THE EFFECT OF RATE REGULATION ON INFORMATION LAG

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Abstract

It has been a controversial topic whether the insurance premium rate should be regulated by the government. Because in most of insurance industries the rates must be filed with the insurance commissioners and approved prior to use, this requirement might delay the correspondence of premium rates to loss information and consequently might have an influence on insurance price and fluctuations of underwriting profits. However, the empirical evidence of whether the regulatory lag does exist has not been provided yet.

The objective of the empirical analysis in this paper is to investigate whether there exists difference in the length of information lag between the regulated market and the unregulated market when insurers apply loss information to insurance ratemaking. And the findings of this paper suggest that prior approval regulation does delay the information.

I. Introduction

It has been a controversial topic wheter the insurance premium rate should be regulated by the government. Under the U.S. Supreme Court decision of Paul vs.

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Virginia in 1869, insurance was held not to be commerce, and therefore not subject to control by the federal government under the commerce clause of the Constitution. However, the Supreme Court reversed its position in the South-Eastern Underwriters Association case in 1944 (322 U.S. 533), holding that insurance is commerce and therefore subject to federal regularion. This case struck down the earlier decision of Paul vs. Virginia in 1869 (See Cummins and Harrington, 1987).

To avoid drastic changes in insurance regulation, Congress in 1945 adopted the McCarran-Ferguson Act (Public Law 15-79) which exempted insurance from the antitrust laws to the extent that insurance was regulated by the states. This act held that continued state regulation and taxation of insurance was in the public interest (see U.S. Department of Justice, 1977).

Regulated rates were prevalent in the country until the late 1960s, except for California which adopted a competitive rating law in 1947. During the 1960s several factors combined to motivate a reevaluation of rate-regulation, for example, (1) the growth of direct writing insurance companies, (2) the growth in the number of automobiles, and (3) the increase in inflation and rise in interest rates (see Cummins and Harrington, 1987).

Some states responded to these pressures by deregulating the insurance rate, while some other states elected to retain rate regulation. Newadays property-liability insurance price for most lines are regulated in about one-half of the states (Webb, et al, 1984, p51).

The impact of rate regulation on insurance price has been an important subject in insurance research (Harrington, 1984). The goal of rate regulation is to ensure that rates are "neither inadequate, excessive nor unfairly discriminatory" (see Mehr, et al, 1985). On the other hand, economic theory says that a competitive market will drive prices and profits to the appropriate level. Several studies have tried to compare the price levels between regulated and unregulated states to see whether regulation has any impact on the price level.

For example, Witt and Urrutia (1983) thought the long-run loss ratio may be greater in competitive rating states due to the favorable impact of competition on operating efficiency. French and Sampron (1980) suggested that because of the regulator's efforts to protect consumers from inadequate rates would give lower loss ratio in the regulated states (French and Sampron, 1980). On the other hand, Harrington (1983) found that the average loss ratios for private automobile liability insurance were significantly higher in prior approval states than in the competitive states, which is consistent with the consumer pressure hypothesis. This hypothesis suggests that prior approval regulation may systematically reduce rates and thus raise loss ratios in response to political pressure from consumers (see Smallwood, 1975).

Another important hypothesis for the difference in the loss ratios between the regulated states and the competitive states is the regulatory lag hypothesis. A common prediction of this hypothesis is that loss ratios in prior approval states will be lower than those in competitive rating states in the periods of favorable underwriting experience and vice versa in periods of unfavorable experience. Because in most of regulated states the rates must be filed with the state insurance commissioner and approved prior to use (see Rand Corporation 1985), this requirement miqht delay the correspondence of premium rates to losses information and consequently might have an influence on the insurance price and the autocorrelation of underwriting returns (Cummins and Outreville, 1987, and Witt and Miller, 1980). However, the empirical evidence of whether the regulatory lag does exist has not been provided yet.

The objective of the empirical analysis in this paper is to investigate whether there exists difference in the length of information lag in regulated stated and unregulated states when insurers apply loss information to insurance ratemaking. The empirical analysis is conducted based on private automobile liability insurance because it is a typical example for discussing the differences in rate regulation systems.

The structure of this paper is organized as follows. Section II presents testing hypothesis and testing model for information lag. Section III discusses test methodology. Data description is provided in section IV. Test results are discussed in section V and followed by conclusion and suggestions in section VI.

II. Test Hypothesis and Test Model

A. Test Hypothesis

Since the objective of this paper is to investigate whether there exists difference in the length of information lag for rate-making in regulated and unregulated states, the null hypothesis of this test is as follows.

H_0: Information lag is longer in regulated states than in unregulated states.

B. Test Model

The empirical analysis of the effect of regulation effect is conducted under the hypothesis of rational expectations that insurers set price based on rational forecast of losses. The test model is an equation system including an information equation and a pricing equation. The information equation describe the relevant information for rational loss forecast. The pricing equation is developed based on fair rate concept (present value of expected losses) but with modification. It uses price growth rate instead of price itself due to data constraints.

$$\ln L_t = \beta_o + \sum_{j=1}^{4} \beta_j \ln L_{t-j} + \sum_{j=1}^{4} \Gamma_j \ln X_{t-j} + u_t \qquad (1A)$$

$$\left.\begin{aligned}\ln(P_t/P_{t-1}) &= \alpha_0 + \alpha_1\{\ln L^e_{t-i} - \ln L_{t-i-1}\} + \alpha_2\{\ln L^e_{t-i-1} - \ln L_{t-i-2}\} \\ &+ \alpha_3\{\ln(1+r_{t-i}) - \ln(1+r_{t-i-1})\} \\ &+ \alpha_4\{\ln(1+r_{t-i-1}) - (1+r_{t-i-2})\} + e_t \qquad (1B) \\ & i = 0,1,2,\cdots\cdots \end{aligned}\right\} \quad (1)$$

Where, P_t = price per policy of time t

L_t = mean losses per policy of time t

X_t = macroeconomic variable at the end of t

$\ln L^e_t$ = forecast of $\ln L_t$

$= \beta_o + \sum_{j=1}^{4} \beta_j \ln L_{t-j} + \sum_{j=1}^{4} \Gamma_j \ln X_{t-j}$ for constrained system

$= b_o + \sum_{j=1}^{4} b_j \ln L_{t-j} + \sum_{j=1}^{4} c_j \ln X_{t-j}$ for unrestricted system

r_t = discount factor for time t

e_t, u_t = independent random errors at t

$\alpha_i, \beta_i, \Gamma_i, b_i, c_i$ = coefficients.

The equation system looks somewhat lengthy. Some explanation may be needed. First, the time index of loss forecast in the price equation is not fixed in order to study the information lag. That is, each time when doing test, we specify a value for i. Second, the equation of rate-making is revised to take into account the loss forecasts of two periods because the data set applied for price in this study is based on "premiums earned" instead of "premiums written". Because each reported result for premiums earned involves at least two periods of premiums written[1], the test model is modified to consider this effect.

III. Test Methodology

The methodology of the empirical analysis for the regulatory lag is rather straightforward. The first step is to divide the states into two groups, regulated and unregulated states. The distinction is based on types of rate regulation as recorded in the NAII automobile insurance data file. States with state-made rates, mandatory bureau, prior approval, modified prior approval laws, and file-and-use laws with mandatory bureau rates are classified as regulated states. The other states belong to the category of unregulated states, which includes states adopting file-and-use with bureau raetes advisory only, use and file, and no-file laws. The

1 premiums earned of each period is equal to the premiums written during the current period plus the unearned premiums reserve at the beginning of this period minus the unearned premium reserve at the end of this period. That is, $PE_t = PW_t + UP_{t-1} - UP_t$, where PE_t is the premiums earned during the period t, PW_t is the premiums written during the period t, UP_S is the unearned premium reserve at the end of period s.(see Webb, et al, 1984).

two groups of states are exhibiled in appendix 1.

The second step is to conduct the joint estimation of forecasting equation and price equation for two groups of states respectively, by using the procedures of rational expectation analysis (see Mishkin, 1983) in order to bring information effect into rate-making decision.

The rationality analysis for each group is provided first to make sure that insurers do need relevant loss information in their pricing decision and hence information lag will affect price. Because it is meamingless to discuss information lag if the insurers do not set price based on relevant information of losses. This rationality analysis is conducted by comparing the sum of squared residuals of the restricted system with that of the unrestricted system through the likelihood ratio test.

The third step is to investigate the information lag caused by rate regulation, which is the primary purpose of this paper. The investigation consists of rationality analyses of two groups of states repeated with different lags, i, where i = 0,1,2, ⋯ , of loss information until α_1 of at least one of the two groups becomes significantly different from 0. If the information lag hypothesis is true, the value of i of the regulated ststes would be larger (i.e. longer lag) than that of the unregulated states because price changes could not respond to cost information so efficiently as the unregulated states.

IV. Data Description

The test of information lag is applied to private automobile liability insurance. The test period covers from the first quarter of 1976 to the third quarter of 1988.

Data on cost (L_t) are obtained from the Fast Track data base of National Association of Independent Insurers (NAII). This data file contains private passenger automobile insurance quarterly data of claims frequency and average paid claim cost (severity) for each type of coverage for each state from the first quarter of 1975 to the third quarter of 1988. Data are reported to Fast Track by all companies that are members of the Insurance Services Office (ISO) and NAII. Together these companies account for about 90 percent of auto insurance market share of the U.S.

To test the regulatory lag, data are drawn from the records of each state and then aggregated into two groups. The raw data of claim costs of each state are integrated into two groups of data, regulated and unregulated, to get the amount for total losses, total number of policies, and so forth for each group so that we can calculate the losses per policy for each group.

The data for price are also obtained from the Fast Track data base of NAII which provides quarterly premiums earned data for each state. The data period covers the first quarter of 1976 to the third quarter of 1988. Based on the regulation types of each state, the premiums earned of esch state are aggregated into the total premiums earned for each of the two types of states. And then the total premiums earned are divided by the exposure base, number of earned car years, to obtain the average premiums earned per car year (PE) for each regulatory group of states.

The average three-month Treasury Bill rate for each quarter is substituted for data on the discount factor forecast (r_t). Treasury Bill rate data are obtained from the Board of Governors of the Federal Reserve Board.

The data of macroeconomic variables needed for relevant information for forecasting losses are obtained from the Consumer Price Index Detailed Report, a publication of US Department of Commerce. Several macroeconomic variables initially considered for forecasting losses include CPI, hourly wage rate, medical expense CPI, new car CPI, and used car CPI, because they are thought to be most relevant to automobile insurance coverage. The variable finally selected for loss forecast equation is medical expense CPI.[2]

V. Test Results

Tables 1 and 2 show the relationship between the price changes and the loss forecasts of the constrained system with zero information lag and one period information lag for the private automobile liability insurance under two types of rate regulation.

The rationality analysis result is discussed first to see whether the insurers do apply relevant information into their pricing decision. The sum of squared residuals of the constrained system, unrestricted system (SSR_C and SSR_U) and the likelihood ratios for each type of states are presented in table 1. The likelihood ratio statistics suggest that the hypothesis of rationality cannot be rejected for either the regulated states or the unregulated states since the likelihood ratios are less than the critical values.

Table 1 presents estimates of the intercept (α_0), the coefficients on the anticipated loss changes (α_1 and α_2), and the coefficients on the discount factor (α_3 and α_4)with the corresponding t values when there is no information lag.

According to the estimated parameters of the price equation, the empirical results for the test model with zero information lag show that the changes of price are not significantlyrelated to the immediate information (zero lag) of losses for either the regulated states unregulated states because the α_1 of both groups are not

2 The specification of variables for forecast equation (1A) is through empirical experiments. A variable is chosen once the F statistic for the four lagged values of that variable is significantly different from zero (see Mishkin, 1983). Because of small sample size, the paper only take one variable, medical expense CPI, which F statistic is most significant.

significantly different from zero at the 5 percent level.

However, the parameter estimates in table 1 also show that differences exist between the two groups. Except for the intercept term, none of the parameters estimates for the regulated states are significantly different from zero at 5 percent level, which implies the price changes in the regulated states do not respond to the losses and interest rate information immediately. One the other hand, the perameter estimates of the unregulated states imply that the price changes in these states are related to the immediate information of interest rate and one lagged information of losses.

To provide a more comprehensive understanding of the information lag, the empirical results based on the test model with one information lag are provided in table 2. The parameter estimates for the loss forecasts and interest rate of the regulated states are still insignificant, which impies the price changes in the regulated states do not correspond well to the rate-making information.

The empirical results for the unregulated ststes show that the price changes in the unregulated states are related to the one lagged loss information. This is consistent with the results in the table 1 because α_2 of table 1 and α_1 of table 2 both coefficients are to represent the relationship between price changes and one lagged information of losses.

The sum of squared residuals of the constrained system, unrestricted system (SSR_c and SSR_u) and the likelihood ratios for each type of states are also included in table 2. The likelihood ratios in table 2 again are less than the critical value and thus the rationality hypothesis cannot be rejcted for either the regulated states or unregulated states.

VI. Conclusion and Suggestions

The empirical findings of this paper suggest that rate regulation does have an impact on the speed of correspondence between rate-making decisions and loss information for private automobile liability insurance. The price changes of automobile liability insurance in the regulated states cannot respond to the loss information as quickly as those in the unregulated states.

The information lag appears to be one of the potential determinants for insurance prices and underwriting profit cycles (Cummins and Outreville, 1987). Information lag primarily results from the loss settlement delays which is an inherent feature of the property-liability insurance industry, while the rate regulation exaggerates the length of lag. To shorten regulation lag might be one way to improve insurance price and underwriting cycles.

Appendix 1

(A) Regulated States:

Alabama	Mississippi	Rhode Island
Delaware	Nebraska	South Carolina
Indiana	New Hampshire	Tennessee
Iowa	New Jersey	Texas
Kansas	New York	Vermont
Louisiana	North Carolina	Virginia
Maine	North Dakota	Washington
Maryland	Ohio	West Virginia
Massachusetts	Oklahoma	Wyoming
Michigan	Pennsylvania	Alaska

(B) Unregulated States:

Arizona	Illinois	Oregon
Arkansas	Kentucky	South Dakota
Colorado	Minnesota	Utah
Connecticut	Missouri	Wisconsin
Florida	Montana	Hawaii
Georgia	Nevada	
Idaho	New Mexico	

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Table 1

Information Lag Hypothesis Test Under Zero Information Lag for Private Automobile Liability Insurance

Model: $\ln(P_t/P_{t-1}) = \alpha_0 + \alpha_1\{\ln L^e_t - \ln L_{t-1}\} + \alpha_2\{\ln L^e_{t-1} - \ln L_{t-2}\} + \alpha_3\{\ln(1+r_t) - \ln(1+r_{t-1})\} + \alpha_4\{\ln(1+r_{t-1}) - \ln(1+r_{t-2})\} + e_t$

parameter	regulated states	unregulated states
α_0	0.0170* (5.4839)	0.0158* (5.6429)
α_1	0.0402 (0.6109)	0.0308 (0.5168)
α_2	0.0909 (1.3963)	0.1798* (3.0168)
α_3	-0.1939 (-0.9251)	-0.5564* (-2.5558)
α_4	0.2333 (1.0989)	-0.4234 (-1.9602)
SSR_c	0.0224	0.0232
SSR_u	0.0210	0.0208
likelihood ratio stat.	6.3248	10.7015

Note: * = significant at 5 percent level, N = 49

t values in parentheses.

$t\ (44,\ 0.05) = 2.02$, $X^2(7,\ 0.05) = 14.067$

$\ln L^e_t = \beta_0 + \sum_{j=1}^{4} \beta_j \ln L_{t-j} + \sum_{j=1}^{4} \Gamma_j \ln X_{t-j}$

where, X = medical expense CPI

Table 2

Information Lag Hypothesis Test Under One Information Lag for Private Automobile Liability Insurance

Model: $\ln(P_t/P_{t-1}) = \alpha_0 + \alpha_1\{\ln L^e_{t-1} - \ln L_{t-2}\} + \alpha_2\{\ln L^e_{t-2} - \ln L_{t-3}\} + \alpha_3\{\ln(1+r_{t-1}) - \ln(1+r_{t-2})\} + \alpha_4\{\ln(1+r_{t-2}) - \ln(1+r_{t-3})\} + e_t$

parameter	regulated states	unregulated states
α_0	0.0160* (4.8485)	0.0162* (5.4000)
α_1	0.1076 (1.5393)	0.1747* (2.6960)
α_2	0.0703 (1.0233)	-0.0302 (-0.4682)
α_3	-0.2614 (-1.2198)	-0.4358 (-1.8720)
α_4	0.0082 (0.0378)	-0.0387 (-0.1688)
SSR_c	0.0227	0.0256
SSR_u	0.0208	0.0234
likelihood ratio stat.	8.3915	8.6262

Note: * = significant at 5 percent level, N = 48

t values in parentheses.

$t\ (43,\ 0.05) = 2.02$, $X^2(7,\ 0.05) = 14.067$

$\ln L^e_t = \beta_0 + \sum_{j=1}^{4} \beta_j \ln L_{t-j} + \sum_{j=1}^{4} \Gamma_j \ln X_{t-j}$

where, X = medical expense CPI