of simultaneity. For product liability coverage, for example, there is a well documented lag before losses affect insurance prices (Viscusi, 1993). The analogues of equations (2) and (3) also are estimated for losses, and these variants follow the same pattern as above.

The estimated patterns of influence shown in Table 6 follow expectations for the most part. The lagged value of losses and current premiums each exert a positive influence on losses. A 100 percent increase in premiums leads to a 51 percent increase in losses, but a 100 percent increase in lagged losses leads to only a 38 percent increase in current losses. Because of the highly stochastic nature of losses, there is not a strong intertemporal link in firm-specific loss levels.

The main variable of interest, the liability reform measure, reduces losses by 17 percent. The estimated long-run influence taking into account the effect on lagged losses is 27 percent. The percentage effect on losses is consistent with loss levels being the focus of the reform efforts. The reform appears to have achieved its objective of restoring insurance market stability by constraining insurance costs, which, in turn, gave rise to the effects on loss ratios and premiums discussed above.

The file-and-use/use-and-file insurance regulation variable implies that states with this form of insurance price regulation tend to experience lower losses. This variable may reflect the mix of risks that are insured in regulated states. For example, firms that face price constraints would be expected to insure policies posing lower than average risk, thus yielding negative coefficients.

Table 6
Log Losses Regression Results, 1985-1991

Variable	Ordinary Least Squares		Weighted Least Squares Ln(Assets)	
	Coefficient	S.E.	Coefficient	S.E.
Intercept	-1.482*	0.097	-1.513*	0.097
Log Losses Incurred _{t-1}	0.381*	0.003	0.379*	0.003
Log Premiums _t	0.512*	0.004	0.512*	0.004
Liability Reform	-0.171*	0.014	-0.170*	0.014
<i>Insurance Price Regulation</i>				
Prior Approval or Modified				
Prior Approval	-0.045*	0.025	-0.047*	0.025
Flex Rating	-0.012	0.028	-0.015	0.028
File-and-Use or Use-and-File	-0.064*	0.024	-0.067*	0.024
<i>Economic Conditions</i>				
Log Treasury Bill Rate	-0.066*	0.022	-0.066*	0.022
Log National Premiums Written	0.083*	0.004	0.085*	0.004
Log State Aggregate Income	0.130*	0.006	0.133*	0.006
Log Four-Firm Concentration Ratio	0.031	0.025	0.035	0.025
<i>Ownership Structure</i>				
Mutual	-0.256*	0.017	-0.242*	0.017
Lloyd's	0.274*	0.110	0.262*	0.124
Reciprocal	-0.211*	0.042	-0.202*	0.041
$\bar{R}^2$	0.771		0.774	

Note: S.E. = standard error.

* Statistically significant at the 95 percent confidence level, one-tailed test.

Alternatively, these state regulatory variables may be correlated with omitted aspects of the state liability regime that lead to lower losses for any given premium level.

Although most of the other variables are included primarily to control for different aspects of the mix of firms and economic conditions, one variable is of particular interest. The variable for the log of state aggregate income has the expected positive effect. This result accords with theoretical predictions. Higher levels of income and wages in a state should be associated with greater losses because the values of the economic losses will be greater under these circumstances.

The long-run effect of liability reform on losses is captured in the reduced form equation estimates in Table 7. These findings imply that, by directly estimating the effect on losses, the percentage effect of liability reforms on the value of losses is 22 percent. This estimate is a bit below the 27 percent estimate of the long-run effect on losses based on the direct effect in Table 6 coupled with the effect of the lagged value of losses on the current loss level.

Table 7
 Direct and Long-Term Effects of Liability Reform on Losses:
 Log Losses Regression Results, 1985-1991

Variable	Ordinary Least Squares		Weighted Least Squares Ln(Assets)	
	Coefficient	S.E.	Coefficient	S.E.
Intercept	-3.189*	0.107	-3.254*	0.107
Log Premiums _t	0.849*	0.004	0.846*	0.004
Liability Reform	-0.217*	0.015	-0.213*	0.015
<i>Insurance Price Regulation</i>				
Prior Approval or Modified				
Prior Approval	-0.052*	0.028	-0.055*	0.028
Flex Rating	-0.003	0.031	-0.007	0.031
File-and-Use or Use-and-File	-0.102*	0.027	-0.105*	0.025
<i>Economic Conditions</i>				
Log Treasury Bill Rate	0.053*	0.025	0.047*	0.025
Log National Premiums Written	0.137*	0.004	0.141*	0.004
Log State Aggregate Income	0.214*	0.007	0.220*	0.007
Log Four-Firm Concentration Ratio	0.047	0.028	0.055	0.027
<i>Ownership Structure</i>				
Mutual	-0.365*	0.019	-0.349*	0.018
Lloyd's	0.416*	0.123	0.404*	0.137
Reciprocal	-0.372*	0.046	-0.360*	0.045
$\bar{R}^2$	0.716		0.721	

Note: S.E. = standard error.

* Statistically significant at the 95 percent confidence level, one-tailed test.

The pattern of the interactions for the liability reform variable shown in Table 8 indicates that the liability reform variable exerts a negative influence on the lagged value of losses and a negative effect in the flex rating states. These findings mirror those for the loss ratios. Formerly high loss states that did adopt liability reforms continued in this pattern, but they experienced a significant dampening in the extent to which the past loss experience affected current loss levels.

Effect on Premiums

The expected effect of liability reform on premiums is not clear-cut. The basic difficulty is that premiums comprise two components, price and quantity. If liability reforms are successful in restraining costs, then there should be a price-restraining effect. However, there may also be an expansion in quantity,

Table 8
 Liability Reform in Interaction with Other Variables:
 Log Losses Regression Results, 1985-1991

Variable	Ordinary Least Squares		Weighted Least Squares Ln(Assets)	
	Coefficient	S.E.	Coefficient	S.E.
Intercept	-1.667*	0.128	-1.704*	0.128
Log Losses Incurred _{t-1}	0.401*	0.005	0.398*	0.005
Log Premiums _t	0.513*	0.004	0.513*	0.004
Liability Reform	0.081	0.103	0.089	0.102
<i>Insurance Price Regulation</i>				
Prior Approval or Modified				
Prior Approval	-0.068	0.093	-0.057	0.092
Flex Rating	0.143	0.101	0.151	0.100
File-and-Use or Use-and-File	-0.139	0.092	-0.131	0.091
<i>Economic Conditions</i>				
Log Treasury Bill Rate	-0.071*	0.022	-0.072*	0.022
Log National Premiums Written	0.084*	0.004	0.086*	0.004
Log State Aggregate Income	0.131*	0.006	0.134*	0.006
Log Four-Firm Concentration Ratio	0.039	0.025	0.043*	0.025
<i>Ownership Structure</i>				
Mutual	-0.255*	0.017	-0.242*	0.017
Lloyd's	0.276*	0.110	0.265*	0.124
Reciprocal	-0.212*	0.042	-0.202*	0.041
<i>Interactions</i>				
Reform x Log Losses Incurred _{t-1}	-0.026*	0.004	-0.025*	0.004
Reform x Prior Approval or Modified Prior Approval	0.013	0.097	-0.002	0.096
Reform x Flex Rating	-0.185*	0.105	-0.197*	0.104
Reform x File-and-Use or Use-and-File	0.088	0.095	0.076	0.094
$\bar{R}^2$	0.772		0.774	

Note: S.E. = standard error.

* Statistically significant at the 95 percent confidence level, one-tailed test.

because of an increase in demand for insurance at lower prices as well as a decrease in quantity rationing.¹¹

The following equation is used to assess the effect of liability reform on premiums:

¹¹ Quantity rationing effects are particularly difficult to assess within the context of insurance markets because of their highly regulated nature.

$$\begin{aligned} \text{Log Premiums}_{it} = & \alpha_2 + \beta_2 \text{Log Premiums}_{it-1} \\ & + \gamma_2 \text{Reform}_{it} + \sum_{j=1}^N \delta_j X_{jit} + \varepsilon_{2it}. \end{aligned} \quad (5)$$

This equation follows the same general form as equation (1) in that it is a simple autoregressive equation in which the key variables are the lagged value of the dependent variable and the regulatory reform variable. The variants of the model omitting the lagged dependent variable and including the interaction terms follow the same pattern as equations (2) and (3).

Table 9 presents the estimation results for the log premium regression equations. As in earlier tables, two different sets of estimates are reported, ordinary least squares and weighted least squares. The lagged value of the log of premiums has the expected positive effect on premium levels. This relationship has a coefficient of 0.74, indicating an autoregressive relationship much closer to one-for-one than in the case of loss ratios or losses.

The liability reform variable is negative and quite substantial in magnitude. The introduction of liability reform has the direct effect of reducing premiums in a particular state by 7 percent. One would ultimately expect some pass-through of lower losses to lower premiums, though not to a complete extent if insurance was unprofitable at the time of the reforms. The long-term effect that takes into account the effect of liability reform on the lagged value of premiums as well as its direct effect on premiums is considerably greater, as the estimates in Table 9 imply a 29 percent long-run effect of the liability reform. The period immediately following the introduction of liability reform was largely one of substantial escalation in premiums. These results indicate that states that adopted liability reform experienced less of a surge in premium growth in the mid- and late-1980s than did firms that did not adopt these reforms.

States in which there are price restraints will embody both constraints on the price of insurance as well as quantity rationing in response to the constrained price. One would consequently expect a negative effect of regulation on premiums. The only statistically significant state regulatory regime variable is for file-and-use/use-and-file regulation.

The economic condition variables also are statistically significant. Higher values of national premiums written and higher levels of state aggregate income both have a strong positive association with higher premium levels at the specific firm, as expected. Higher Treasury bill rates are associated with higher premium levels. Although higher real rates of return should lead to lower prices and, consequently, lower premiums, Treasury bill rates are also correlated with the quantity of insurance purchased since interest rates tend to rise during periods of intense economic activity. The quantity effect appears to outweigh any price effect.

The four-firm concentration ratio has a significant negative effect. Although monopolistic quantity restrictions may be present, the more likely explanation

Table 9
Log Premiums Regression Results, 1985-1991

Variable	Ordinary Least Squares		Weighted Least Squares Ln(Assets)	
	Coefficient	S.E.	Coefficient	S.E.
Intercept	-2.345*	0.065	-2.415*	0.065
Log Premiums _{t-1}	0.744*	0.002	0.745*	0.002
Liability Reform	-0.073*	0.009	-0.078*	0.009
<i>Insurance Price Regulation</i>				
Prior Approval or Modified				
Prior Approval	-0.062*	0.017	-0.067*	0.017
Flex Rating	-0.001	0.019	-0.004	0.019
File-and-Use or Use-and-File	-0.034*	0.017	-0.036*	0.016
<i>Economic Conditions</i>				
Log Treasury Bill Rate	0.122*	0.015	0.125*	0.015
Log National Premiums Written	0.194*	0.002	0.197*	0.002
Log State Aggregate Income	0.218*	0.004	0.220*	0.004
Log Four-Firm Concentration Ratio	-0.042*	0.017	-0.037*	0.017
<i>Ownership Structure</i>				
Mutual	0.084*	0.011	0.081*	0.011
Lloyd's	0.389*	0.076	0.388*	0.084
Reciprocal	0.004	0.029	-0.004	0.028
$\bar{R}^2$	0.862		0.866	

Note: S.E. = standard error.

* Statistically significant at the 95 percent confidence level, one-tailed test.

is that highly concentrated states are thin insurance markets in which less coverage is written.

Two organizational form variables are significant in the premium equation. Mutuals have slightly higher premiums relative to stock companies. Lloyd's are also associated with higher premiums relative to stock companies. A likely explanation is that Lloyd's are associated with unusual and unique hazards and therefore require higher premiums to compensate for greater uncertainty.

Whereas the results presented in Table 9 indicate that liability reforms had a restraining effect on premiums, the results presented in Table 10 omitting the lagged value of premiums are just the opposite. This result may be spurious since it fails to control for the size of the state insurance markets, unlike the findings in Table 9. In particular, states with large values of premiums tend to be those that enacted product liability reforms. It is noteworthy, for example, that California, New York, and Florida were among the many reform states in 1986. Although the results presented in Table 10 do include a variable to capture the overall size of the state, the level of the state's aggregate income, one would expect states in which the insurance industry has a disproportionate

Table 10
 Direct and Long-Term Effects of Liability Reform on Premiums:
 *Log Premiums Regression Results, 1985-1991

Variable	Ordinary Least Squares		Weighted Least Squares Ln(Assets)	
	Coefficient	S.E.	Coefficient	S.E.
Intercept	-10.344*	0.145	-10.771*	0.114
Liability Reform	0.133*	0.017	0.128*	0.017
<i>Insurance Price Regulation</i>				
Prior Approval or Modified				
Prior Approval	-0.145*	0.032	-0.162*	0.031
Flex Rating	0.011	0.036	-0.001	0.035
File-and-Use or Use-and-File	-0.144*	0.031	-0.147*	0.030
<i>Economic Conditions</i>				
Log Treasury Bill Rate	0.155*	0.029	0.154*	0.028
Log National Premiums Written	0.743*	0.003	0.762*	0.003
Log State Aggregate Income	0.930*	0.007	0.943*	0.007
Log Four-Firm Concentration Ratio	0.059	0.032	0.081*	0.031
<i>Ownership Structure</i>				
Mutual	0.629*	0.021	0.593*	0.021
Lloyd's	1.626*	0.141	1.670*	0.157
Reciprocal	0.241*	0.053	0.220*	0.051
$\bar{R}^2$	0.521		0.537	

Note: S.E. = standard error.

* Statistically significant at the 95 percent confidence level, one-tailed test.

role relative to the size of the state to be those in which reforms were enacted. Thus, this result perhaps should not be taken at face value.

Table 11 presents estimates of the log premium regression equations including interaction variables. None of the interaction variables is statistically significant, as the effect of the liability reform variable is simply to generate a downward constant term shift in the level of premiums.

Conclusion

The liability crisis of the mid-1980s generated substantial public attention and provided the impetus for reforming the structure of state product liability laws. The explosion of liability premiums in the mid-1980s was accompanied by a flurry of state regulatory reforms of liability laws. From 1985 to 1987, 46 states enacted major product liability reform bills in an effort to restrain the surge in liability costs. Since the structure of liability law dictates both the circumstances under which damages will be paid as well as the amount of these

Table 11
 Liability Reform in Interaction with Other Variables:
 Log Premiums Regression Results, 1985-1991

Variable	Ordinary Least Squares		Weighted Least Squares Ln(Assets)	
	Coefficient	S.E.	Coefficient	S.E.
Intercept	-2.291*	0.089	-2.358*	0.088
Log Premiums _{t-1}	0.748*	0.003	0.748*	0.003
Liability Reform	-0.126*	0.074	-0.133*	0.073
<i>Insurance Price Regulation</i>				
Prior Approval or Modified				
Prior Approval	-0.151*	0.064	-0.159*	0.063
Flex Rating	-0.047	0.070	-0.048	0.068
File-and-Use or Use-and-File	-0.156*	0.063	-0.160*	0.062
<i>Economic Conditions</i>				
Log Treasury Bill Rate	0.120*	0.015	0.123*	0.015
Log National Premiums Written	0.194*	0.002	0.197*	0.002
Log State Aggregate Income	0.218*	0.004	0.220*	0.004
Log Four-Firm Concentration Ratio	-0.045*	0.017	-0.039*	0.017
<i>Ownership Structure</i>				
Mutual	0.084*	0.011	0.081*	0.011
Lloyd's	0.389*	0.076	0.389*	0.084
Reciprocal	0.005	0.029	-0.003	0.028
<i>Interactions</i>				
Reform x Log Premiums _{t-1}	-0.005	0.004	-0.005	0.003
Reform x Prior Approval or Modified Prior Approval	0.091	0.066	0.094	0.065
Reform x Flex Rating	0.044	0.072	0.041	0.071
Reform x File-and-Use or Use-and-File	0.134*	0.066	0.136*	0.064
$\bar{R}^2$	0.862		0.866	

Note: S.E. = standard error.

* Statistically significant at the 95 percent confidence level, one-tailed test.

damages, one would expect these measures to influence the liability costs unless the courts adjust in some fashion to negate the impact of the reforms.

Examination of the effect of these reform measures on insurance firms over the 1985 through 1991 period indicates that these reforms were generally successful in achieving their avowed objective of reducing loss levels. Our results suggest that the reforms reduced loss levels by 17 percent in the short run and by 22 to 27 percent in the long run. Purchasers of insurance benefited from this dampening of losses as well, as the lower loss levels in turn resulted

in lower premiums, which declined by 7 percent following the adoption of liability reforms. The net effect was to enhance insurer profitability, as loss ratios declined by 11 percent in the short run and by 25 percent in the long run, following the adoption of the reforms. Over the sample period, loss ratios decreased by 40 percent overall, so that one can view liability reforms as a major contributor to enhancing the profitability of insurance markets. The effort by states to stabilize the liability system may have had an additional effect beyond that estimated here since this increased stability may have generally enhanced the insurance climate.

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