Media Attention, Insurance Regulation and Liability Insurance

by M. Martin Boyer

Working Paper 99-05
August 1999

ISSN : 1206-3304

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Abstract

The goal of this paper is to test whether the threat of regulating (or of more stringent regulation of) automobile liability insurance as portrayed in the popular and industry press induces insurers to change the way they price their policies. More to the point, using quarterly state data from 1984 to 1993 we attempt to determine whether insurance companies reduced premium increases to avoid regulation, a test we call the *Regulatory Threat Hypothesis*. Our results suggest that automobile liability insurance premiums increase at a slower pace (or decrease) in the presence of a regulatory threat.

JEL : G22, L5, C35

Keywords : Regulation, Voluntary Price Restraints, Automobile Liability Insurance, Regulatory Threat.

Résumé

Le but de cet article est de tester si les menaces de réglementation de l'assurance responsabilité des automobilistes, telles que véhiculées par la presse populaire et professionnelle, ont incité les assureurs à modifier la manière dont ils fixent les primes. Plus spécifiquement, nous utilisons des données trimestrielles pour voir si les assureurs ont réduit leurs primes pour éviter d'être réglementés. Nous testons alors ce que nous appelons l'*hypothèse des menaces de réglementation*. Nos résultats semblent indiquer que les primes d'assurance responsabilité automobile ont crû à un rythme plus faible en présence de menaces de réglementation.

JEL: G22, L5, C35

Mots clés : Réglementation, réduction volontaire des prix, assurance automobile, menaces de réglementation.

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ABSTRACT: The goal of this paper is to test whether the threat of regulating automobile liability insurance as portrayed in the popular and industry press induces insurers to change the way they price their policies. More to the point, using quarterly state data from 1984 to 1993 we attempt to determine whether insurance companies reduced premium increases to avoid regulation, a test we call the Regulatory Threat Hypothesis. The results of the regressions suggest that automobile liability insurance premiums increase at a slower pace (or decrease) in the presence of a regulatory threat.

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1 Introduction and Motivation

It is well known that …rms react to outside pressure. Many companies have public relations departments to deal with pressure groups and other outside forces that may a¤ect pro…ts. Insurance companies faced such outside pressure in the mid to late-1980s during the so-called insurance liability crisis. This crisis a¤ected all types of liability insurance including personal automobile liability insurance.[1] The 1980s was also a period of great political pressure on state regulators. Consumer groups throughout the United States petitioned state regulators to mandate insurance …rms to reduce premiums, or at least the rate of increase. One consumer group collected so many signatures that California held a referendum in November 1988 on automobile insurance premiums regulation. The referendum was known as Proposition 103.[2]

The referendum basically asked whether insurance companies should be mandated to reduce automobile liability premiums, and whether any premium increase should be approved by an elected insurance commissioner.[3] The popular vote was almost evenly divided, but ultimately Proposition 103 passed with 51% of the vote. A main driver of the vote was the behavior of city dwellers (especially in Orange County) who saw an opportunity to extract money from suburban residents. Higher premiums are paid in cities and city dwellers voted in favor of Proposition 103 since it asked for rates to be based on experience rather than geographic location. This behavior would follow the argument initiated by Peltzman (1976), who argued that di¤erent groups use their political clout to in‡uence regulation.

The vote rocked the stock market as the value of insurance companies publicly traded plummeted. Fields et al. (1990) found that insurance companies doing business in California had an average cumulative abnormal return of ¡6:9%, which means that insurers' stock prices under performed the market by 6:9%. In addition, the more the business a company had in California, the greater the negative cumulative abnormal return. What is even more surprising is that a …rm's proportion of business in states neighboring California also had a negative impact on the cumulative abnormal return. Moreover, the stock price of some …rms with no operation in California also fell.[4]

One possible explanation for this phenomenon is that investors in …rms operating in states neighboring California were afraid that insurance rates were going to be controlled there as well. In fact, this concern may have been well founded; according to a survey, 90% of Americans would be in favor of passing a law similar to California's Proposition 103.[5]

[1] Berger, Cummins and Tennyson (1994) examine the case of the general liability insurance crisis and its impact on the greater general liability reinsurance market. For a detailed exposition of the liability crisis in personal automobile insurance, see Cummins and Tennyson (1992).

[2] The case of California is special, not only because it is the largest market in the United States, but also because California is one of the few states where popular referendums are binding.

[3] More to the point, Proposition 103 asked for the following: premium rates to be cut by a minimum 20 percent; all rates would have to be approved by the insurance commissioner; the commissioner would be elected by the public rather than appointed by the governor; and the rates were to be based on driving history rather than geographic location.

[4] National Underwriter, 7 October 1989.

[5] National Underwriter, 26 June 1989.

If investors perceived threats of regulation in states other than California, then one has to wonder whether the insurance companies themselves perceived such regulatory threats. If the insurance industry acknowledges the possibility of regulation, then it seems natural to conclude that it will do something to reduce the probability of such regulation. The question is, What should the industry do? There are at least two ways the insurance industry can react to the threat of regulation.

The …rst is to in‡uence the regulator so that it becomes more conciliatory toward insurers.[6] The second is to persuade the population through voluntary price reductions not to support state insurance commissioners' threat of regulation. The former tactic is in line with the capture theory idea introduced by Stigler (1971) and Posner (1974), while the latter is the main subject of this paper. Obviously, the industry can use both tactics at the same time. We can think of a game where insurance …rms …rst set premiums (perhaps voluntarily reduce them in certain instances), and then compete with so-called consumer groups to capture the regulator. If premiums are set low, consumer groups would be less inclined to devote money and energy to capturing the regulator since they do not have much to gain. As a consequence, it becomes easier for the industry to capture the regulator since they are the only ones to apply pressure. Once the regulator has been captured, insurers are then able to increase premiums to normal levels.

The use of voluntary price restraints by producers has been shown by Er‡e and McMillan (1990) (see also Er‡e, McMillan and Grofman, 1989, and Glazer and McMillan, 1992). They showed that during the oil crisis of the Seventies …rms voluntarily reduced price increases of the most visible sort of oil to convince the federal government that no price ceilings were needed.

In this paper, we apply a similar technique to that of Er‡e and McMillan (1990) to test the regulatory threat hypothesis for the property and liability insurance industry. According to that hypothesis, insurance companies in markets where price regulation (or more stringent price regulation) is possible should voluntarily reduce premiums or premium increases so as to signal to the population and the regulator that premiums are not too high and that further regulation is not necessary. We use the automobile liability insurance industry because it is already heavily regulated sector in many states. Furthermore, there was a large movement toward insurance rate suppressions during the insurance liability crisis of the mid 1980s (see Harrington, 1992, and Kramer, 1992), and before that (see Harrington, 1987). Therefore the threat of regulation or the threat of more stringent regulation may have been more credible than in any other given economic sector.

To test our model, we use the Fast Track data tapes available through the National Association of Independent Insurers (NAII). These tapes provide us with basic quarterly insurance market data for every state, plus the District of Columbia. Such data include total premiums paid, number of exposure units and total losses incurred. The tapes span 1984 to 1993 inclusively. This period is signi…cant in that the liability

[6] Throughout the paper we suppose that the only possible intervention from the insurance commissioner's o¢ce is to reduce price ceilings for automobile liability insurance premiums. Insurers can capture the regulator by having it not reduce the ceilings, or increase them. We shall assume that insurance commissioners cannot set price ‡oors.

crisis occurred in 1987-89. Therefore, the tapes give us a su¢cient number of observation quarters before and after the crisis to test our regulatory threat hypothesis.

This paper's contributions are two-fold. The …rst is the empirical analysis of the pricing behavior of insurers threatened by regulation.[7] The second concerns the construction of the regulatory threat variable. We have researched close to 130 newspapers and business journals from 1984 to 1993 and highlighted all the threats of regulation that arose in every state for any quarter of any year. The regulatory threat variable took the value one if there was discussion of liability insurance premium regulation.

The main result we obtain is that the threat of regulation had a signi…cant impact on the pricing behavior of insurance companies in the personal automobile liability insurance industry. We also …nd that price increases were signi…cantly smaller after the passage of Proposition 103 in California. We conclude from these two results that the insurance industry reduced premium in‡ation as a result of regulatory threats reported by the news media. We also conclude that the passage of Proposition 103 sent a signal to the industry that regulation or more stringent regulation was a serious possibility after 1988.

The paper is structured as follows. In section 2, we develop a simple model of how …rms price their product. We present our primary results in section 3. The ordinary least-square analysis is …rst presented to determine what a¤ects the average premium increase[8] in a state in a quarter. We …nd that price increases are smaller whenever there is a threat of regulation. In section 4 we present a two-step estimator procedure to control for the simultaneity between premium increase and the presence of a regulatory threat. After controlling for many outside factors we …nd evidence to support the regulatory threat hypothesis that is quite robust to model variations (section 5). Finally, section 6 concludes.

2 Model

2.1 Institutional background

Insurance services in the United States are regulated at the state level under the McCarran-Ferguson Act. Each state appoints an insurance commissioner (or regulator) who oversees insurance practices in the state. The level of intervention of insurance commissioners varies greatly not only across states, but also across lines of insurance within a state. Insurance commissioners are either appointed by the state or elected by the general population.

There are four broad types of regulatory stringency in the United States. The least stringent is called No File. In this case, insurance companies are not required to …le their rates with the state insurance department. Insurance companies, however, need to keep a historical database of their rates and experience and make

[7] A similar study was done by Er‡e and McMillan (1990), for the oil and gas industry. Er‡e and McMillan collected four years of weekly data for the state of New York, for six oil and gas companies. This yielded a maximum of 1,218 observations. We have 10 years of quarterly data for 50 states and the District of Columbia. This yields a potential of 2,040 observations.

[8] We shall refer to premium increases to indicate premium variations (premium increases and premium decreases). Premium decreases should therefore be viewed as negative increases.

it available to the insurance commissioner upon request. The third-most-stringent type of regulation is called File and Use (F&U) and Use and File (U&F).[9] In this type of regulation, rates must be …led with the state insurance department either before (F&U) or after (U&F) they are being used. Speci…c approval is not required, but the insurance commissioner reserves the right of subsequent disapproval. The second-most-stringent kind of regulation is called Prior Approval. In this case, rates must be …led with the insurance commissioner who must approve them.[10] In the most stringent kind of regulation, the insurance commissioner sets the rates. This type of regulation is called Promulgated.

There has been a broad trend to automobile insurance regulation in the past 30 years. Joskow (1976) …rst noticed that insurance commissioners helped insurance companies maintain higher than competitive rates by helping collusion amongst insurers. The wave of deregulation in the late 1970's and early 1980's was associated with a marked reduction in premiums paid, since collusion amongst insurer was no longer helped by the insurance commissioner. In the late 1980's, the regulation pendulum was moving toward regulation that suppressed rates. Thus insurance commissioners were no longer allies of the insurance industry, but rather allies of consumer groups that believed insurance companies were making excessive pro…ts. The liability crisis of the late 1980's fell right in the midst of this wave of reregulation.

Insurance companies that previously welcomed the presence of tight regulation were now worried about becoming regulated again.[11] The new commissioners are presumably less likely to act in the best interests of insurance companies. Thus insurers were some of the staunchest opponents of the reregulation frenzy of the late 1980's and early 1990's.

Our paper …ts exactly within that time frame. Perhaps because the available reinsurance capital was drying up (see Berger, Cummins and Tennyson, 1993), or because of enormous liability settlements were being awarded by the courts, insurance companies faced greater losses and had little reserves left in the 1980's. This was called the liability crisis. Insurers needed to increase premiums to o¤set those two capital-reducing events. Premium increases were not welcomed by the general population. Consumer groups pressed for reregulation that would establish price ceilings and other constraints on insurers. Our paper documents how insurers responded to regulatory threats during the liability crisis. We argue that a simple way to respond is to reduce premium increases to reassure consumers that more stringent regulation in the form of a price ceiling is not warranted.

[9] We group them in a single category since they basicaly amount to the same regulatory stringency in practice.

[10] In some states Flex Rating and Modi…ed Prior Approval regulation are similar in spirit to Prior Approval, while the regulation in others are similar in spirit to File and Use. In both cases, rate revisions are subject to prior approval if they involve changes in expense ratios and rate relativity (Modi…ed Prior) or if rate changes exceed a threshold (Flex).

[11] The reason being that state insurance departments were previously headed more often than not by industry-friendly commissioners.

2.2 Model

Our model draws extensively on that of Erfle and McMillan (1990). Suppose the insurance industry is not indifferent between voluntary and mandatory restraints. Although both restraints lead to the same results in the short term, voluntary restraints are not necessarily permanent. Mandatory restraints, however, can be somewhat permanent in that the industry cannot remove them as it wishes. The value of the firm today depends on its expected value in the next period. The firm's next-period value is either V_u if the regulatory environment remains unchanged, or V_r if the regulatory environment is more stringent.[12] Assume that $V_u > V_r$. Assume also that $V_p'(p; y) > 0$ and $V_{pp}''(p; y) < 0$, where p is the premium charged by the firm, and y is a vector of all other factors in the economy that may influence a firm's value. Let q be the probability that the value of the firm is V_r. If q is independent of the firm's behavior, the expected value of the firm is

$$EV = (1 - q) V_u(p) + q V_r \tag{1}$$

Suppose now that q depends on the price the firm charges for its service, namely liability insurance. In other words, suppose that $q = q(p; x)$, where p is the price of a liability insurance contract and x is a vector of some outside parameters over which a firm has no control. The first order condition of this program is

$$\frac{dEV}{dp} = (1 - q(x; p)) \frac{dV_u}{dp} - (V_u(p) - V_r) \frac{dq}{dp}(x; p) = 0 \tag{2}$$

Suppose that $\frac{dq}{dp} \geq 0$.[13] Thus $\frac{dV_u}{dp}$ must also be greater than or equal to zero. Denote by p^* the equilibrium price charged by the industry if its behavior has no impact on the probability of being regulated. Since $\frac{dV_u}{dp} > 0$ when $\frac{dq}{dp} > 0$, then it must be that $p < p^*$ since we assumed that $V'' < 0$. Therefore if there is a non-zero chance that the insurance industry will become regulated, then insurers will charge a lower premium than they will when under no threat of regulation.

The test we are conducting is whether the threat of regulation influenced the pricing of liability insurance. We want to assess the impact a change in the value of q has on the price charged by insurers. Isolating $\frac{dV_u}{dp}$ in the previous equation yields

$$\frac{dV_u}{dp} = (V_u(p) - V_r) \left(\frac{dq}{dp}(x; p) \right) \frac{1}{1 - q(x; p)} \tag{3}$$

We see from this equation that if the probability of being regulated (q) increases, and $\frac{dq}{dp}$ remains con-

[12] As mentioned earlier, we shall assume that regulation is not good for the insurance industry in that more stringent regulation means lower price ceilings. This seems like a plausible assumption for the time frame under study. It is true that in the past more stringent regulation often meant higher price floors (see Joskow, 1978). This was no longer the case, however, in the late 1980's and early 1990's (see Kramer, 1992, and Harrington, 1992).

[13] The question is not whether it makes sense for $\frac{dq}{dp}$ to be positive, but rather whether it makes sense to be anything else. Suppose $\frac{dq}{dp}$ is negative. Thus the higher the price for insurance, the less probable regulation becomes. This does not make much sense in today's business environment. It seems more likely that an industry is more apt to be regulated if it charges too high a price than too low. Therefore it is logical to presume that $\frac{dq}{dp}$ is positive.

stant,[14] then $\frac{dV_u}{dp}$ must also increase. Thus the price that an insurer charges its policyholder must decrease. Alternatively, if $\frac{dq}{dp}$ increases, then $\frac{dV_u}{dp}$ must also increase; this means that the equilibrium price must decrease. Therefore, as the probability of regulation increases, insurance companies should reduce premium increases. We also need to control for the impact of price on the probability of more stringent regulation, using a two-step procedure.

To test this simple model, we need to use a line of insurance that is subject to regulation, and whose possible regulation was discussed extensively for a time. The line is personal automobile liability insurance, and the time is the liability crisis of the late 1980's.[15]

2.3 Testable Model

We first present our dependent variable, the average premium increase in automobile liability insurance. The data on insurance prices come from the National Association of Independent Insurers (NAII) Fast Track Data Tapes. Insurance companies reporting to the NAII are typically the larger insurers. Although this factor may cause a bias in some instances, we do not believe it to be large in our study. The reason is that larger companies are expected to be more responsive to political pressure, as Erfle and McMillan (1990) found for the oil industry. Another limitation of the NAII tapes is that reporting varies across companies (for example, the definition of a claim paid varies across companies) and the reporting is not subject to stringent edit screens as in other data bases such as the NAIC's or Bests'. The Fast Track tapes provide information on both the automobile and homeowner insurance markets. The data are divided by state and by quarter. We have access to 10 years of data (1984-1993). The states of California and New Jersey have been removed from the data set because of omissions in the data,[16] and so has the District of Columbia. Because of the presence of lagged variables, we are left with quarterly data for 48 states which span nine years (85-93). This yields a total of $1{,}764$ observations.

The NAII tapes provide the total number of units insured in a state in a quarter (exposure units) and the total earned premium amount for the same period. We shall use the ratio of total earned premiums to total exposure units as the measure of the price of insurance ($PREMAVG$). The dependent variable is constructed with this price of insurance. We calculate the percentage increase in the average premium in

[14] This can happen if q is a quasi linear function of the premium. For example, if $q(x;p) = \phi(x) + \rho(p)$, then variations in $\phi(x)$ affect $q(x;p)$, but not $\frac{dq}{dp}$.

[15] Automobile liability insurance presents two interesting characteristics. First, it is readily available. And second, the regulation of it was a subject of considerable controversy in the late 1980's and early 1990's.

[16] The passage of Proposition 103 in California and the Fair Access to Insurance Reform Act of 1992 in New Jersey prohibited statistical agents from publishing information on California and New Jersey. Even if we had the information on California, we do not believe including it would make for sound econometrics. By including California, we would be biasing our regulatory threat hypothesis toward not rejecting it since there was a great deal of talk about rate regulation in California after the passage of Proposition 103, and premiums dropped suddenly in 1989. And since we use what happened in California as a starting point for all the regulatory movements, including California would amount to double counting events that occurred there.

automobile liability insurance (AUTOINC).[17] It is thus constructed as

$$AUTOINC = 100 \times \frac{PREMAVG - PREMAVG_{t-1}}{PREMAVG_{t-1}} \quad (4)$$

Premium increases in comprehensive (COMPINC) and homeowner (HOMINC) are constructed in the same manner. Figure 1 plots percentage premium increases by quarter for the years 1985 to 1993.

We see in figure 1 that the three types of insurance followed the same pattern, especially after period 18 (which corresponds to the second quarter of 1989). COMPINC and AUTOINC have closer patterns than HOMEINC, which is to be expected since the first two relate to the same underlying product, the automobile. This makes it even more important to control for premium increases in other lines of insurance. We note also that premium increases seem to be more variable for homeowner insurance. This observation from the figure is confirmed when we look at our summary statistics in table 1B. By correcting for endogeneity between the three lines of insurance does not change the main results of the paper. If anything, the size of the THREAT coefficient becomes more negative and more significant.

We also observe a seasonal pattern in premium increases. This suggests that we will need to deseasonalize the data using dummy variables for quarters. Another interesting observation regarding premium increases is that there is a sharp drop in the last quarter of the last year of the data (period 36), which might have been caused by redlining issues that came to light in 1993.

Figure 2 illustrates how the average premium and the average loss evolved from 1985 to 1993. We see that until 1991 (period 25), the average loss and the average premium were very close. In 1991, however, average losses seem to stabilize, while average premiums keep increasing. Thus premium increases seem to have been warranted before 1991 as most if not all of them were returned to policyholder as indemnity payments. This is no longer the case starting in 1991as we observe that the gap between the average premium and the average loss increase and reach a maximum in late 1993.

What we now need to construct is a variable that measures the perceived threat of automobile liability insurance regulation or of more stringent regulation by the insurance industry itself. We shall use the level of public attention to automobile insurance rate reduction in the news media as an approximation of the threat of regulation. It seems appropriate to use the amount of publicity that rate regulation gets in the press, since previous studies, such as Iyengar et al. (1982) and Behr and Iyengar (1985), have found that although the media cannot tell the public what to think, they can tell the public what to think about. Their results suggest that as the news media direct their attention to a certain subject, or intensifies their coverage of it, the public starts to think more deeply about it. This can possibly generate political pressure until the issue put forward in the media is resolved.

The regulatory threat variable (THREAT) was constructed with the LEXIS/NEXIS on-line service.

[17] A lagged value shall be denoted with subscript $t-1$. For example, the lagged value of PREMAVG is given by $PREMAVG_{t-1}$. When there is no subscript we are referring to the current period.

We went through LEXIS/NEXIS to research all references to automobile insurance rate regulation in the United States between 1984 and 1993.[18] About 130 newspaper and business journal titles were included in our search. The THREAT variable is constructed as a dummy whose value equals one when there is some reference to automobile insurance rate regulation in a state in that quarter, and zero otherwise.[19] We constructed the THREAT variable in this manner to represent all discussions, whether in newspapers not included in LEXIS/NEXIS, or on the radio and television, that could have occurred in the state on automobile insurance rate regulation. Table 1A presents the distribution of that variable by quarter and by state.

With other control variables[20] (the summary statistics of all variables are shown in table 1B), the testable equation is

$$AUTOINC_{tj} = Cst + THREAT_{tj} + other_{tj} + \varepsilon_{tj} \quad (5)$$

where index t represents the period, and j represents the state. Our regulatory threat hypothesis predicts that media coverage of the regulation issue will negatively affect the percentage premium increase of automobile liability insurance. Therefore, assuming that the regulatory threat variable represents the amount of political pressure on regulating automobile liability insurance more stringently, we expect the THREAT coefficient to be negative.

3 Primary Results

3.1 OLS Results

We begin by showing what we shall use as our structural model in the two-step procedure.

The variable of interest in this study is THREAT. It appear that the threat of regulation negatively affected the increase in the average premium for automobile liability insurance during the liability crisis of the late 1980's. Its impact is of the predicted sign, but significant at the 10% level only.

We also include as an explanation for automobile liability premium increase premium increases for two other lines of insurance. We do this to control for insurance price increases in general, perhaps owing to greater expenses. We expected the impact on AUTOINC of the price increase in comprehensive automobile insurance (COMPINC) and in homeowner insurance (HOMEINC) to be positive.[21] Furthermore, since comprehensive insurance relates basically to the same insured good, it is natural to expect COMPINC to

[18] The exact search on LEXIS/NEXIS was performed with the following parameters: insurance with regulation in the same sentence, and rate with regulation in the same paragraph, and automobile, and date between 1983 and 1994. This search provided 2,134 hits. After eliminating the articles that were not relevant (for example, we eliminated the hits related to automobile credit insurance regulation), we were left with 154 usable hits.

[19] Taking into account multiple hits does not change the results significantly as we discuss in section 5.2.

[20] The list, construction and source of the variables are provided in the appendix.

[21] The reason we used comprehensive insurance instead of collision was purely arbitrary. The results were almost the same whether we used comprehensive or collision to represent price increases in automobile insurance in general.

have a greater impact on AUTOINC than HOMEINC. It seems that we were right. The coe¢cient of COMPINC is indeed positive and greater than the coe¢cient of HOMEINC, which is also positive. Both coe¢cients are signi…cantly di¤erent from zero. We also control for the average premium paid by policyholders and for insurance market conditions observed last period. We expect that the greater PREMAVG is, the smaller the percentage increase will be. It seems that our expectations are supported, since the coe¢cient of PREMAVG is negative, and signi…cant at the 1% level. We include past market conditions in our analysis because insurers use this information to decide what kind of price increase is warranted in this period.

The …rst such variable is last period's percentage price increase, $AUTOINC_{t-1}$. We expect that last period's price increase should positively a¤ect the current period's price increase. Our reasoning is that if policyholders were willing to accept a given premium increase last quarter, they may still be willing to accept a similar price increase this quarter. The other lagged variable we include is the unit price of insurance, $UNIT_{t-1}$. The unit price is given by the ratio of total premiums earned to total losses incurred. We expect this variable to have a negative impact on this quarter's premium increase. Our hypothesis is based on the fact that a greater unit price last quarter means that the insurer collected relatively more premiums than it paid in losses. As a result the insurer may feel pressure to decrease premiums this quarter because of the excess reserves accumulated last quarter. Our results seem to support those expectations. The coe¢cient of $AUTOINC_{t-1}$ is positive and the coe¢cient of $UNIT_{t-1}$ is negative. Furthermore both are signi…cant at the 1% level.

We also added a few indicators to correct for seasonality (Q1, Q2, Q3), the passage of Proposition 103 in California (PROP103), and the problem of red-lining in homeowner insurance in 1993 (DUM93). If the passage of Proposition 103 did indeed send a credible message[22] to the markets that regulation had a higher probability of occurrence, then we should expect its coe¢cient to be negative. According to the results the impact of PROP103 on the price increase of automobile liability insurance is signi…cant and of the expected sign. DUM93, which is an instrument for all red-lining problems that surfaced in 1993, is also signi…cant and of the expected sign. This variable is constructed as a dummy variable whose value is 1 for the year 1993, and zero otherwise. It seems that the red-lining problems of 1993 caused a sharp reduction in the average price increase of liability insurance. This would make sense if insurers did indeed eliminate their bad risks from their portfolios, which is why insurers were suspected of red-lining some policyholders.

The signi…cance of DUM93 and PROP103 prompted us to check whether there were two types of trend in the data set. A logical breaking point in the trend is the passage of Proposition 103 in California. It is quite possible that there was some trend before the passage of Proposition 103, and some other trend after. It seems that this is the case; there seems to have been no particular trend prior to the passage of Proposition

[22] Er‡e and McMillan (1990) suggested that for a threat to have an impact, that threat has to be credible. The economic literature has many examples that predict that non-credible threats should have no impact on the behavior of economic agents. In game theory, any game where cheap talk is involved can be considered a game where threats are not credible.

103 (TREND), and a negative and signi…cant trend afterwards (TREND103). This would strengthen the view that the passage of Proposition 103 sent a credible signal to insurers that regulatory threats should be taken seriously, and thus that insurers should reduce premiums as a response.

Finally, we controlled for expected general …nancial market conditions. An insurer anticipates those …nancial conditions when deciding what premium to charge. These general …nancial variables are the expected return on the United States three-month treasury bill (TBILL), on long-term corporate debt (CORPBOND) and on the Standard & Poor's 500 stock index (SNP500). These returns are all in real terms. We also include the expected rate of in‡ation (CPI).

The reason we include those variables is that insurers base their premiums on the amount of investment income they expect to receive by investing the premiums they collect (see Myers and Cohn, 1987, and Cummins, 1992). Thus if an insurer expects higher investment income, it will be able to reduce premiums accordingly. Therefore, the expected return on United States treasury bill, on long-term corporate debt, and on the S&P 500 should have a negative impact on AUTOINC. In other words, a higher expected investment return should translate into lower average premiums. Conversely, a higher expected rate of in‡ation should be met with higher premiums because losses will be relatively larger in the future.

Those expectations were calculated by regressing a quarter's return over the return obtained in the last three quarters, a trend variable and quarter dummies. Using the predicted values of those regressions gives us the expected return of an insurer. The regressions are shown in table 3.

Only the expected return on the United States three-month treasury bill (TBILL) is signi…cant at the one percent level and of the expected sign. The expected rate of in‡ation (CPI) is also of the predicted sign, and signi…cant at the ten percent level. The expected return on the S&P500 (SNP500) is not of the correct sign, but it is not signi…cant either. Finally we see that expected return on long-term corporate debt (CORPBOND) is also not of the predicted sign, and that it is signi…cant. A possible explanation for this result is that the rate of return on corporate debt does not represent the possible investment return of an insurer, but represent the insurer's cost of issuing debt on the markets. As the cost of issuing debt increases, insurers must increase premium to pay the higher interest rates demanded by the markets.

Interestingly, if we do not control for the investment opportunities of insurers and past insurance market conditions, THREAT is no longer signi…cant (result not shown). Thus controlling for …nancial opportunities both in terms of the money accumulated through greater reserves ($UNIT_{t-1}$) and future market conditions (TBILL, SNP500, CORPBOND, and CPI), insurers are inclined to listen to regulatory threats. The intuition behind this result is straightforward. Recall that the basic model stipulates that a …rm's value is just equal to the average of its value under regulation and under no-regulation. By controlling for investment opportunities we increase the value of the …rm under no-regulation. If the …rm has greater value without regulation, it may be more willing to ensure that it does not become regulated. A way to do this is to pay attention to what is transmitted in the news media about the possibility of regulating insurance.

The regression presented in table 2 explains 50% of the variation in premium increases. Most of the variables are of the predicted sign, and signi…cant. We shall use this last model as our structural equation in our two-step procedure.

It is possible that the relation between THREAT and AUTOINC is not as speci…ed in the above model. One possibility is that THREAT and AUTOINC are chosen simultaneously. Thus by using an OLS we may be misspecifying the model. Moreover, in the model's equation 3, we observe the term $\frac{dq}{dp}$. This term is not taken into account in the basic OLS regression. We address this point in section 4 of the paper when we conduct a two-step estimator procedure. We will see if we control for the simultaneity between the two variables, our results not only hold, but that the impact of THREAT on AUTOINC is larger and more signi…cant. But …rst we shall present the logistic regression used to explain the presence of a regulatory threat.

3.2 LOGIT Results

With other control variables, the testable logistic equation is

$$THREAT_{tj} = Cst + AUTOINC_{tj} + other_{tj} + \varepsilon_{tj} \quad (6)$$

In table 4, we present the result of our logistic regression using THREAT as the dependent variable and AUTOINC as an explanatory variable. We see that AUTOINC is not signi…cant. We divided the time period in two to examine if the passage of Proposition 103 in‡uenced the presence of a regulatory threat. We also deseasonalized the data and controlled for the red-lining problems in 1993 as in table 2. We hypothesize that both PROP103 and DUM93 should have a positive sign. PROP103 should be positive because consumer groups outside California may have wanted to jump on the bandwagon of Proposition 103 and request similar reforms in their own state. Our hypothesis is supported since PROP103's coe¢cient is positive and signi…cant at the 1% level. DUM93 should be positive because red-lining problems in 1993 should induce consumers to request more regulation. Our hypothesis does not seem to be supported though as DUM93 is not signi…cant. This may be explained by the fact that regulatory threat in 1993 were aimed at homeowner insurance rather than automobile insurance.

There appear to be two di¤erent trends in the data. Prior to the passage of Proposition 103, the trend is positive and signi…cant, whereas after Proposition 103 there is no signi…cant trend as we can see by adding the coe¢cients of TREND and TREND103. This indicates that there was a build-up in the presence of a regulatory threat leading to Proposition 103, and that the likelihood of a threat reached a plateau at that point. Only one of the quarter dummies (Q3) is signi…cant. Its negative sign suggests that there were fewer threats in the Summer. This is logical if we believe that people have better things to do during their vacation than complain about insurance premiums.

We finally added four other variables in the regression to explain THREAT: the average premium (PREMAVG), the average loss paid (LOSSPAID), an election dummy (ELECTION) and whether the insurance commissioner is elected (ELECTED). We include PREMAVG in the regression because we posit that the greater the average premium, the more likely the threat of regulation. In other words, it is quite possible that what will influence THREAT is not only the premium increase, but also the absolute level of the premium. Conversely, the average paid loss is hypothesized to reduce the likelihood of a threat of regulation because more money goes back to policyholders. It is logical to expect that policyholders who see insurance companies working for them (in the sense that they are indemnified for a loss) would be less inclined to believe that insurers need to be more stringently regulated.

We see that PREMAVG does indeed have a significant positive impact on THREAT, although it is significant at the ten percent level only. This suggests that what induces the population to threaten the insurance industry is not the percentage increase in a given premium, as the AUTOINC variable is still insignificant, but the dollar value of the premium itself. LOSSPAID, however, has no significant impact on whether there is a threat of regulation, although it is of the predicted sign.

We also control for election periods through the ELECTION dummy variable, and for whether the insurance commissioner is elected through the ELECTED dummy variable. These two variables plus LOSSPAID will be the instruments used for the two-step estimator procedure we present in section 4. The ELECTION variable equals one in the fourth quarter of an election year and zero otherwise. We expect this variable to have a positive impact on THREAT, since some politicians may use insurance rate regulation as a political platform. Finally, an elected insurance commissioner should be more willing to threaten to regulate the insurance industry as part of her mandate. On the other hand, an elected commissioner is more likely to be in need of money to fund her reelection, which may make her more conciliatory toward the insurance industry and not encourage regulatory threats. Thus we have no a priori regarding the sign of ELECTED. Looking at the results, we see that neither ELECTION nor ELECTED are significant.

We shall use the regression presented in table 4 as our structural equation for explaining the presence of a regulatory threat in the two-step estimator procedure.

4 Two-Step Estimator

4.1 Procedure

In the analysis presented in section 3.1, it was assumed that the presence of a threat was exogenous to the model. It is possible, however, that this is not the case. Whether the news media transmit concerns regarding premium percentage increases may depend on factors that are endogenous to the model. For example, the threat of regulation can depend on premium increases; thus including THREAT as an explanatory variable of AUTOINC is a misspecification of the model. We then have to extricate from the THREAT variable what can be explained by factors already included in the model. In other words, we need to use a two-step estimator.

The problem encountered here is that one of the dependent variables (THREAT) is a qualitative variable. Following Maddala (1983, chapter 8.8), we specify the problem as follows.

We have y_1 observed (AUTOINC) and y_2 dichotomous (THREAT),

$$y_1 = y_1^*$$

$$y_2 = \begin{cases} 1 & \text{if } y_2^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

The structural equations are

$$y_1 = \alpha_1 y_2^* + \beta_1' X_1 + \varepsilon_1$$

$$y_2^* = \alpha_2 y_1 + \beta_2' X_2 + \varepsilon_2$$

while the reduced forms are

$$y_1 = \pi_1 X + \nu_1 \quad (7)$$

$$y_2^* = \pi_2 X + \nu_2 \quad (8)$$

Because y_2^* is observed only as a dichotomous variable, we cannot estimate π_2 directly; we can only estimate $\frac{\pi_2}{\sigma_2}$, where $\sigma_2^2 = Var(\nu_2)$. Hence

$$y_2^{**} = \frac{y_2^*}{\sigma_2} = \frac{\pi_2}{\sigma_2} X + \frac{\nu_2}{\sigma_2} = \pi_2^* X + \nu_2^*$$

We can then rewrite the structural equations as

$$y_1 = \gamma_1 \sigma_2 y_2^{**} + \beta_1' X_1 + \varepsilon_1 \quad (9)$$

$$y_2^{**} = \frac{\gamma_2}{\sigma_2} y_1 + \frac{\beta_2'}{\sigma_2} X_2 + \frac{\varepsilon_2}{\sigma_2} \quad (10)$$

Maddala then says to first estimate equation (7) using OLS and equation (8) using a probit maximum likelihood function. By using the predicted value of equation (7) in (10) instead of y_1, we can estimate equation (10) as a probit maximum likelihood function. Similarly, we can estimate equation (9) by using OLS and the predicted value of (8) instead of y_2^{**}. The important thing is to correctly specify the two structural equations. The structural equations are those shown in table 2 (AUTOINC) and 4 (THREAT).

4.2 Results

The results of our two-step procedure regression appear in table 5. The first two columns present the reduced-form equations, whereas the structural equations are shown in columns 3 and 4.[23] Using the predicted value of the logistic (OLS) regression of column 1 (column 2) in the OLS (logistic) regression shown in column 4 (column 3) yields our final results.

The most interesting result of this procedure is given in column 4. By controlling for the simultaneity between AUTOINC and THREAT we increase the size and significance of the THREAT coefficient in the regression where AUTOINC is the dependent variable. We see in column 3, however, that AUTOINC is still not significant in determining the likelihood of THREAT. Using this two-step estimator we are able to explain almost fifty-two percent of automobile liability insurance premium increases.

We observe in the model that most of the exogenous variables are significant and are of the expected sign. For example, we observe that premium increases in comprehensive automobile and in homeowner insurance positively affect premiums in automobile liability insurance. Moreover, as expected, the coefficient of COMPINC is greater than the coefficient of HOMEINC, which reflects the closer ties between liability and comprehensive insurance than between automobile liability and homeowner insurance. Another positive impact on current premium increases come from last quarter's premium increase ($AUTOINC_{t-1}$). This suggests that there is momentum in automobile liability premium increases. We also observe that last period's unit price reduces premium increases. This reduction should be expected if $UNIT_{t-1}$ instruments the accumulated reserves of insurers. Our reasoning is that when reserves are greater, insurers do not need to increase premiums as much. The last operation-based explanatory variable is the average premium (PREMAVG). Our results suggest that premium increases are smaller when the premium is higher, as is expected in the model.

In the next group of explanatory variables, the negative sign of PROP103 is expected if the passage of Proposition 103 in California sends a credible message to the markets that more stringent price regulation is likely. The coefficient tells us that premium increases were on average 2.532 percentage points lower after the passage of Proposition 103 than before. Finally three of the financial-market variables are of the expected sign (TBILL, SNP500 and CPI), but only one is significant (TBILL). This suggests that insurers set premium increases as a function of expected returns on investment. The positive sign on CORPBOND, which goes against our initial hypothesis, may only be that it does not instrument possible investment opportunities in corporate bonds, but rather that it represents the cost of borrowed funds for insurers.

To test the robustness of our results, we ran a few other regressions. The first one uses all the information we were able to gather on economic, demographic and political state-specific conditions. We reran the same analysis as in this section and in section 3. We also tested the robustness of our results weighting our

[23] The structural equations in columns 3 and 4 are those we presented in table 2 and in table 4.

THREAT variable to take into account multiple mentions of possible regulation in a state in a quarter. None of our main conclusions changed: the presence of a regulatory threat reduces premium increases. We present those tests in section 5.

5 Robustness

5.1 Full Model

5.1.1 OLS

We present in table 6 the full regression model for explaining premium increases in automobile liability insurance. Using our base regression (table 2), we added other variables to control for geographic location, and other demographic, political and insurance market conditions.

We first added five regional dummies (NorthEast, MidEast, SouthEast, NorthWest, SouthWest). The reason one would add regional dummies is that there may be differences across regions that are not picked up by any of the variables in our data set. This does not seem to be the case.

We also added explanatory variables related to the insurance market. RESIDUAL represents the proportion of drivers insured through the residual market. We expect this variable to have a negative impact on premium increases. The reason is that prices in the residual market may act as an effective price ceiling for the voluntary market if consumers can opt for the residual market coverage. On the other hand, a positive sign would be obtained if the residual market runs a deficit that must be compensated by larger premiums on the voluntary market.

The HERFINDAHL variable is a measure of market concentration. The more concentrated a market, the more easily firms can collude, and the more likely a price increase by one insurer will be followed by price increases by other insurers. Another possibility is that concerted efforts to lower premiums between few big companies is easier. Thus we do not have any a priori concerning the relationship between HERFINDAHL and AUTOINC. Similarly, there are two possible effects for the number of companies (NUMCOS). First, the greater the number of companies, the greater the competition and the lower the price increases. Second, the greater the number of companies, the harder it is to concert efforts to lower premiums to avoid regulation, and the greater the price increases. The reason we include both HERFINDAHL and NUMCOS is that the former is weighted in favor of large companies, whereas the latter is equally weighted. It is important to control for those two aspects of the supply of insurance given the size bias of the NAII fast-track tapes. Also, given a Herfindahl measure, it is more difficult to influence price changes if there are more companies. Similarly, for a given number of companies, a greater Herfindahl measure means that collusion is easier.

It has been argued that direct writers have lower operating costs than independent agents (see Cummins and Vanderhei, 1979, and Barrese and Nelson, 1992). This is often attributed to the greater fixed investment that a direct writer makes in establishing an office in a given state. Since direct writers have a greater proportion of their assets invested in fixed assets, we expect them to have greater exposure to regulation risk since it is relatively more costly for them to exit a market than it is for independent agents. Therefore direct writers should be more willing to appease the population and regulators. Thus the greater DWSHARE, the lower price increases should be. Finally, we do not a priori have any hypothesis as to the impact of the number of agent (AGENTS) in a state.

The results seem to indicate that our hypotheses concerning the impact of RESIDUAL and NUMCOS are correct. The greater the proportion of drivers insured through the residual market, the smaller the price increases, and the greater the number of companies, the smaller the increases. HERFINDAHL and DWSHARE are not significant, however.

We also included political variables to represent the state's regulatory environment. The dummy variables included are whether automobile insurance is a regulated line (REGULATION), whether the state has a no-fault law (NOFAULT) and whether the governor is a Democrat (GOVDEM). Other regulatory environment variables we include are the Democrats' proportion of seats in the state's lower house (HOUSEDEM) and the state's per capita budget (BUDPOP). We expect all these variables to have a negative impact on increases in the price of automobile liability insurance.

Price increases should be smaller in a state that regulates its automobile insurance sector if regulation acts as a price ceiling, which seems to be the case for the time frame we study (see Harrington, 1992, and Suponcic and Tennyson, 1995). In a no-fault state, the premium increase should also be smaller because the need for liability insurance is reduced. The next three variables represent the political willingness to regulate automobile insurance. It has been argued that Democrats are more willing to regulate insurance markets than Republicans. Hence we control for whether the governorship (GOVDEM) and/or the state's lower house (HOUSEDEM) is held by Democrats. The state's per capita budget may help determine whether insurers can charge the premium they desire. The greater the state legislature's per capita budget, the more likely it is that the insurance commissioner's office will be staffed with employees who monitor insurance companies closely. Thus the greater the state's per capita budget, the greater the pressure to keep insurance premiums constant. Finally, we expect that insurers will reduce their price increases during election season to reduce the probability that a candidate may use insurance regulation as an election platform, or that insurance regulation will become an issue during the election. We see that none of these five variables are significant.

The last kind of variable we include in the regression is state demographic variables. None of these are significant. This would suggest that the demographic composition of a state has no impact on automobile liability premium increases. A possible conclusion could be that automobile liability premium variations are purely due to supply shocks rather than demand shocks. This would make sense if one believes that automobile insurance is an inelastic good.

5.1.2 LOGIT

We now present the results from our logit analysis controlling for state-speci…c demographic, economic and political situations. Using our base logit model (table 4), the results are shown in table 7.

First, it is …rst interesting to observe that AUTOINC is not signi…cant, while PREMAVG is signi…cant at the ten percent level. In this full logit model, we control for geographic di¤erences in the United States. The interesting location is the SouthWest, which includes all states neighboring California, except Oregon. We see that a threat of regulation is no more likely in these states than in any other, at least not signi…cantly. This result contradicts the Fields et al. (1990) bellwether hypothesis. Fields et al. hold that the e¤ect the threat of regulation should greater in states neighboring California. We do not …nd any evidence of that when controlling for everything else.

Of all the explanatory variables related to the insurance market, only the proportion of drivers insured through the residual market and the number of insurance companies in a state are signi…cant. Both RESIDUAL and NUMCOS are positive, which suggests that the greater the proportion of residual market drivers in a state, the more likely the threat of regulation, and the same holds for the number of companies. It makes sense that insurers in states with larger residual markets are more likely to be threatened with regulation. A large residual market means that high-risk drivers cannot …nd insurance, which means that they may be more likely to …ght premium increases, and thus more likely to be in favor of regulation.

As for the number of companies a¤ecting regulatory threat positively, we are at a loss to explain this result. We were expecting the opposite: the greater the number of companies, the greater the competition, the smaller the premium increases, and thus the less likely the threat of insurance regulation. A possible explanation is that smaller insurers, which make up most of the di¤erence in the number of companies from one state to the next, had the most troubles during the liability crisis. They were thus the ones who had to increase their premiums by large amounts. Larger companies were able to ride out the crisis and wait for better times, but smaller companies could not.

Of all the regulatory environment variables, only REGULATION and NOFAULT are signi…cant at the …ve percent level. A priori, we expected REGULATION and NOFAULT to have a negative impact on THREAT, since drivers are supposedly not as concerned with liability insurance in no-fault states as in liability states, and, in states that are already regulated, the threat of regulation is moot. Our hypotheses regarding REGULATION and NOFAULT seem to be supported.

On the other hand we expected HOUSEDEM, GOVDEM, BUDPOP, ELECTED and ELECTION to have a positive impact on THREAT. Democrats are arguably more willing to regulate the insurance industry. Therefore a Democratic majority in the state's lower house and/or a Democratic governor should encourage threats of regulating the automobile liability insurance industry, or even make the threats themselves. Similarly, an insurance commissioner's o¢ce that has more money (because the state's per capita budget is greater) may be more willing to regulate automobile liability insurance. An elected insurance commissioner should be more willing to threaten to regulate the insurance industry as part of her mandate. Finally, it seemed logical that around election time some candidate would use insurance regulation as an election platform, increasing the likelihood of a threat of regulation. Of these five variables, only HOUSEDEM is of the expected sign. It is also significant at the ten percent level. All other variables are not significant.

The last group of variables consists of the state's demographics. From the data it seems that the proportion of the population with a college degree (COLLEGE), the proportion of new migrants in a state (MIGRANTS) and the size of the state's insurance market as a proportion of the country's (RAUTODPW) all have a significant and positive impact on the likelihood that a threat will be observed. Conversely, the average years of education in a state (EDUCATION) and the total miles driven in the state (TOTMILES) reduce the likelihood of a regulatory threat.

The results presented in this section suggest that automobile liability premium increases do not seem to have any impact on the presence of a regulatory threat. The absolute premium, however, seems to have a positive impact on the presence of a regulatory threat.

5.1.3 Two-step

Similarly to the base model, we used a two-step estimator to control for the endogeneity between THREAT and AUTOINC. The results of this two-step procedure are presented in tables 8A through 8D. The reduced-form equations are in tables 8A and 8B, and the structural equations in tables 8C and 8D. We use the predicted value of the logistic (OLS) regression of table 8A (8B) in the OLS (logistic) regression displayed in table 8D (8C) to obtain our final results. The most interesting result of this procedure is shown in table 8D.

We see by using all available information that the goodness of fit of the second-step regression (as measured by the adjusted R^2) is reduced. This suggests that we may be over specifying the problem by using the so-called full model. The impact of THREAT remains significant at the one percent level, although its size on premium increases is reduced from -9.576 to -2.881.

An interesting aspect of the results presented in table 8D is that some variables (REGULATION, GOVDEM and RAUTODPW) that were not significant in table 6 are now significant. These new results suggest that premium increases are smaller when automobile liability insurance is regulated, which we expected. They also suggest that the presence of a Democratic governor in the state capital induced smaller premium increases, which we also expected.

5.2 Other Tests

We did our second test by modifying the THREAT variable to take into account multiple hits. We do this as a measure of the importance of the regulatory threat in a state in a quarter. Thus far, the THREAT variable could take only the values 0 and 1. We modify this variable by letting the number of hits determine THREAT. Our hypothesis is that the more references to regulatory threat, the smaller price increases should be. These results are presented in table 9. We present the base model regressions only. The full model regressions yield similar results.[24] We see that taking into account multiple hits does not change our main result; THREAT remains significant at the one percent level, although the size of the coefficient is reduced from -9.578 to -3.188. The other differences come from TREND103 which becomes significant at the one percent level, CPI, at the five percent level and SNP500, at the ten percent level. These three coefficients are of the expected sign.

Finally, we ran a third robustness test by modifying the regulation variables to take into account a broader spectrum of regulatory stringency. We constructed dummy variables according to how stringent regulation is in each state (Competitive, Use and File, File and Use, Flex Rating, Modified Prior Approval, Prior Approval and Promulgation). None of the results were affected (results not shown).

6 Conclusion

We tested the Regulatory Threat Hypothesis using state quarterly data from 1984 to 1993 provided by the National Association of Independent Insurers. We constructed our dependent variable as the percentage price increase in automobile liability insurance from one quarter to the next. We ran multiple regressions using a measure of the threat of regulation as our most interesting explanatory variable. We also controlled for many other economic and demographic factors that might explain premium increases. We believe that our results show strong evidence that, in the presence of a credible threat of regulation, insurance companies reduced their automobile liability insurance premiums (or at least reduced the increase in their premiums) during the liability crisis of the late 1980's. This is in accordance with the regulatory threat hypothesis.

According to the results presented in table 5, the presence of a regulatory threat reduced premium increases on average by 9.6 percentage points (or 2.9 percentage points according to the results of table 8D). Given that the average premium increase was 1.68%, it follows that when a threat of regulating automobile liability insurance occurred, premiums declined by 7.9 percentage points. This premium reduction was even more important after the adoption by referendum in California of Proposition 103. It appears that Proposition 103 sent a credible signal to the markets that the automobile insurance industry needed to take regulatory threat seriously. The mere adoption of this proposition reduced premium increases by over 2.5

[24] We ran all our regressions using this weighted measure of threat. None of the results were significantly different from the one we present using a dichotomous threat variable.

percentage points.

We presented many di¤erent models, including one where the dependent variable was changed from the average percentage premium increase to the average absolute premium. We found that in the presence of a regulatory threat, the absolute premium was smaller. The results are robust enough to conclude that the threat of regulation had a signi…cant impact on the way insurers priced automobile liability insurance during the liability crisis of the late 1980s.

One …nal aspect of note regarding the signi…cance of the regression is that it is not due to a speci…c model speci…cation. We tested the robustness of our results in two important ways. First, we tested for speci…cation errors by adding state speci…c demographic, economic and political variables. Our main results were not a¤ected. Second, we modi…ed the $THREAT$ variable to take into account multiple hits. Again our qualitative results were not a¤ected. We can therefore state that our results are robust to model speci…cations.

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8 Appendix: Data

The data used to test the regulatory threat hypothesis can be divided into three sections: insurance price data; instruments; and economic and demographic.

8.1 Insurance Price

All insurance price data come from the NAII Fast Track Data Tapes. $AUTOINC$, $HOMEINC$ and $COMPINC$ are the percentage price increases of automobile liability, automobile comprehensive and homeowner insurance respectively. These increases are constructed as $100 \times \frac{PREMAVG - PREMAVG_{t-1}}{PREMAVG_{t-1}}$, where $PREMAVG$ is equal to the ratio of total earned premium to total exposure units in the state for that line. $LOSSAVG$ is the average losses incurred in automobile liability insurance. It is equal to total losses incurred divided by total exposure units. To obtain $LOSSPAID$, we add $LOSSAVG$ and $LOSSAVG_{t-1}$ and divide by two. $UNITA_{t-1}$ is the lagged unit price, which is given by total premiums earned divided by total losses incurred.

8.2 Instruments

Many instruments are used in our analysis, which can be divided into three types: political, regional and time. The main political instrument is $REGULATION$. We use the definition adopted by the Alliance of American Insurers and/or by the National Association of Insurance Commissioners[25] to determine whether a state is regulated. The dummy equals one when a state is regulated in a quarter in a line, and zero otherwise. $NFAULT$ is the variable that represents whether a state has no-fault regulation (value of 1) or not (value of 0). $ELECTED$ is the variable that represents whether the insurance commissioner is elected in a state (value of 1) or not (value of 0). The $GOVDEM$ dummy takes the value one if the governor is Democrat, and zero otherwise, and the $HOUSEDEM$ variable is equal to the number of Democrats minus the number of Republicans in the state's lower house, divided by the sum of the two.[26]

The second type of instrument is regional. Its purpose is to pick up variations from one region of the United States to the next which cannot be accounted for by any other variable in our data set. We divided the United States into six regions, NorthEast, MidEast, SouthEast, NorthWest, MidWest and SouthWest.

The last type of instrument is time. $PROP103$ is the dummy variable whose value is one after the passage of Proposition 103 in California and zero before (for every quarter after 88:4 $PROP103$ equals 1). $ELECTION$ equals one in the last quarter of every even year, which corresponds to the election quarter. $DUM93$ is a dummy variable to take into account all red-lining problems encountered in homeowner

[25] Whenever the two did not correspond, we went through the law itself to see which how we would record it.

[26] Except for Nebraska, where the number was unavailable. We assigned the number 0 to $MAJDEM$ for all quarters for all years in Nebraska.

insurance in 1993. DUM93 is equal to 1 for the year 1993. TREND is a time trend whose value increases by one at every quarter. Finally Q1, Q2 and Q3 are seasonal dummies.

8.3 Demographic and Economic

The demographic data were lent to us by Sharon Tennyson,[27] whereas the economic variables were found in the Citibase data tapes. RESIDUAL is the percentage of automobile drivers insured through the residual market in a state. HERFINDAHL is the Herfindahl index of market concentration in automobile liability insurance. INCOME is the average per capita income of a state. URBAN is the percentage of counties considered urban in the United States census. TOTMILES is the total miles driven in a state. DWSHARE is the market share of direct writers in automobile liability. RAUTODPW is equal to the ratio of the state's automobile liability direct premiums written to the country's as a whole. YOUNG is the percentage of the population between the ages of 18 and 24. FATALITIES represents the fatalities in car accidents. HOSPDAY is the average cost of one day of hospital stay. BUDPOP is equal to the total state budget divided by the state's population. AGENTS is the number of insurance agents in the state.[28] Finally NUMCOS is the number of insurance companies that sell automobile liability in the state. All these variables are not available by quarter. Still, we do not consider that important, since they should not vary that much within a year (especially not the URBAN variable).

COLLEGE is the percentage of the population with a college degree in 1990. MIGRANTS is the percentage of the population new to the state in 1990 compared with 1980. EDUCATION is the average number of years of education of the population in 1990. These variables are not available by year.

Finally, United States economic data are used to consider the investment opportunities of insurance companies (or their cost of capital). TBILL is the return on United States Treasury bills, CORPBOND is the return on long-term corporate bonds, SNP500 is the return on the Standard and Poor's 500, and CPI is the consumer price index increase.

[27] We are very grateful to Sharon Tennyson for allowing us to use her data.

[28] This number is not available for Connecticut and Rhode Island in 1987. We therefore assigned the numbers corresponding to the averages of 1986 and 1988.

FIGURE 1

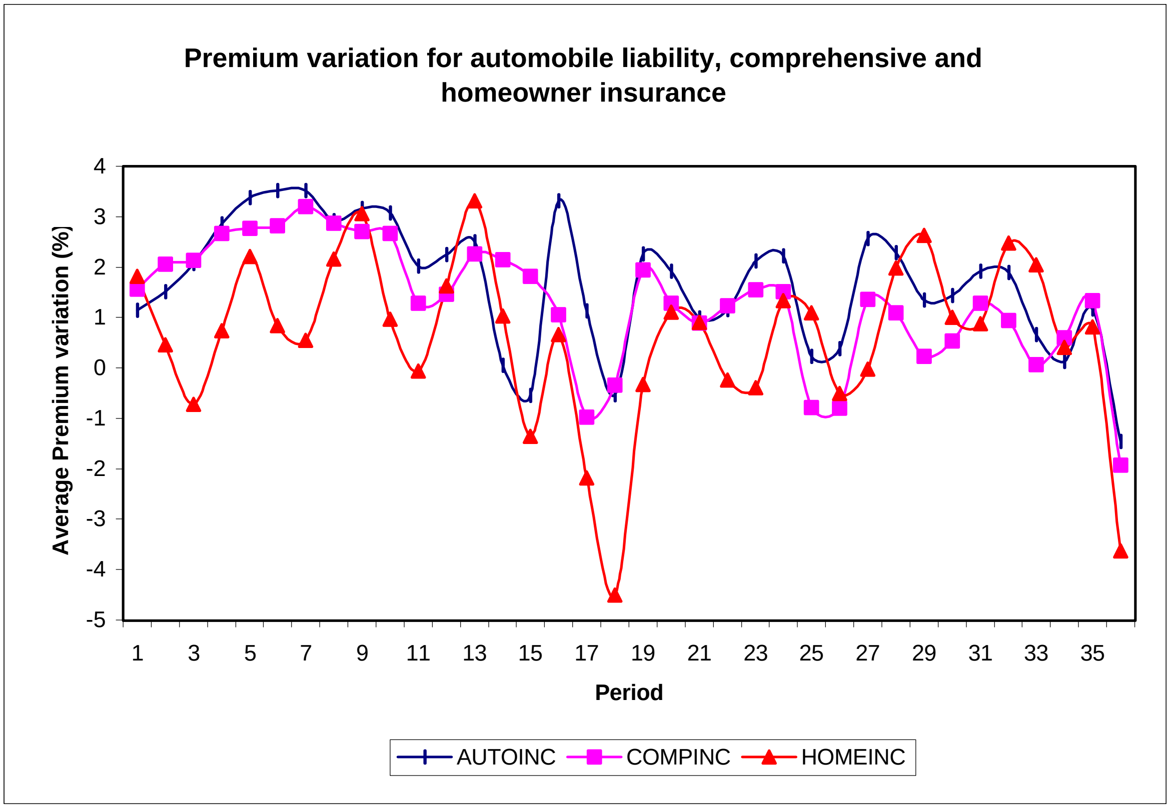

FIGURE 2

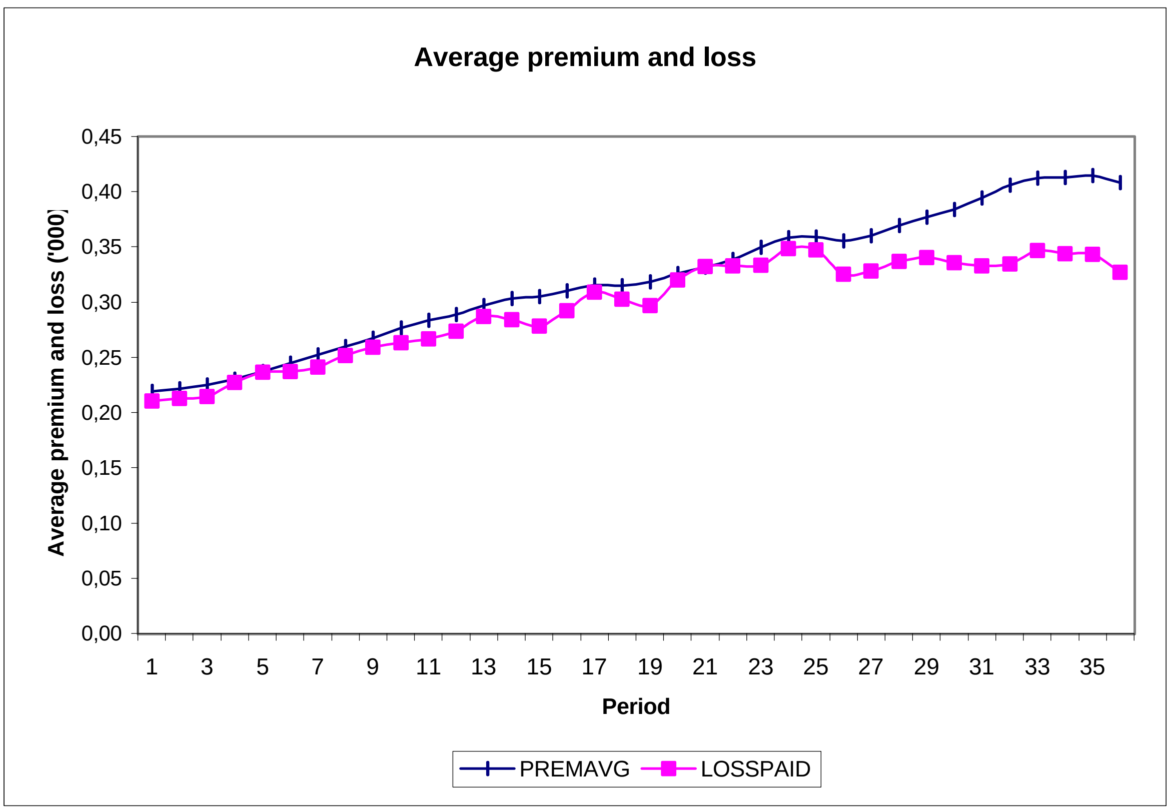

Table 1A
Regulatory Threat Dummy Variable by State and by Quarter

	84,1	84,2	84,3	84,4	85,1	85,2	85,3	85,4	86,1	86,2	86,3	86,4	87,1	87,2	87,3	87,4	88,1	88,2	88,3	88,4	89,1	89,2	89,3	89,4	90,1	90,2	90,3	90,4	91,1	91,2	91,3	91,4	92,1	92,2	92,3	92,4	93,1	93,2	93,3	93,4	sum
AL																																									0
AK																																									0
AZ																					1	1		1	1	1	1	1								1	1		1	1	11
AR																																									0
CO																																									0
CT																	1				1																				2
DE																																									0
FL										1						1				1	1	1					1	1								1					8
GA																										1	1				1					1					4
HI																																				1					1
ID																									1																1
IL										1								1		1	1	1	1	1	1																8
IN																					1																				1
IA																				1		1																			2
KS																																									0
KY																																									0
LA																																						1			1
ME																					1	1																			2
MD	1																			1	1	1																			4
MA																1				1		1			1	1	1	1				1				1			1	1	11
MI																																									0
MN																																									0
MS																																									0
MO																								1	1			1													3
MT								1																																	1
NE																																									0
NV																						1	1	1	1	1										1	1				7
NH																					1											1									2
NM																						1		1																	2
NY																																							1		1
NC																								1										1		1					3
ND																																									0
OH																				1	1	1																			3
OK																																									0
OR										1										1	1																				3
PA														1						1	1	1	1		1	1				1				1		1					10
RI															1																	1									2
SC																						1		1							1					1					4
SD																																									0
TN																																									0
TX																						1	1	1		1	1		1				1			1	1				9
UT																																									0
VT																																									0
VA																			1	1	1			1																	4
WA																						1																			1
WV																					1																				1
WI																					1	1																			2
WY																																									0
	1	0	0	0	0	0	0	1	0	3	0	0	0	1	1	2	1	1	1	9	14	15	4	9	7	6	5	4	1	1	2	3	1	2	0	10	3	1	3	2	
				1				1				3				4				12				42				22				7				13				9	114

TABLE 1B

Summary Statistics

Variable Name	Mean	Standard Deviation	Minimum	Maximum
AUTOINC (%)	1.68236	2.47422	-18.0222	21.3705
COMPINC (%)	1.29130	2.90989	-28.6963	45.8809
HOMEINC (%)	0.61533	2.95057	-22.6002	25.9735
THREAT	0.05961	0.23682	0	1
LOSSPAID ('000)	0.29599	0.20128	0.09147	2.00740
PREMAVG ('000)	0.32023	0.22805	0.10474	2.56858
$UNIT_{t-1}$	1.10414	0.15932	0.58798	3.06659
TREND	5.37500	2.59783	1	9.75
PROP103	0.44444	0.49705	0	1
TBILL (%)	4.08739	7.89044	-22.6300	21.3270
CORPBOND (%)	1.46163	0.44137	0.69800	2.18710
SNP500 (%)	3.34644	4.11852	-6.07000	12.3270
CPI (%)	0.90874	0.48798	-0.42800	2.15560
DUM93	0.11111	0.31436	0	1
ELECTED	0.22454	0.41740	0	1
ELECTION	0.11111	0.31436	0	1
Variable Name	Mean	Standard Deviation	Minimum	Maximum
RESIDUAL	0.04184	0.09721	0.00002	0.73168
HERFINDAHL	0.10313	0.03164	0.04460	0.23319
DWSHARE	0.64220	0.12070	0.25780	0.89220
AGENTS	0.00665	0.00421	0.00352	0.08868
NUMCOS	89.6505	22.7096	26	147
REGULATION	0.56482	0.49593	0	1
NOFAULT	0.27315	0.44571	0	1
GOVDEM	0.58565	0.49275	0	1
HOUSEDEM	0.19456	0.32857	-0.62857	0.90164
BUDPOP ('000)	3.20477	1.28549	0.56068	10.1010
INCOME ('000)	16.2439	3.21272	9.1870	26.979
URBAN	0.49468	0.15776	0.213	0.868
COLLEGE	0.12848	0.02345	0.075	0.180
MIGRANTS	0.11521	0.04667	0.043	0.294
EDUCATION	19.5729	3.66915	12.3	27.2
YOUNG	0.10877	0.00855	0.0870	0.1312
RAUTODPW	0.01697	0.01736	0.00104	0.08293
TOTMILES ('000 000)	36.4179	31.9830	3.84000	163.329
FATALITIES	0.00032	0.00014	0.00011	0.00226
HOSPDAY	610.410	175.874	282	1130
NorthEast	0.1667	0.3728	0	1
MidEast	0.1250	0.3308	0	1
SouthEast	0.1667	0.3728	0	1
NorthWest	0.2083	0.4062	0	1
MidWest	0.1875	0.3904	0	1
SouthWest	0.1458	0.3530	0	1

TABLE 2

Determinants of the percentage increase in the average automobile liability insurance premium(AUTOINC).

Variable Name	
Intercept	-0.138 (0:976)
THREAT	-0.188¤ (0:108)
COMPINC (%)	0.352¤¤¤ (0:017)
HOMEINC (%)	0.131¤¤¤ (0:017)
PREMAVG ('000)	-0.851¤¤¤ (0:199)
UNIT$_{t ¡ 1}$	-0.878¤¤¤ (0:281)
AUTOINC$_{t ¡ 1}$	0.390¤¤¤ (0:020)
PROP103	-2.518¤¤¤ (0:867)
Q1	-0.012 (0:390)
Q2	-0.537¤ (0:316)
Q3	-0.466 (0:362)
DUM93	-1.062¤¤¤ (0:231)
TREND	-0.054 (0:056)
TREND103	-0.371¤¤¤ (0:127)
TBILL (%)	-0.187¤¤¤ (0:026)
CORPBOND (%)	0.656¤¤ (0:329)
SNP500 (%)	0.141 (0:087)
CPI (%)	1.083¤ (0:559)
N	1728
$\overline{R}^2$	.500

Value of the coe¢cient, standard error in parentheses.

***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 3
Determinants of expected return

Variable	Model 1 T-Bill	Model 2 Corp. Bond	Model 3 S&P 500	Model 4 CPI
Intercept	9.706*** (0:606)	0.199*** (0:021)	5.557*** (0:334)	0.142*** (0:045)
LAG1	-0.171*** (0:024)	1.158*** (0:024)	-0.004 (0:024)	0.099*** (0:024)
LAG2	-0.227*** (0:023)	-0.092** (0:036)	-0.047** (0:023)	0.195*** (0:024)
LAG3	-0.191*** (0:023)	-0.193*** (0:023)	0.212*** (0:021)	0.180*** (0:024)
TREND	-0.650*** (0:068)	-0.013*** (0:002)	-0.191*** (0:038)	-0.006 (0:004)
Q1	3.096*** (0:500)	-0.111*** (0:009)	2.272*** (0:279)	0.514*** (0:031)
Q2	0.748 (0:526)	0.194*** (0:010)	-1.029*** (0:264)	0.430*** (0:031)
Q3	-2.484*** (0:502)	0.063*** (0:011)	-3.761 (0:273)	0.512*** (0:032)
$\bar{R}^2$	.205	.917	.146	.235

Value of the coe¢cient, standard error in parentheses.
***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 4

Determinants of the likelihood that THREAT = 1: Logistic regression

Variable Name	
Intercept	-7.006¤¤¤ (0:771)
AUTOINC (%)	-0.006 (0:036)
PROP103	6.261¤¤¤ (1:631)
Q1	-0.084 (0:290)
Q2	-0.136 (0:281)
Q3	-0.913¤¤¤ (0:387)
DUM93	-0.150 (0:600)
TREND	0.986¤¤¤ (0:151)
TREND103	-1.293¤¤¤ (0:250)
PREMAVG ('000)	2.508¤ (1:345)
LOSSPAID ('000)	-0.841 (1:585)
ELECTION	-0.134 (0:561)
ELECTED	-0.319 (0:277)
Somer's D Concordant	.603 .798

Value of the coe¢cient, standard error in parentheses.

***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 5

Two-step estimator regressions. Logit regression when THREAT is the dependent variable; OLS regression when AUTOINC is the dependent variable

Variable Name	Reduced equation THREAT	Reduced equation AUTOINC	Structural equation THREAT	Structural equation AUTOINC
Intercept	-6.548*** (2:145)	0.434 (0:762)	-7.127*** (0:773)	0.689 (0:778)
THREAT (LOGIT)				-9.576*** (1:117)
AUTOINC (OLS)			0.046 (0:052)	
COMPINC (%)	0.055* (0:032)	0.326*** (0:017)		0.404*** (0:017)
HOMEINC (%)	-0.012 (0:035)	0.120*** (0:017)		0.120*** (0:016)
UNIT_{t-1}	-0.795 (0:911)	0.470 (0:364)		-0.911*** (0:276)
AUTOINC_{t-1} (%)	-0.025 (0:040)	0.385*** (0:020)		0.387*** (0:020)
PREMAVG ('000)	4.170** (1:854)	-6.698*** (0:990)	3.061** (1:462)	1.203*** (0:312)
LOSSPAID ('000)	-2.867 (2:201)	6.800*** (1:137)	-1.555 (1:749)	
TREND	0.839*** (0:183)	-0.103** (0:050)	1.001*** (0:150)	0.317*** (0:068)
TREND103	-0.734* (0:419)	0.393*** (0:126)	-1.309*** (0:248)	0.186 (0:125)
PROP103	2.868 (2:662)	-2.514*** (0:872)	6.334*** (1:621)	-2.532*** (0:857)
Q1	0.400 (0:734)	-0.182 (0:267)	-0.044 (0:293)	0.059 (0:266)
Q2	0.008 (0:561)	-0.575*** (0:207)	-0.078 (0:287)	-0.700*** (0:202)
Q3	-1.318 (0:959)	-0.324*** (0:334)	-0.910** (0:388)	-1.345*** (0:287)
DUM93	-0.429 (0:627)	-1.079*** (0:232)	-0.114 (0:596)	-1.223*** (0:229)
TBILL (%)	-0.032 (0:065)	-0.132*** (0:023)		-0.197*** (0:022)
CORPBOND (%)	1.019 (0:696)	0.419* (0:218)		1.525*** (0:250)
SNP500 (%)	-0.057 (0:172)	-0.011 (0:053)		-0.037 (0:051)
CPI (%)	-0.403 (1:486)	0.413 (0:492)		0.487 (0:483)
ELECTION	0.233 (0:661)	-0.376** (0:189)	-0.126 (0:566)	
ELECTED	-0.314 (0:278)	0.040 (0:101)	-0.326 (0:277)	
Goodness of Fit	D =.609 .801	$\bar{R}^2$ =.509	D =.599 .796	$\bar{R}^2$ =.519

Value of the coe¢cient, standard error in parentheses.

***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 6
Determinants of the percentage increase in the average automobile liability insurance premium (AUTOINC). OLS regression

Variable Name	
Intercept	2.606 (1:730)
THREAT	-0.218* (0:113)
COMPINC (%)	0.361*** (0:017)
HOMEINC (%)	0.131*** (0:017)
PREMAVG ('000)	-0.752** (0:378)
$UNIT_{t-1}$	-1.014*** (0:297)
$AUTOINC_{t-1}$ (%)	0.375*** (0:020)
TBILL (%)	-0.156*** (0:022)
CORPBOND (%)	0.516** (0:223)
SNP500 (%)	-0.048 (0:052)
CPI (%)	0.618 (0:493)
TREND	-0.102 (0:072)
TREND103	0.316** (0:129)
PROP103	-2.129** (0:885)
Q1	-0.283 (0:272)
Q2	-0.713*** (0:208)
Q3	-0.827*** (0:286)
DUM93	-0.969*** (0:237)

Variable Name	
NorthEast	-0.265 (0:249)
MidEast	0.192 (0:227)
SouthEast	0.196 (0:280)
NorthWest	0.035 (0:242)
SouthWest	0.184 (0:253)
RESIDUAL	-1.853*** (0:688)
HERFINDAHL	-4.082 (3:370)
DWSHARE	-0.554 (0:913)
AGENTS	19.09* (10:71)
NUMCOS	-0.012*** (0:004)
REGULATION	-0.153 (0:115)
NOFAULT	-0.068 (0:129)
GOVDEM	-0.162 (0:104)
HOUSEDEM	0.009 (0:274)

Variable Name	
BUDPOP ('000)	0.048 (0:063)
INCOME ('000)	0.023 (0:045)
URBAN	0.305 (0:635)
COLLEGE	-1589 (10:34)
MIGRANTS	-1.369 (1:924)
EDUCATION	-0.015 (0:071)
YOUNG	6.876 (11:01)
RAUTODPW	6.077 (9:900)
TOTMILES ('000 000)	0.825 (5:300)
FATALITIES	-203.3 (421:5)
HOSPDAY	0.001 (0:001)

N	1728
$\bar{R}^2$	.501

Value of the coe¢cient, standard error in parentheses.
***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 7
Determinants of the likelihood that THREAT = 1: Logistic regression

Variable Name		Variable Name		Variable Name	
Intercept	-20.59¤¤¤ (5:114)	Q1	-0.014 (0:359)	BUDPOP ('000)	-0.210 (0:271)
		Q2	-0.118 (0:327)	ELECTED	-0.178 (0:544)
AUTOINC	-0.002 (0:040)	Q3	-1.067¤¤ (0:431)	ELECTION	-0.106 (0:595)
LOSSPAID ('000)	-1.007 (2:457)	DUM93	-0.584 (0:672)	INCOME ('000)	0.033 (0:147)
PREMAVG ('000)	2.995¤ (1:790)	RESIDUAL	3.484¤¤ (1:670)	URBAN	-2.016 (2:251)
NorthEast	0.858 (0:837)	HERFINDAHL	9.943 (12:02)	COLLEGE	66.27¤ (36:32)
MidEast	-0.471¤ (0:850)	DWSHARE	-2.895 (3:526)	MIGRANTS	13.71¤¤ (6:554)
SouthEast	-0.362 (1:072)	AGENTS	-59.61 (130:6)	EDUCATION	-0.444¤ (0:245)
NorthWest	0.414 (0:934)	NUMCOS	0.048¤¤¤ (0:016)	YOUNG	57.66 (35:75)
SouthWest	0.854 (0:929)	REGULATION	-0.801¤¤ (0:398)	RAUTODPW	99.68¤¤¤ (26:98)
TREND	1.283¤¤¤ (0:280)	NOFAULT	-1.199¤¤ (0:493)	TOTMILES ('000 000)	-3.000¤¤ (1:300)
TREND103	-1.426¤¤¤ (0:289)	GOVDEM	-0.362 (0:330)	FATALITIES	925.3 (665:7)
PROP103	6.823¤¤¤ (1:861)	HOUSEDEM	1.875¤ (0:995)	HOSPDAY	0.002 (0:002)

Somer's D	.785
Concordant	.890

Value of the coe¢cient, standard error in parentheses.
***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 8A
Determinants of the likelihood that THREAT = 1: Logistic regression
Reduced-form equation for a two-step procedure

Variable Name	
Intercept	-18.37¤¤¤ (5:649)
COMPINC (%)	0.059 (0:036)
HOMEINC (%)	-0.040 (0:038)
LOSSPAID ('000)	-3.618 (3:365)
PREMAVG ('000)	5.289¤¤ (2:523)
UNIT$_{t¡1}$	-1.602 (1:342)
AUTOINC$_{t¡1}$ (%)	-0.039 (0:043)
TREND	1.128¤¤¤ (0:293)
TREND103	-0.974¤¤ (0:461)
PROP103	4.122 (2:932)
Q1	0.429 (0:805)
Q2	-0.062 (0:610)
Q3	-1.758 (1:033)
DUM93	-0.831 (0:710)
ELECTED	-0.176 (0:552)
ELECTION	0.307 (0:694)

Variable Name	
TBILL (%)	-0.058 (0:070)
CORPBOND (%)	0.890 (0:761)
SNP500 (%)	-0.113 (0:189)
CPI (%)	-0.437 (1:559)
NorthEast	0.830 (0:845)
MidEast	-0.309 (0:852)
SouthEast	-0.236 (1:094)
NorthWest	0.397 (0:939)
SouthWest	0.765 (0:936)
RESIDUAL	3.239¤ (1:815)
HERFINDAHL	5.805 (12:51)
DWSHARE	-2.151 (3:665)
AGENTS	-10.04 (119:7)
NUMCOS	0.044¤¤¤ (0:016)
REGULATION	-0.881¤¤ (0:405)
NOFAULT	-1.286¤¤ (0:491)

Variable Name	
GOVDEM	-0.454 (0:332)
HOUSEDEM	1.834¤ (1:004)
BUDPOP ('000)	-0.170 (0:279)
INCOME ('000)	0.018 (0:148)
URBAN	-1.855 (2:262)
COLLEGE	61.24¤ (37:10)
MIGRANTS	13.80¤¤ (6:685)
EDUCATION	-0.421¤ (0:248)
YOUNG	56.67 (35:97)
RAUTODPW	97.55¤¤¤ (26:90)
TOTMILES ('000)	-0.030¤¤ (0:013)
FATALITIES	771.5 (668:9)
HOSPDAY	0.002 (0:002)

Somer's D	.789
Concordant	.891

Value of the coe¢cient, standard error in parentheses.
***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 8B

Determinants of the percentage increase in the average automobile liability insurance premium (AUTOINC); OLS analysis

Reduced form equation for a two-step procedure

Variable Name		Variable Name		Variable Name	
Intercept	1.402 (1:707)	TBILL (%)	-0.134¤¤¤ (0:023)	GOVDEM	-0.241¤¤ (0:103)
COMPINC (%)	0.329¤¤¤ (0:017)	CORPBOND (%)	0.493¤¤ (0:220)	HOUSEDEM	-0.146 (0:271)
HOMEINC (%)	0.118¤¤¤ (0:017)	SNP500 (%)	-0.011 (0:053)	BUDPOP ('000)	-0.012 (0:062)
LOSSPAID ('000)	9.596¤¤¤ (1:316)	CPI (%)	0.367 (0:490)	INCOME ('000)	0.010 (0:044)
PREMAVG ('000)	-7.894¤¤ (1:034)	NorthEast	-0.552¤¤ (0:248)	URBAN	-0.516 (0:637)
UNIT$_{t ¡ 1}$	-0.711¤ (0:377)	MidEast	0.095 (0:230)	COLLEGE	-9.539 (10:28)
AUTOINC$_{t ¡ 1}$ (%)	0.364¤¤¤ (0:020)	SouthEast	0.276 (0:308)	MIGRANTS	-1.922 (1:931)
TREND	-0.153¤¤ (0:072)	NorthWest	-0.022 (0:244)	EDUCATION	0.047 (0:070)
TREND103	0.435¤¤¤ (0:129)	SouthWest	-0.061 (0:260)	YOUNG	3.651 (10:87)
PROP103	-2.802¤¤¤ (0:881)	RESIDUAL	-3.029¤¤¤ (0:702)	RAUTODPW	-1.202 (9:710)
Q1	-0.156 (0:269)	HERFINDAHL	-8.648¤¤ (3:386)	TOTMILES ('000)	0.0059 (0:0053)
Q2	-0.566¤¤¤ (0:207)	DWSHARE	1.758¤ (0:915)	FATALITIES	-316.8 (413:1)
Q3	-0.325 (0:332)	AGENTS	21.78¤¤ (10:55)	HOSPDAY	0.0005 (0:0006)
DUM93	-1.074¤¤¤ (0:235)	NUMCOS	-0.014¤¤¤ (0:004)		
ELECTED	0.003 (0:138)	REGULATION	-0.146 (0:117)		
ELECTION	-0.371¤¤ (0:188)	NOFAULT	-0.075 (0:127)		

N 1728

$\overline{R}^2$ .516

Value of the coe¢cient, standard error in parentheses.

***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 8C

Determinants of the likelihood that THREAT = 1: Logistic regression

Second stage of a two-step procedure: structural equation

Variable Name	
Intercept	-20.57*** (5:112)
AUTOINC (OLS)	0.012 (0:060)
LOSSPAID ('000)	-1.384 (2:663)
PREMAVG ('000)	3.239** (1:897)
TREND	1.287*** (0:279)
TREND103	-1.435*** (0:287)
PROP103	6.874*** (1:848)
Q1	-0.002 (0:360)
Q2	-0.099 (0:332)
Q3	-1.071** (0:430)
DUM93	-0.559 (0:674)
ELECTED	-0.186 (0:545)
ELECTION	-0.100 (0:597)

Variable Name	
NorthEast	0.880 (0:836)
MidEast	-0.469 (0:850)
SouthEast	-0.353 (1:073)
NorthWest	0.398 (0:934)
SouthWest	0.854 (0:928)
RESIDUAL	3.475** (1:666)
HERFINDAHL	10.17 (12:01)
DWSHARE	-2.955 (3:532)
AGENTS	-59.05 (130:5)
NUMCOS	0.048*** (0:016)
REGULATION	-0.789** (0:401)
NOFAULT	-1.195** (0:493)
GOVDEM	-0.361 (0:328)
HOUSEDEM	1.860* (0:993)

Variable Name	
BUDPOP ('000)	-0.210 (0:270)
INCOME ('000)	0.033 (0:147)
URBAN	-1.962 (2:245)
COLLEGE	66.25* (36:31)
MIGRANTS	13.74** (6:559)
EDUCATION	-0.443* (0:245)
YOUNG	57.03 (35:74)
RAUTODPW	99.35*** (27:00)
TOTMILES ('000)	-0.030** (0:013)
FATALITIES	-926.8 (665:1)
HOSPDAY	0.002 (0:002)

Somer's D	.786
Concordant	.890

Value of the coe¢cient, standard error in parentheses.

***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 8D
Determinants of the percentage increase in the average automobile liability insurance premium (AUTOINC)
Second stage of a two-step procedure: structural equation

Variable Name	
Intercept	0.209 (1:797)
THREAT (LOGIT)	-2.881¤¤¤ (0:580)
COMPINC (%)	0.377¤¤¤ (0:017)
HOMEINC (%)	0.127¤¤¤ (0:017)
PREMAVG ('000)	-0.032 (0:412)
UNIT$_{t ¡ 1}$	-1.049¤¤¤ (0:295)
AUTOINC$_{t ¡ 1}$ (%)	0.374¤¤¤ (0:020)
TREND	0.021 (0:077)
TREND103	0.263¤¤ (0:129)
PROP103	-2.126¤¤ (0:879)
Q1	-0.191 (0:271)
Q2	-0.715¤¤¤ (0:207)
Q3	-0.986¤¤¤ (0:286)
TBILL (%)	-0.168¤¤¤ (0:022)
CORPBOND (%)	0.781¤¤¤ (0:229)
SNP500 (%)	-0.046 (0:052)
CPI (%)	0.588 (0:489)

Variable Name	
NorthEast	-0.182 (0:248)
MidEast	0.158 (0:225)
SouthEast	0.068 (0:279)
NorthWest	0.061 (0:241)
SouthWest	0.298 (0:253)
RESIDUAL	-1.618¤¤ (0:686)
HERFINDAHL	-3.458 (3:352)
DWSHARE	0.549 (0:908)
AGENTS	-19.89¤ (10:64)
NUMCOS	-0.007¤ (0:005)
REGULATION	-0.235¤¤ (0:115)
NOFAULT	-0.169 (0:130)
GOVDEM	-0.223¤¤ (0:104)
HOUSEDEM	0.071 (0:273)

Variable Name	
BUDPOP ('000)	-0.070 (0:062)
INCOME ('000)	0.029 (0:044)
URBAN	-0.050 (0:636)
COLLEGE	10.07 (10:58)
MIGRANTS	0.257 (1:943)
EDUCATION	-0.103 (0:073)
YOUNG	15.76 (11:11)
RAUTODPW	17.57¤ (10:15)
TOTMILES ('000)	-0.002 (0:005)
FATALITIES	165.2 (426:2)
HOSPDAY	0.001 (0:001)

N	1728
$\overline{R}^2$	.507

Value of the coe¢cient, standard error in parentheses.
***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.

TABLE 9

Base two-step estimator regressions. Probit regression when THREAT is the dependent variable; OLS regression when AUTOINC is the dependent variable

Variable Name	Reduced equation THREAT	Reduced equation AUTOINC	Structural equation THREAT	Structural equation AUTOINC
Intercept	-4.838¤¤¤ (1:027)	0.434 (0:379)	-5.229¤¤¤ (0:202)	-1.904¤¤¤ (0:359)
THREAT (LOGIT)				-3.188¤¤¤ (0:501)
AUTOINC (OLS)			0.010 (0:013)	
COMPINC (%)	0.018 (0:016)	0.326¤¤¤ (0:008)		0.355¤¤¤ (0:008)
HOMEINC (%)	-0.005 (0:017)	0.120¤¤¤ (0:008)		0.128¤¤¤ (0:008)
UNIT$_{t ¡ 1}$	-0.215 (0:429)	0.470¤¤¤ (0:181)		-0.912¤¤¤ (0:140)
AUTOINC$_{t ¡ 1}$ (%)	-0.018 (0:019)	0.385¤¤¤ (0:010)		0.385¤¤¤ (0:010)
PREMAVG ('000)	1.889¤¤ (0:848)	-6.698¤¤¤ (0:493)	1.535¤¤¤ (0:363)	-0.604¤¤¤ (0:108)
LOSSPAID ('000)	-1.128 (1:028)	6.800¤¤¤ (0:566)	-0.726¤ (0:438)	
TREND	0.378¤¤¤ (0:077)	-0.103¤¤¤ (0:025)	0.455¤¤¤ (0:033)	-0.046¤ (0:026)
TREND103	-0.356¤ (0:190)	0.393¤¤¤ (0:063)	-0.607¤¤¤ (0:057)	0.309¤¤¤ (0:063)
PROP103	1.431 (1:219)	-2.514¤¤¤ (0:434)	2.939¤¤¤ (0:377)	-2.168¤¤¤ (0:434)
Q1	0.249 (0:344)	-0.182 (0:133)	-0.063 (0:072)	-0.227¤ (0:134)
Q2	0.033 (0:262)	-0.575¤¤¤ (0:103)	-0.066 (0:070)	-0.685¤¤¤ (0:103)
Q3	-0.689 (0:464)	-0.324¤ (0:166)	-0.384¤¤¤ (0:090)	-0.843¤¤¤ (0:142)
DUM93	-0.087 (0:281)	-1.079¤¤¤ (0:115)	0.009 (0:004)	-1.016¤¤¤ (0:115)
TBILL (%)	-0.031 (0:031)	-0.132¤¤¤ (0:011)		-0.160¤¤¤ (0:011)
CORPBOND (%)	0.568¤ (0:304)	0.419¤¤¤ (0:108)		0.566¤¤¤ (0:111)
SNP500 (%)	-0.078 (0:082)	-0.011 (0:026)		-0.050¤ (0:026)
CPI (%)	-0.431 (0:695)	0.413¤ (0:245)		0.559¤¤ (0:245)
ELECTION	0.096 (0:296)	-0.376¤¤¤ (0:094)	-0.156 (0:128)	
ELECTED	-0.094 (0:130)	0.040 (0:050)	-0.093 (0:064)	
Goodness of Fit	LL =-424.75	$\overline{R}^2$ =.513	LL =-1712.84	$\overline{R}^2$ =.505

Value of the coe¢cient, standard error in parentheses.

***, **, * are signi…cant at the 1% , 5% and 10% levels respectively.