The Relationship Between Auto Insurance Rate Regulation and Insured Loss Costs: An Empirical Analysis

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Abstract

This study points out a potential unintended effect of efforts to enhance affordability of insurance prices by regulating rates: It may ultimately lead to higher insurance costs. This is because rate regulation that suppresses insurance prices below competitive levels, or provides significant premium subsidies for some consumers, creates a variety of incentive distortions in the market. The article summarizes the theoretical arguments for this effect and provides empirical evidence of cost-increasing effects of rate regulation. The analysis uses state-level data on automobile insurance costs and claims rates for the period 1990 through 1998, and employs empirical methods that control for the possible reverse causation of high insurance costs leading to consumer demand for rate regulation. We find that bodily injury and property damage liability loss costs are higher in rate-regulated states, and that the bodily injury to property damage liability claims ratio is higher in regulated states.

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I. Introduction

There were over 39,000 fatalities and 1.8 million injuries in 6.16 million automobile accidents in the United States in 2005 (NHTSA, 2006). As the primary mechanism for funding these accident costs, the automobile insurance market generated premium volume of $161.3 billion in 2005. As both a public policy matter and as an economic system, the auto accident compensation mechanism is an important concern. Despite recent declines, automobile insurance prices remain high in many states, with large differences in average prices across areas. For example, average expenditures on auto insurance increased from $691 in 1996 to $829 in 2005. Average prices were highest in New Jersey ($1,184) and lowest in North Dakota ($562) in 2005 (III, 2007).

Automobile insurance is a compulsory purchase for most drivers in the United States, and this raises concerns about affordability. Partly because of this, many states regulate insurance prices with the objectives of assuring both insurance affordability and insurance availability.[1] However, the goals of affordability and availability may conflict. For example, affordability is enhanced when rates are reduced below those that would exist in a competitive market. However, insurance may become unavailable if regulated rates are so low that insurers cannot earn a reasonable return on capital (Harrington, 1992).

There is a significant body of research that suggests that the affordability-availability trade-off is more than just a theoretical concern. These studies have found that during periods when rate regulation significantly reduces rate increases, the proportion of drivers who are insured in the involuntary (residual) market increases (Ippolito, 1979; Grabowski, Viscusi and Evans, 1989; Bouzouita and Bajtelsmit, 1997; Jaffee and Russell, 1998). Residual markets typically run deficits, and these deficits tend to be passed on to consumers insured in the voluntary market (Harrington, 1990). Other research has shown that the number of insurance providers is reduced in stringently regulated states, and that the character of firms operating in regulated markets is distorted (Joskow, 1979; Grabowski, Viscusi and Evans, 1989; Gron, 1996; Tennyson, 1997; Suponcic and Tennyson, 1998; Weiss and Choi, 2008).

This study points out another market distortion associated with efforts to enhance insurance affordability by regulating rates: rate regulation may ultimately lead to higher insured loss costs in regulated states. This is because a variety of incentive distortions may come about when rate regulation suppresses insurance prices below competitive levels, or if rate regulation results in significant premium subsidies for large groups of consumers. The suppression of prices (and thus,

1. The traditional goals of state insurance rate regulation are that rates be adequate but not excessive, and not unfairly discriminatory. Rate adequacy refers to the ability of insurers to earn competitive profits, but rates would be viewed as excessive if profits are greater than that. Rates should reflect expected loss costs, and all those with the same expected loss costs should pay the same insurance rates. “Fair” rate discrimination implies that insurers should charge different rates to those classes of risks that face different expected loss costs.

insurer profits) below competitive levels may reduce insurers' incentives to make efficiency-enhancing or cost-reducing investments (Harrington, 1992; Weiss and Choi, 2008). Premium subsidies reduce the link between accident risk and insurance prices, which may reduce the incentives of consumers to engage in risk-reducing behaviors (Harrington and Doerpinghaus, 1993). If regulation results in a large residual market and the operating losses from the residual market are shared among all insurers, and/or if residual market losses are passed on to consumers insured in the voluntary market, this may further reduce the incentives of both insurers and drivers to invest in loss reduction.

Insurance rate regulation may also affect consumers' claims filing incentives. When rate regulation limits the differences between rates charged to low- and high-risk drivers or lowers, across-the-board rate increases not only are incentives for loss control reduced but incentives for claims avoidance are also reduced. This may lead to a higher rate of legitimate insurance claims (holding accidents fixed) and also to a higher rate of fraudulent insurance claims, further increasing insured losses in regulated states.

Due to these incentive effects of regulation, insurance loss costs may be higher in states that actively regulate insurance rates. Measures of fraudulent insurance claiming may also be higher in states that actively regulate rates. We test for these effects using regression analysis of state level data on automobile insurance costs and claims rates for the period 1990 through 1998. We analyze bodily injury and property damage liability loss costs per insured car, because they represent the majority of auto insurance losses and are more similar across states than are other coverages. We also examine the ratio of bodily injury to property damage liability claims frequency, a measure that is sometimes used as an indicator of fraudulent claiming in auto insurance markets (for example, see Cummins and Tennyson, 1992, 1996; Hoyt, Mustard and Powell, 2004). Our empirical results provide support for the hypothesis that rate regulation is associated with higher insured loss costs. We find that bodily injury and property damage liability loss costs are higher in regulated states, and also that the bodily injury to property damage liability claims ratio is higher in regulated states.

Of course, a positive association between rate regulation and insurance costs may originate not from the effects of regulation in raising costs but because high insurance costs may lead to consumer demand for insurance rate regulation. We employ two methods of controlling for this potential effect in our analysis: use of a formal econometric technique that allows for joint causation among a dependent and independent variable (two stage least squares) and use of a lagged measure of regulatory stringency to reduce the likelihood of joint causation. Our results remain the same using these empirical methods, providing some additional assurance that the causation runs from rate regulation to higher insurance costs.

Our findings have important implications for public policy, especially in light of the recent efforts to deregulate across the financial services industry. This is a particularly important area for research as the National Association of Insurance Commissioners (NAIC) is in the process of developing a model personal lines regulatory framework. Within the framework, a model personal lines rating law is under consideration (NAIC, 2007). From a public policy perspective, it is important to examine the costs and benefits of alternative rating laws now in use across states so that recommendations for a model law may be based on sound, rigorous analysis. Our evidence, and the evidence from recent deregulatory experiments among the states, suggests that deregulation of insurance rates may improve incentives and reduce insurance prices overall.

The paper is organized as follows: Section 2 outlines the differences among systems of state rate regulation, and develops the theoretical background for our analysis. Section 3 includes a discussion of the data used in the study and our empirical methodology. The results of our investigation are presented in Section 4, and Section 5 concludes.

2. Rate Regulation and the Cost of Insurance

Insurance rate regulation can take several forms, but state rate regulatory regimes are often categorized into prior approval and "competitive" rating states. Under prior approval systems, insurers must file requests for rate adjustments in advance of applying the rates.[2] The insurance commissioner's office reviews the entire rate structure across driver risk classes and territories, and also reviews insurer expenses and profit margins before approving or denying the rate request. Under "competitive" rating systems, insurers may use rates without the insurance regulator's prior approval.[3]

It has often been noted that automobile insurance prices are higher in states that actively regulate insurance rates. This association may arise because high prices lead consumers to demand rate regulation that holds prices below what insurers would otherwise charge. While we do not dispute this possibility, we argue that higher prices in closely regulated states may also partially result from regulation. More specifically, to the extent that regulation substantially reduces prices for at least some drivers below those that would occur in a competitive market, insurer and consumer behavior may be distorted in ways that lead to higher costs.

Rate regulation may result in incentive distortions when drivers are charged premiums that are not directly related to expected loss costs. The most obvious way this can occur is when prior approval regulation results in the promulgation of rates that are less than drivers' expected loss costs (often called rate suppression).

2. Note that Massachusetts used (until April 2008) a "fix-and-establish" rate regulation model, where the state sets the rates that all insurers are required to use across territories and risk classes. Subject to regulatory prior approval, insurers may deviate from the state-set rate by offering credits for good experience within risk classes. See Tennyson, Weiss, and Regan (2002) and Derrig (1993) for a more detailed discussion of regulation in Massachusetts.

3. Most "competitive" rating states use a "file and use" or a "use and file" system in which insurers use the rates in the market subject to the regulators' later approval. If rates are not approved, they must be withdrawn from the market. A few states exercise no regulatory approval of rates, allowing the market to set the rates.

Prior approval rate regulation might also limit across-the-board rate increases to an inadequate fixed percentage per rating period, suppressing all drivers' rates regardless of risk type. Alternatively, prior approval regulation may result in reduced rates for some consumers (usually high-risks) relative to others (usually low-risks)—often termed rate compression (Harrington, 1992). Regulators may compress rates by limiting the number of risk classes that can be used to rate drivers so that relatively lower- and higher-risk drivers pay the same rates. Regulation may also limit rate differentials across driver classes, with lower risk classes paying more and higher risk classes paying less than their expected costs. Further, the highest risk drivers may pay premiums that are substantially less than their expected costs if residual market rates are capped. Under either rate suppression or rate compression, economic theory suggests that incentives to control loss costs are lower for insured drivers. Further, disincentives also exist for insurers if prior approval results in rate suppression, even if rate suppression occurs only intermittently in the state.

Insurer Incentives

Regulatory suppression of insurance rates runs the risk of driving average premiums below competitive market levels, and this will reduce insurer returns below a competitive rate of return. Even if rate regulation allows insurers to earn positive rates of profit, if those profit rates are below the competitive rate of return, insurers' incentives to sell in the market will be reduced. Firms will respond to such rate suppression by ceding more policies to the residual market or, in extreme cases, by exiting the market (Harrington, 1992). Just as important, new insurers will be less likely to enter a market in which rates are suppressed or where rates are likely to be suppressed in the future. Insurers remaining in the market will have less incentive to make cost-reducing or efficiency-enhancing investments if the returns from these do not cover the cost of capital. To understand this, it is important to keep in mind that investments are forward-looking, made in the current period with the expectation of returns to be earned currently and in future periods as well. Regulatory pressures on insurer profits will both reduce the current funds available to make such investments, and lower expectations of future returns, making investment less attractive. Thus, even if rate regulation does not affect prices significantly on average across some broad period of time (Harrington, 2002), it may still provide disincentives if insurers' perceived risk of future intervention is higher for rate regulated states.[4]

Moreover, if regulated prices are set in relation to firms' costs, as is the case in some prior approval states, then cost-reducing technologies or processes that require upfront investments by the firm will be even less attractive (Weiss and Choi, 2008). This is because firms will recognize that the cost-reduction will lead

4. Harrington (2002) shows that prior approval regulation is associated with higher levels of volatility in underwriting loss ratios over the period 1972 to 1998. This also provides a disincentive for insurers to commit capital to a prior approval state or to enter a prior approval state.

to lower regulated prices that wipe out any returns from the investment. More generally, if firms' reports of lower costs will lead the regulator to set lower prices, then firms have less incentive to reduce costs.[5] Price competition will also be lessened, because insurers will be reluctant to reduce prices in response to better loss or expense experience, due to uncertainty about whether regulators will allow upward adjustments in the future.

Driver Incentives

If insurance premiums reflect the expected marginal costs of coverage, consumers have appropriate information on which to base their decisions about insurance purchase and also their decisions to purchase a car, and/or to drive (Harrington and Doerpinghaus, 1993). Consumers who receive rate subsidies face less than the true expected marginal cost of their decisions with respect to insuring and driving. They will, therefore, be more likely to drive and to purchase more insurance than they otherwise would. Consumers who pay rate surcharges will have the opposite response, tending to be less likely to drive and to purchase less insurance. The combined effect of these incentive distortions is likely to increase the average expected cost of insurance coverage relative to that under a cost-based system of rates, because of the greater relative participation of high risks in the driving and insuring populations.[6]

On the margin, cross-subsidies built into regulated insurance rates will increase the risky choices of all drivers, not just those currently receiving rate subsidies. This is because the penalty for risk-taking is lower, since regulated prices are less responsive to each driver's actual experience than would be the case under (risk-based) competitive pricing. As a result, drivers' choices regarding the amounts and types of driving, driving behavior and other actions that affect expected accident frequency or severity will be less oriented toward accident prevention, and expected accident losses will be higher.

There may also be an additional upward shift in claims and loss costs due to increased incentives for claims filing. Regulation that holds down prices in relation to costs reduces the premium consequences of filing claims. This will increase the propensity of consumers to file claims (holding accidents constant),

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5. The negative incentive effects of price regulation based on cost-plus or rate-of-return systems have received a great deal of analysis in the economics of regulation, leading to changes in the form of rate regulation for most regulated monopolies (see Laffont and Tirole, 1993; Gilbert and Newbery, 1994).

6. One situation in which this would not be the case, is if large numbers of high-risk drivers who would otherwise drive uninsured choose to purchase insurance due to regulatory rate subsidies. In that case, average insured loss costs could decline under rate regulation due to the shifting of loss costs from the uninsured motorist coverage onto the insurance of the previously uninsured drivers. In this way, costs would be spread across a larger number of insureds (Smith and Wright, 1992). However, previous studies of uninsured driving rates have found no significant relationship between insurance prices and uninsured driving (Ma and Schmit, 2000; Jaffee and Russell, 1998), suggesting that this effect is not likely.

leading to an increase in insured loss costs.[7] These same arguments also apply to fraudulent or exaggerated claims, and may provide a partial explanation for the problems of fraud experienced in some closely regulated markets (Derrig and Tennyson, 2008; Tennyson, 2007).

Residual Market Effects

As noted above, rate regulation has been shown to reduce insurance availability, as measured by a greater fraction of consumers insured through residual markets. This is consistent with the idea that regulation often reduces insurance rates below those that would be obtained in the competitive market, for at least some drivers. Rate cross-subsidies contribute to residual market size because insurers will not voluntarily underwrite consumers whose rates are lower than expected loss costs.

A large residual market may produce adverse effects on insurer behavior if residual market shortfalls are shared across insurers. Loss sharing implies that the incentives to hold down claims costs may be lower for residual market claims (Blackmon and Zeckhauser, 1991). More generally, if insurers' claims handling methods do not differ for voluntary market policies and residual market policies, a large residual market may reduce insurer incentives for claims efficiencies overall, leading to higher claims settlements and higher levels of claims fraud.[8]

Consumers' incentives may also be distorted by residual markets. Drivers insured through the residual market face weak links between their accident experience and the insurance premiums they pay, due to the premium subsidies that are typically offered in the residual market. If large portions of the market are insured through the residual market mechanism, these distorting effects could have a substantial impact on the overall market.

In summary, rate regulation that seeks to enhance affordability of insurance by reducing prices (for all or some consumers) below those that would prevail in a competitive market creates incentive distortions that are predicted to lead to higher loss costs and to a greater propensity to file insurance claims. The extent of these effects in practice depends upon both the stringency of regulation and the sensitivity of loss control, insuring and claiming behaviors to insurance prices.

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7. Although in theory, a not-at-fault driver in an accident should not be penalized by the insurer, in practice it may be unclear to the not-at-fault driver that he/she will not be treated with impunity. Anecdotal stories abound about increased premiums following a claim filing, and even if these are only "urban legends" they may have an effect on claiming behavior. In addition, many states have comparative negligence laws or may ascribe degrees of fault to more than one party under contributory negligence laws so that there may be no driver involved in the accident who is free of all fault.

8. In many jurisdictions, it would be unlawful for insurers to discriminate between voluntary and residual market policies in their claims handling practices.

Hypothesis Specification

Although it is difficult, if not impossible, to directly measure these incentive distortions, if they are present in a regulated market, they will lead to higher insurance claims and higher claims costs. A growing body of formal empirical evidence suggests that rate regulation is associated with higher loss costs in some regulated insurance markets. For example, several studies in workers compensation insurance have found that rate regulation leads to higher loss costs and claims rates (Danzon and Harrington, 2000; Danzon and Harrington, 2001; Barkume and Ruser, 2001). Case studies of the regulated automobile insurance markets in Massachusetts and South Carolina (Tennyson, Weiss and Regan, 2002; Grace, Klein and Phillips, 2002; Derrig and Tennyson, 2008) find that losses and claims are higher during periods of stringent regulation in these states and lower when regulatory stringency is relaxed. To explore whether these patterns are observed more broadly in automobile insurance markets, we compare annual average loss costs and relative claims frequencies for regulated and unregulated states over the time period 1990 to 1998.

We initially define regulated states as those using prior approval or stricter regulation of rates, and refer to all other states as unregulated. We use the classification system in Harrington (2002) to assign states to each category. Bodily injury and property damage liability loss costs are measured as dollar losses paid in the calendar year divided by car years earned and exclude insurer loss adjustment expenses.[9] The relative liability claims rate is measured as the number of bodily injury liability claims per 100 property damage liability claims. The data are drawn from the Insurance Research Council's Trends in Auto Injury Claims database (2000).

It is important to note that our data are not loss ratio data as used in many prior automobile insurance studies. The use of loss ratio data may mask the distorting effects of prior approval regulation on loss costs. That is, if prior approval regulation leads to higher loss costs and insurers charge an increased premium to cover these losses, the loss ratio would not be affected adversely. Instead, the price rate would remain the same, while consumers would be dealing with ever-increasing premiums.

Figure 1 shows the average annual loss costs and relative claims frequencies for regulated and unregulated states for each year of our sample period. The top panel shows the differences in bodily injury liability loss costs per insured car across the period. In each year, losses are higher for the groups of regulated states, on average. The middle panel shows similar results for property damage liability

9. Our hypotheses suggest that all classes of insured losses should be higher in regulated states as compared to unregulated states. We do not have loss data on first party collision or comprehensive damage coverage or medical expense claims. Therefore, we confine our analysis to bodily injury and property damage loss costs only. However, since approximately 67 percent of private passenger automobile claims payments arise from injuries to people and from property damage liability, our measure of loss costs captures the majority of claims payments (III, 2005).

claims, with costs higher, on average, in the regulated states. The lower panel compares the relative liability claims rate across the regulated and unregulated states, with similar results. Recall that the ratio of bodily injury to property damage liability claims frequency is used as an indicator of fraudulent claiming.

Table 1 compares the bodily injury and property damage liability loss costs and claiming rates for regulated versus unregulated states, on average, for the entire 1990-1998 period. Small sample t-tests indicate that the difference in the averages between regulated and unregulated states are statistically significant at the one percent confidence level for both bodily injury liability loss costs and relative claiming rates. However, no statistically significant difference in property damage liability loss costs exists between regulated and unregulated states for this time period.

Thus, economic theory, prior literature and the state comparisons above form the basis for the hypotheses tested in this study:

> H1: Bodily injury and property damage liability loss costs will be higher in rate regulated states.
>
> H2: The ratio of bodily injury to property damage liability claims (relative liability claims rate) will be higher in rate regulated states.

Previous empirical studies of automobile insurance rate regulation have documented that regulatory implementation, stringency and their effects appear to vary across states, even among those that nominally employ the same prior approval systems (e.g., Weiss and Choi, 2008; Harrington, 2002; Cummins, Phillips and Tennyson, 2001). Because of this, we also employ a continuous measure of rate regulation that can account for differences across states and years in the effects of regulation. To measure these differences, we take advantage of the fact that drivers for whom regulated rates are set below the market rate are more likely to be forced to obtain insurance in the residual market. In a market in which regulation distorts insurance rates away from cost-based rates, insurers will tend to reject risks for which the difference between loss costs and regulated rates is the largest. These rejected risks will then be insured in the state residual market at subsidized rates. Moreover, if residual market rates contain a large regulatory subsidy, this will also increase the fraction of drivers who receive their insurance there (Jaffee and Russell, 1998). Therefore, we use the size of a state's residual market as a measure of regulatory premium reductions.

Although both regulated and unregulated states operate residual market pools, the fraction of drivers insured through the residual market tends to be larger among the regulated states, and several formal empirical studies have found that prior approval rate regulation increases the proportion of drivers insured in the residual market (Bouzouita and Bajtelsmit, 1997; Ippolito, 1979; Harrington, 2002). This measure has also been used in studies of regulation in other insurance markets, and those studies found that residual market size is associated with higher loss cost inflation (Danzon and Harrington, 2000; Grace, Klein and Phillips, 2002). Because all states operate residual markets, examining the relationship between residual market size and insurance loss costs allows us to take into account the fact that states have means of compressing the insurance rate structure that may occur outside of prior approval regulatory systems. Economic theory predicts that the reduction of insurance prices below competitive levels for some or for all drivers will lead to cost-increasing incentive distortions—not prior approval regulation per se.

Thus, economic theory, prior literature and our state comparisons form the basis for two additional hypotheses tested in this study:

> H3: Bodily injury and property damage liability loss costs will be positively associated with the size of a state's residual market.
>
> H4: The ratio of bodily injury to property damage liability claims (relative liability claims rate) will be positively associated with the size of a state's residual market.

3. Empirical Models

The simple state comparisons in the previous section cannot control for other factors that might influence loss costs or claim rates across states. Therefore, this study uses regression analysis of state-level data on automobile insurance from all 50 states over the time period 1990-1998 to further examine the relationship between rate regulation and loss costs and claims rates.[10] Three different dependent variables are used in the regression analysis: bodily injury liability loss costs; property damage liability loss costs; and the ratio of bodily injury liability claim frequency to property damage liability claim frequency (the relative liability claims rate).

As noted above, we use two measures of regulation. Our first measure of regulation is an indicator variable that is set equal to one if the state regulatory regime is prior approval or more stringent during our period, and zero otherwise, again using the classification scheme in Harrington (2002). The models with the regulation indicator variable are first estimated using ordinary least squares. As noted above, there may be some concern about a potentially endogenous relationship between our rate regulation variable and insured loss costs in a state. To control for this effect, we also estimate the regression models using two-stage least squares. In the first stage, the likelihood that a state is regulated is modeled as the dependent variable, and the predicted value of the regulation variable is used as an instrument in the second stage estimation.[11]

10. Econometric tests indicate that our data are not characterized by heteroscedasticity, autocorrelation, or multicollinearity.

11. The variables used in the first stage of the regression model include all of the exogenous variables, as well as dummy variables set equal to one if the state has restrictions on the use of age as an underwriting factor and zero otherwise, average Medicaid payments to Medicaid recipients (and its squared value), and the unemployment rate squared. Statistical tests confirm that the excluded instruments are valid instruments and are strongly statistically significant in the first stage regressions.

We also use a continuous variable, the state residual market share, to measure the stringency of regulation within a state. The residual market share data are published by the Automobile Insurance Plans Service Office (AIPSO). We use the lagged value of the residual market share, due to the possibility that the current residual market share will be jointly determined with our dependent variables.[12]

Other Control Variables

Additional explanatory variables are included in the regression models to control for other factors that differ across states and might be expected to influence loss costs and/or relative claims rates. Income is likely to be an important predictor of average liability loss costs in a state and year. Bodily injury liability claims include compensation for income lost due to an accident, and so states with higher income levels would have higher bodily injury loss costs, all else equal. Also, higher income states might have a relatively larger proportion of higher priced cars, which would be more expensive to repair on average, thus increasing property damage liability loss costs. Finally, because the expected return to a liability claim might be more valuable as income increases, it might be the case that higher income states have higher relative claim rates than lower income states. However, auto insurance is relatively more expensive for lower income insureds on average. For example, Miller (1998) reports that auto insurance accounts for seven times the percentage of income for those families in the lowest income quintile as for those in the top quintile. Thus, income might be negatively associated with the propensity to file a bodily injury claim if the pay-off from doing so is relatively greater at lower incomes. Therefore, it is difficult to predict the relationship between income and relative claim rates across states. Statewide per capita income is used to control for any differences in loss costs or relative claims rates across states that are related to income.

Accident frequency is significantly higher for younger drivers than for the population in general. The accident frequency rate per mile driven for 16 to 19 year-olds is four times as high as for older drivers (IIHS, 2005a). But, younger drivers might experience lower severity per accident on average, since income losses are likely to be lower, injuries less severe, and autos driven are less expensive.[13] The relationship between claiming behavior and population age across states is also difficult to predict. It may be the case that, if both bodily injury and property damage liability costs are generally likely to be lower, younger

12. Lagged values of potentially endogenous variables are frequently used for econometric purposes since for the current period their values are predetermined (Judge et al., 1982). Statistical tests indicated that lagged residual market share is not endogenous in our time period. For the year 1990, the lagged residual market share is calculated using data for 1989. Our results are robust to including the current residual market share instead of the lagged value, and to treating the current or lagged residual market share as endogenous.

13. A recent study indicates that both first and third party property damage liability losses are highest for younger drivers, but that bodily injury liability losses are not significantly higher (HLDI, 2007).

drivers have reduced financial incentive to make claims. Alternatively, if compensation for auto liability losses is a large percent of income for younger drivers, they might be more likely to file a claim (even if the absolute amount of the claim is relatively low). Thus, the relationship between loss costs, claims frequency and population age across states is difficult to predict. The proportion of the population between age 18 and 24, as reported by the U.S. Census Bureau, is included in the analysis to control for differences in accident rates and claiming behavior by young drivers.[14]

There are significant differences in traffic density across states, and traffic density tends to be positively related to accident frequency. To control for these differences, the percentage of miles driven per million miles of roadway is included in our models. States also differ in the use of no-fault laws to limit tort claims. No-fault laws contain limits on the right to sue for non-economic losses arising out of automobile accidents, and provide for first party coverage for economic losses. States with no-fault laws may have lower bodily injury accident claims frequency, since some claims are eliminated from the system. However, average bodily injury accident severity would be expected to be larger, since only more serious bodily injury claims are permitted. Cummins and Weiss (1991) show that bodily injury loss costs are higher under no-fault with a monetary threshold as compared to a tort system, but lower under no-fault with a verbal threshold. Thus the effect of no-fault on loss costs is ambiguous. To control for the potential effects of no-fault across states, an indicator variable is used which is set equal to one in states and years in which no-fault laws are in place, and zero otherwise.[15]

As unemployment increases, fewer people are commuting to work, and therefore have a lower probability of being involved in an automobile accident. Further, lost income claims may be lower, on average, in states with relatively higher unemployment levels. However, the incentive to file claims might be greater as unemployment increases if the possible claims payment is seen as an additional source of income. Cummins and Tennyson (1996) suggest a positive association between unemployment and the willingness to file claims, but Browne and Puelz (1999) find no significant association between claims costs and unemployment. Average state-wide unemployment rates are reported by the Bureau of Labor Statistics and are used for this analysis.

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14. There is also reliable evidence that both accident frequency and severity are higher among younger males than younger females. This is because males drive more often and face greater exposure, and also because males are more likely to engage in risky behavior (see for example, IIHS 2005b; Hersch, 1996). A model was estimated in which the proportion of the population that was male was included as a control variable, but the coefficient for this variable was insignificant in all models. Additionally, the variable for the proportion of the population that was male was interacted with the younger driver variable, but no significant relationship between bodily injury or property damage liability loss costs, or relative claims rates was found with respect to this variable.

15. We also included a variable to indicate whether a state had a verbal or monetary threshold in its no-fault law, and a variable that measured the dollar amount of the no-fault threshold for monetary threshold states, but we found that these were not related to our dependent variables in any model, and so were dropped from the analysis.

Previous research has found that attorney involvement in claims is associated with higher claims severity (AIRAC, 1989; Browne and Puelz, 1996, 1999). As access to legal services increases, people may be more likely to file claims and claims costs will be higher overall for both bodily injury and property damage liability loss costs.[16] The measure of access to legal services used in the regression models is the number of people employed in the legal sector in a state divided by state population, as reported by County Business Patterns at the U.S. Census Bureau Web site. Because this ratio is so small relative to our other measures, it is scaled up by a factor of 1000 in the regression models.

Insured losses are also likely to differ across states based on a variety of factors that affect driving conditions and thus, the nature and frequency of automobile accidents: these include things such as weather and road conditions, traffic enforcement and speed limits. To control for these types of factors without introducing a large number of variables in our models, our regression models include the number of fatal traffic accidents per registered vehicle. There might also be differences in relative claims rates or average insured loss costs by state due to the size of the insurance market. To control for these potential differences, the number of car years insured in each state and year is included in the models. The variable is scaled down by a factor of 100,000 to make it comparable to the dependent variables in the model.

Finally, indicator variables for each year of the sample period are included to capture any differences in relative claiming rates or loss costs across time. All of the regression models also include indicator variables for each U.S. census region to capture any unmeasured differences across regions not accounted for by the included explanatory variables.[17] Table 2 contains the summary statistics for the dependent and explanatory variables in the analysis.

4. Discussion of Results

The results for our analysis are shown in Tables 3, 4 and 5. Table 3 shows the results for each dependent variable when regulation is measured by the indicator

16. At the state level, it seems unlikely that higher auto insurance costs would lead to more employment at legal firms in a state, and thus, we expect this variable to be exogenous in our regression models. However, if the legal employment variable is actually endogenous, then the possibility exists that the coefficients in our model are biased. To make sure that our coefficients are not biased, we ran the models without the legal employment variable. The regulation variables remain positive and significant and approximately the same magnitude in these models.

17. States also vary in the amount of insurance that drivers are required to carry for third party property damage and liability coverage, and some of these do change somewhat over our sample period. Since the required amount of insurance carried may be related to average insured losses, we included the minimum required limits for each state in our initial analysis. However, the results were not consistent across models, nor did inclusion of the limits affect the results of any other variable in the models, and so these were dropped from the analysis. Perhaps the behavior of these variables in the models is attributable to the fact that the limits did not vary that much within regions over the sample period.

variable, Table 4 shows the results when the regulation indicator is treated as endogenous by using two-stage least squares regression. Table 5 shows the results when regulation is measured by the lagged residual market share. Each table shows three models. In model 1, the dependent variable is bodily injury liability loss costs. Model 2 uses property damage liability loss costs, and model 3 uses the ratio of bodily injury to property damage liability claims frequencies as dependent variables.[18] The models are all statistically significant at greater than the one percent confidence level.

Across all models, we find strong support for the hypotheses that average insured loss costs per car year and claiming frequency are greater in states that use prior approval or more stringent regulation, even after controlling for other factors that might influence average loss costs and claiming rates in a state. The estimated coefficient of the regulation indicator variable in Table 3 is positive and statistically significant at better than the one percent level for all three dependent variables, indicating that regulated states have both higher loss costs and higher relative claims rates than unregulated states for our period. The results in Table 4 show that when regulation is treated as endogenous, the estimated coefficient is still positive and statistically significant at the one percent level for all three dependent variables. In Table 5, the lagged value of residual market share is also positive and statistically significant at better than the five percent level for all specifications of the dependent variable. These findings provide strong evidence that regulation that suppresses and/or compresses rates is associated with both higher loss costs and greater claiming rates.

The results for the control variables included in the analysis are robust to changes in the specification of the regulation variable. The regression estimation results indicate that loss costs and claiming rates are positively related to traffic density as measured by miles driven divided by million miles of roadway. The estimated coefficient is positive and statistically significant at the one percent level across the equations for all three dependent variables. Our results indicate that income is positive and significantly related to both bodily injury and property damage liability loss costs. However, there is no significant relationship between claiming rates and income regardless of the specification of the regulation variable used in the model.

We also find that states with no-fault laws have both lower bodily injury liability loss costs and lower bodily injury to property damage liability claims rates in the Table 5 results. The estimated coefficient is negative and significant at better than the one percent level regardless of the specification of the regulation variable used in the model. This is not surprising, since the goal of no-fault is to eliminate at least some bodily injury claims. However, there is no significant relation between no-fault and property damage liability loss costs on average.

We find positive and statistically significant associations between unemployment rates and both bodily injury and property damage liability loss

18. We do not report the regression estimates for the region and year dummy variables to conserve space on the tables.

costs, but unemployment rates are not statistically associated with relative claims rates. Fatality rates are negative and significantly related to both bodily injury loss costs and relative claim rates, but are not related to property damage liability loss costs. We find strong evidence that legal employment per capita is associated with both higher bodily injury and property damage liability loss costs, and with greater rates of claiming. The estimated coefficients for this variable are statistically significant at better than the one percent level for all models. This might reflect the greater costs of claims once attorney fees are included in claims payments, consistent with Brown and Puelz (1996, 1999), and suggests a relationship between attorney availability and bodily injury liability claim frequency.

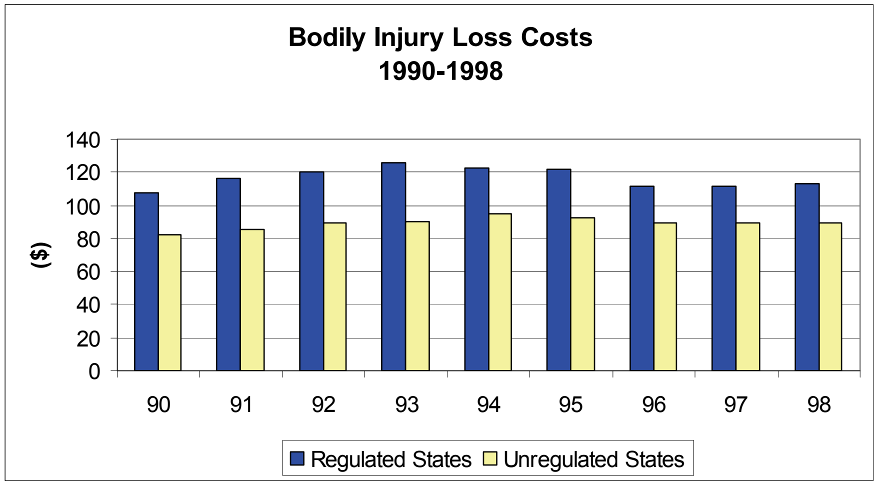
5. Conclusion

State regulation of automobile insurance rates may have the objective of making insurance more affordable to consumers by controlling insurer profits and pricing practices. Contrary to this view of regulation, economic theory predicts that distorting insurance prices through regulation will create driver and insurer incentives that will lead to higher average costs of insurance. This research analyzes the relation between automobile insurance rate regulation, bodily injury and property damage liability loss costs, and relative claims rates to determine whether states that allow insurers less discretion in setting rates experience higher relative claims rates and/or higher loss costs.

Our empirical results show a strong and consistent positive link between regulation and loss costs and claims rates, even after controlling for other factors that might differ across states. We also find that states that are more stringently regulated as measured by residual market share have both higher loss costs and greater claiming rates than less stringently regulated states. These findings have important implications for public policy. If regulation that is designed to increase coverage affordability results in higher average premiums to cover the resulting higher loss costs, one objective of rate regulation will be undermined. Cost increases must ultimately lead to higher average insurance prices, and these effects must be weighed against any societal gains from rate regulation.

Of course, other public policy goals might be served by this type of regulation. By lowering premiums for higher risk drivers, previously uninsured drivers may choose to purchase coverage, thus eliminating externalities associated with uninsured drivers (Jaffee and Russell, 1998). Public policy might tolerate higher accident costs, within limits, if it results from previously uninsured higher risk drivers obtaining insurance (Cohen and Dehejia, 2004). However, the existing research record provides no evidence that rate regulation decreases the rate of uninsured driving, either overall or among high risk drivers (Ma and Schmit, 2000; Jaffee and Russell, 1998). The relation between uninsured driving and insured loss costs is an important subject on its own and one worth further study.

Figure 1


Bodily Injury Loss Costs
1990-1998
($)
140
120
100
80
60
40
20
0
90
91
92
93
94
95
96
97
98
Regulated States
Unregulated States

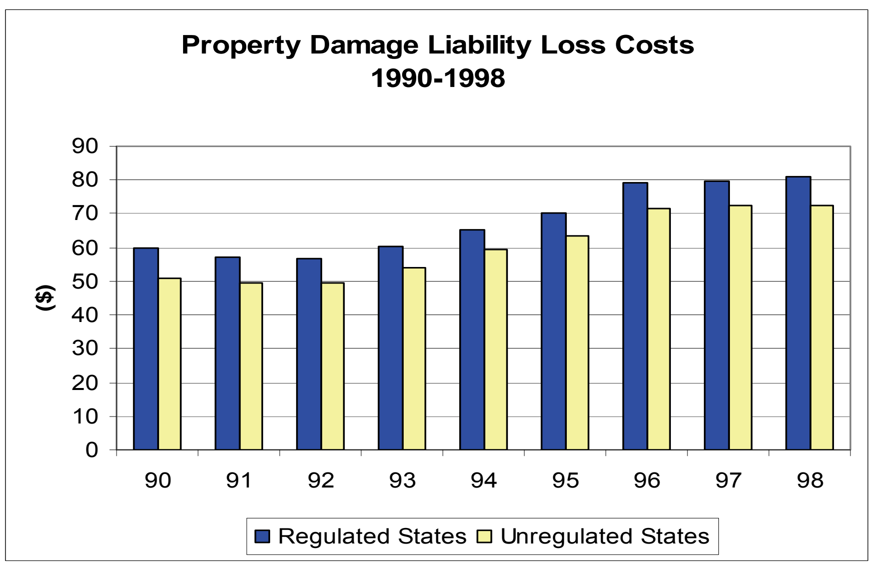

Property Damage Liability Loss Costs
1990-1998
($)
90
80
70
60
50
40
30
20
10
0
90
91
92
93
94
95
96
97
98
Regulated States
Unregulated States

Figure 1 (cont.)

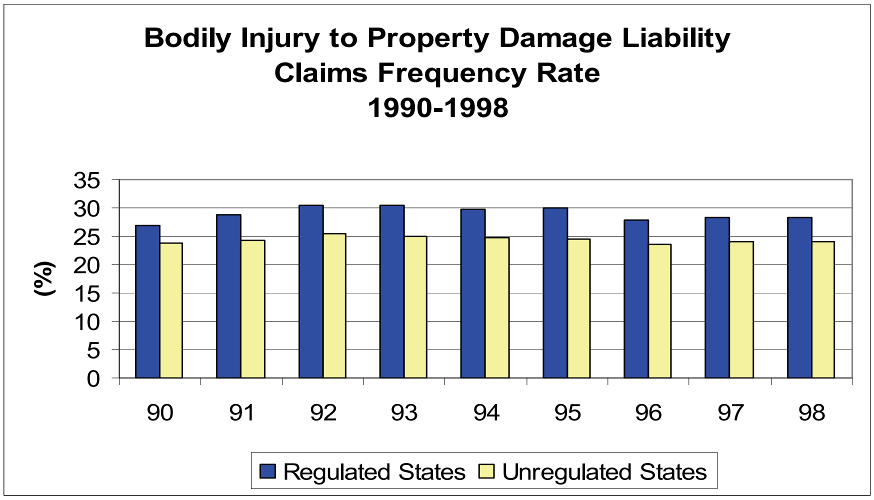


Table 1
Test for Differences in Means for Regulated and Unregulated States
1990-1998
Means and Standard Deviations

	Regulated States	Unregulated States	Probability
Bodily Injury Liability Loss Cost	$116.74	$89.23	< 0.0001
	$45.26	$28.96	
Property Damage Liability Loss Cost	$67.70	$60.27	0.1345
	$10.07	$9.89	
Bodily Injury to Property Damage	28.98	24.39	< 0.0001
Claims Frequency Ratio	1.24	0.653	

Source: IRC, Insurance Research Council's Trends in Auto Injury Claims database, 2000.
Note: Standard deviations appear below means. Probability corresponds to the results of t-tests for the null hypothesis that the means for regulated and unregulated states are equal.

Table 2
Sample Summary Statistics
1990 - 1998

	Mean	Standard Deviation
Bodily Injury Liability Loss Cost ($)	$ 107.32	$ 42.16
Property Damage Liability Loss Cost ($)	$ 65.05	$ 15.70
Bodily Injury to Property Damage Claims Frequency Ratio	0.27	0.11
Regulation Indicator Variable	0.60	0.48
Lag(Residual Market Share) (%)	3.53	8.48
No-Fault Indicator	0.27	0.45
Unemployment Rate (%)	5.56	1.51
Per Capita Income	$21,236.00	$4,135.00
Population 18-24 (%)	9.65	0.98
Traffic Density	0.66	0.45
Fatal Accident Rate	8.64	2.27
Per Capita Legal Employment	0.01	0.00
Market Size	29.43	27.79

Bodily injury liability loss cost is bodily injury claims paid divided by car years earned.
Property damage liability loss cost is claims paid divided by car years earned.
Bodily injury to Property damage claim frequency is bodily injury claims per 100 property damage claims.
Regulation Indicator is one if a state uses prior approval or more stringent regulation, and zero otherwise.
Residual market share is the percent of cars insured in the residual market.
No-fault Indicator is one if a state has a no-fault law, and zero otherwise.
Traffic Density is miles driven divided by million miles of roadway.
Fatal accident rate is the number of fatalities per million vehicle miles
Legal employment per capita is the number employed in legal establishments per 1,000 state population.
Market size is the number of written car years divided by 100,000.

Table 3
OLS Estimates with Rate Regulation Indicator
1990 - 1998

Variable	**Model 1** BILC		**Model 2** PDLC		**Model 3** BI to PD Ratio	
Intercept	-61.45	-2.95 ***	-11.93	-1.70 *	0.134	2.50 **
Regulation Indicator	9.330	3.25 ***	4.750	4.97 ***	0.033	4.38 ***
No-Fault Indicator	-18.830	-6.36 ***	0.713	0.72	-0.157	-23.12 ***
Unemployment Rate (%)	4.410	4.36 ***	0.634	1.69 *	0.001	0.22
Per Capita Income ($)	0.003	4.59 ***	0.002	6.20 ***	0.001	0.84
Population 18-24 (%)	193.860	1.64	184.630	3.84 ***	0.504	1.58
Traffic Density	46.080	7.94 ***	5.981	2.95 ***	0.069	4.44 ***
Fatal Accident Rate	-127.54	-2.38	-12.168	-0.55	-.5904	-4.31 ***
Per Capita Legal Employment	3.838	7.89 ***	0.958	6.21 ***	0.004	3.01 ***
Market Size	-0.249	-2.58 **	0.021	0.90	0.001	3.21 ***
Adjusted R-squared	0.71		0.74		0.69	

Note: ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels respectively.
Coefficients and robust T-statistics are reported.
All models also include year and region indicator variables.
Bodily injury liability loss cost is bodily injury claims paid divided by car years earned.
Property damage liability loss cost is claims paid divided by car years earned.
Bodily injury to Property damage claim frequency is bodily injury claims per 100 property damage claims.
Regulation Indicator is one if a state uses prior approval or more stringent regulation, and zero otherwise.
Residual market share is the percent of cars insured in the residual market.
No-fault Indicator is one if a state has a no-fault law, and zero otherwise.
Traffic Density is miles driven divided by million miles of roadway.
Fatal accident rate is the number of fatalities per million vehicle miles
Legal employment per capita is the number employed in legal establishments per 1,000 state population.
Market size is the number of written car years divided by 100,000.

Table 4
2SLS Estimates with Rate Regulation Indicator
1990 - 1998

Variable	**Model 1** BILC		**Model 2** PDLC		**Model 3** BI to PD Ratio	
Intercept	-84.313	-3.42 ***	-14.006	-1.95 *	0.078	1.35
Regulation Indicator	47.670	3.95 ***	8.420	2.82 ***	0.126	5.17 ***
No-Fault Indicator	-16.828	-4.75 ***	0.877	0.87	-0.153	-17.89 ***
Unemployment Rate (%)	1.963	1.35	0.397	0.99	-0.005	-1.32
Per Capita Income ($)	0.004	4.73 ***	0.002	6.57 ***	0.000	-0.47
Population 18-24 (%)	247.790	1.74 *	189.328	3.93 ***	0.636	1.71 *
Traffic Density	37.247	5.49 ***	5.187	2.71 ***	0.047	2.59 ***
Fatal Accident Rate	-177.303	-2.79 ***	-16.830	-0.76	-0.711	-4.81 ***
Per Capita Legal Employment	4.091	7.02 ***	0.990	6.22 ***	0.005	2.90 ***
Market Size	-0.205	-2.22 **	0.024	1.06	0.001	3.65 ***
Adjusted R-squared	0.62		0.74		0.61	

Note: ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels respectively.
Coefficients and robust T-statistics are reported.
All models include year and region indicator variables.
Bodily injury liability loss cost is bodily injury claims paid divided by car years earned.
Property damage liability loss cost is claims paid divided by car years earned.
Bodily injury to Property damage claim frequency is bodily injury claims per 100 property damage claims.
Regulation Indicator is one if a state uses prior approval or more stringent regulation, and zero otherwise.
Residual market share is the percent of cars insured in the residual market.
No-fault Indicator is one if a state has a no-fault law, and zero otherwise.
Traffic Density is miles driven divided by million miles of roadway.
Fatal accident rate is the number of fatalities per million vehicle miles.
Legal employment per capita is the number employed in legal establishments per 1,000 state population.
Market size is the number of written car years divided by 100,000.

Table 5
OLS Estimates with Lagged Residual Market Share
1990 - 1998

Variable	Model 1 BILC		Model 2 PDLC		Model 3 BI to PD Ratio	
Intercept	-54.646	-2.63 ***	-7.920	-1.18	0.163	3.12 ***
Lag(residual market share)	32.670	2.55 **	28.210	6.27 ***	0.230	5.72 ***
No-Fault Indicator	-19.470	-6.60 ***	0.315	0.34	-0.161	-23.32 ***
Unemployment Rate (%)	5.075	5.02 ***	0.995	2.64 ***	0.003	1.13
Per Capita Income ($)	0.003	4.38 ***	0.002	6.15 ***	0.000	0.93
Population 18-24 (%)	133.680	1.12	136.910	2.79 ***	0.121	0.37 *
Traffic Density	47.670	8.26 ***	6.630	3.33 ***	0.073	4.74 ***
Fatal Accident Rate	-107.190	-2.01 **	1.198	0.06	-0.4884	-3.68 ***
Per Capita Legal Employment	3.731	7.67 ***	0.894	5.61 ***	0.004	2.60 ***
Market Size	-0.251	-2.67 ***	0.015	0.68	0.001	3.06 ***
Adjusted R-squared	0.71		0.74		0.70	

Note: ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels respectively.
Coefficients and robust T-statistics are reported.
All models also include year and region indicator variables.
Bodily injury liability loss cost is bodily injury claims paid divided by car years earned.
Property damage liability loss cost is claims paid divided by car years earned.
Bodily injury to Property damage claim frequency is bodily injury claims per 100 property damage claims.
Regulation Indicator is one if a state uses prior approval or more stringent regulation, and zero otherwise.
Residual market share is the percent of cars insured in the residual market.
No-fault Indicator is one if a state has a no-fault law, and zero otherwise.
Traffic Density is miles driven divided by million miles of roadway.
Fatal accident rate is the number of fatalities per million vehicle miles.
Legal employment per capita is the number employed in legal establishments per 1,000 state population.
Market size is the number of written car years divided by 100,000.

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