# THREE ESSAYS ON THE EFFECTS OF RISK AND REGULATION ON THE PRICE OF TERM LIFE INSURANCE

by

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**ABSTRACT**

While life insurers are generally free to set prices on term life insurance contracts, they face three constraints in doing so. Two of these constraints, insurance premium taxes and insurance guaranty funds, are imposed by state governments, while the third, the insolvency risk premium of insurance contracts issued by a specific insurer, is imposed directly by the market.

The first two essays estimate the effects of the two government-imposed constraints on the price of term life insurance. In essay one, we look at how guaranty funds affect the price of term life insurance. Guaranty funds, which exist in every state, reduce the cost of insurer insolvency to policyholders by paying out death benefits up to a specified amount, usually $300,000, on policies written by insurers that have become insolvent. We show theoretically, using an expected value model, and empirically, using data from the California term life insurance market, that the price per thousand dollars of coverage is significantly lower for policies with a face value above the amount guaranteed by the state guaranty fund.

In essay two, we estimate the effects of state insurance premium taxes on the price of term life insurance. In estimating the effects of state-specific premium taxes on the price of term life insurance, we linearly bifurcate each state's premium tax into a domestic premium tax, which is paid by all life insurance companies, regardless of domicile, and a retaliatory tax, which is paid only by an insurer whose state of domicile has a premium tax greater than that of the state in which the policy is written. We find that a one percent increase in both the domestic premium tax and the retaliatory tax increase the price of term life insurance by less than one percent.

Finally, in the third essay, we estimate the effect of an insurer's insolvency risk, as measured by A.M. Best Financial Strength Ratings, on the price of a term life insurance contract issued by that insurer. Insurance contracts sold by an insurer with a relatively lower rating should sell at a discount to policies written by firms with a higher rating. We find strong evidence that insurers with a relatively higher A.M. Best rating actually charge lower prices.

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# CHAPTER 1

# INTRODUCTION

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## CHAPTER 2

## IS THERE 'MARKET DISCIPLINE' IN INSURANCE MARKETS? EVIDENCE FROM THE CALIFORNIA TERM LIFE INSURANCE MARKET


### Abstract

In this paper, we show theoretically, using an expected value model, and empirically, using data from the California term life insurance market, that the price per thousand dollars of coverage is significantly lower for policies with a face value above the amount guaranteed by the state guaranty fund. In doing so, we provide a formal explanation for non-convexity of the offer curve of term life insurance and extend the 'market discipline' literature to include another risky asset, term life insurance.



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**Keywords:** Life Insurance, Guaranty Funds, Insurer Insolvency


### I. Introduction

In the literature on the price of term life insurance, several papers[1] provide evidence, both theoretical and empirical, that the price per thousand dollars of coverage declines as the quantity of coverage purchased increases. However, while these papers have noted the existence of this phenomenon, none have provided a formal explanation for its occurrence. For many goods, one would simply come to the conclusion that there are economies of scale. However, for insurance, this should not be the case. Because of adverse selection, the offer curve for insurance should be

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[1] Brown and Goolsbee (2002), Cawley and Philipson (1999), and Pauly, et al. (2003).

convex. This occurs because, on average, bad risks will want to purchase a higher quantity of insurance and insurers, who are aware of this, will charge higher prices in order to cover the higher cost of providing additional coverage to bad risks.

If adverse selection does not provide an explanation for the shape of the offer curve, then what does? One explanation is that some policies are riskier than others. Because of the possibility of default, one firm may have to charge a lower price than another because the latter insurer is viewed as more likely to fulfill its contractual obligations. However, this should only affect the level of the price, not the slope of the offer curve. What if, for all insurers, some policies were seen as riskier than others? Obviously, all insurers would have to discount riskier policies in order to induce consumers to purchase them.

Because of the existence of state insurance guaranty funds that pay out death benefits on life insurance contracts up to a certain face value in the event of insurer insolvency, term life insurance contracts with death benefits at or below the guaranteed amount could be viewed as safer than contracts that exceed the threshold.[2] Thus, the price per thousand dollars of coverage would be lower for policies above this amount.

This paper adds to the literature in two ways. First, it provides both a theoretical and empirical explanation for the non-convexity of the offer curve. Second, in doing so, it expands the scope of the 'market discipline' literature to include term life insurance.

In the next section, we discuss the price determinants of term life insurance. In section III, we provide a discussion on state guaranty funds, examine the literature on 'market discipline,' and present a theoretical model that shows, under certain conditions, that the price

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[2] This is true as long as the promise of payment by the guarantor is seen as credible. Using data from the Federal Savings and Loan Insurance Corporation, Cook and Spellman (1991) and (1996) show that guarantor risk has a significant effect on the risk premium.

per thousand dollars of term life insurance coverage for policies with a face value above the guaranteed amount is always less than that of policies with a face value at or below the guaranteed amount. In section IV, we present our econometric model, descriptive statistics, and results. We provide concluding remarks in the final section.

## II. The Price of Term Life Insurance

The determinants of the price of term life insurance can be divided into two categories: those that affect the level of the premium and those that affect the slope of the offer curve. According to Brown and Goolsbee (2002), the actuarially fair price of a one-year term life insurance policy that pays a face value of *F* on the final day of the year is a function of the individual's probability of dying during that year and the interest rate and is given by

$$P = \frac{q_a F}{(1+r)}, \quad (1)$$

where $q_a$ is the mortality risk and *r* is the interest rate. If either the interest rate falls (rises) or mortality risk increases (decreases), then the price of coverage increases (decreases).

One determinant of the level of the premium is market structure. Brown and Goolsbee (2002) hypothesize that the advent of insurance comparison websites reduced search costs for individuals and in turn reduced the market power of firms, causing the price of term life insurance to fall. Using policy data from LIMRA International, they find that the increase in Internet usage has reduced term life insurance premiums 8-15%.

One determinant of the slope of the offer curve should be the cost structure. From a theoretical standpoint, asymmetric information should have a relatively large effect on the slope of the offer curve. Individuals who are of high risk will purchase more insurance than those of low risk under asymmetric information. Insurers must charge higher prices in order to avoid losing money on relatively large policies bought by bad risks. However, using three data sets with varying levels of aggregation that include information on self-perceived risk, actual risk, and prices, Cawley and Philipson (1999) find a negative covariance between risk and quantity; in other words, they find no evidence of adverse selection. In addition to this, they find that individuals tend to purchase multiple contracts instead of one, large policy; thus, even if firms want to charge individuals higher prices for larger policies, they cannot because individuals would instead buy multiple policies from multiple firms.

Pauly, Withers, Subramanian-Viswanathan, Lemaire, Hershey, Armstrong and Asch (2003), (hereafter Pauly, *et al*), also find no evidence of adverse selection. In determining the risk elasticity (the change in risk with respect to a change in price) for a given risk class and the price elasticity of demand, they investigate whether an individual's demand for life insurance depends only on the loading percentage, which is the ratio of premiums to expected benefits; if it does, then the price elasticity of demand with a given level of risk should equal the risk elasticity of demand given a certain price. They find the price elasticity of demand, using different measures and definitions of price, to be between -0.3 and -0.5, and the risk elasticity to be between .16 and .29, and find no evidence of adverse selection.

If cost structure does not affect the slope of the offer curve via asymmetric information, it may do so through other channels. One channel is economies of scale. The three papers mentioned above look at this as well. Pauly, *et al* hypothesize, and Cawley and Philipson (1999) and Brown and Goolsbee (2002) find empirical evidence, that the annual premium for term life insurance has both a fixed and a constant marginal cost component and is given by

$$P = c + bX, \quad (2)$$

and the average price of coverage falls as a member of a given risk class purchases more insurance.

## III. Expected Value, Guaranty Funds, and Partial Guarantor Default

### *A. Overview*

In explaining their results, Cawley and Philipson (1999) hypothesize that insurers have other methods of distinguishing between low- and high-risk customers and have an information advantage with regard to the costs they face.

Another possible explanation for non-convexity of the offer curve of term life insurance is default risk. Several papers[3] comment on the fact that an insurance contract can be seen as a type of risky debt. If we view insurers as investment companies, then these companies simply issue debt and equity to finance investments above some hurdle rate. In this case, however, the debt issued are not bonds, but insurance contracts. With risky debt, included in the coupon payment is a risk premium. Therefore, it should hold that risky life insurance contracts should also include a risk premium. This risk premium shows up in insurance contracts in the form of a discount. The riskier the policy, the greater the discount should be.

However, because of the existence of insurance guaranty funds, it is possible that one policy is relatively riskier than another, even if both are underwritten by the same insurer. Typically, death benefits are guaranteed by state insurance guaranty funds up to $300,000.[4] Therefore, the face value of term life insurance policies can be separated into a guaranteed portion and a non-guaranteed portion. In the event of insurer insolvency, the guaranteed portion will be paid out by the state while the non-guaranteed portion will not and the beneficiaries must try and collect from the residual value of the insurer.

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[3] See Cummins and Phillips (2000), Cummins and Danzon (1997), Ligon and Thistle (2007), and Doherty and Tinic (1981).

[4] The Life & Health Insurance Guaranty Association System (2009).

Thus, one explanation for non-convexity of the offer curve of term life insurance policies could be due to a kink occurring at the ceiling amount of the guaranty fund. Above the guaranteed amount, firms must offer discounts to incentivize purchasers to purchase one large contract from that particular insurer instead of several smaller contracts from multiple insurers.

While this is the first paper that we know of to look at the effect of guaranty funds on the price of term life insurance, there is a whole section in the banking literature on 'market discipline' that deals with this topic. In general, the market discipline literature looks at the effect of bank risk-taking activity on the risk premium earned by holders of bank liabilities, such as deposit accounts and subordinated debt.[5] A subsection of this literature looks at the role played by the guarantor.

Bartholdy, Boyle, and Stover (2003) use data from 13 countries over six years to estimate the risk premium for bank deposits in countries with and without deposit insurance. They find, on average, that bank deposits in countries without deposit insurance pay a risk premium of forty basis points above bank deposits in countries with deposit insurance. In addition to this, they investigate whether the relationship between the level of deposit insurance and the risk premium is monotonic. In their analysis, they note that the partial derivative of the risk premium with respect to the level of deposit insurance is linear only when there is no moral hazard and the sign of the partial derivative depends on whether the greater protection that goes along with a higher level of deposit insurance outweighs the increased risk of bank default due to moral hazard. Empirically, they find that an increase in the ceiling insurance level leads to a decrease in the risk premium.

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[5] For a detailed literature review, see Gorton and Santomero (1990); Bartholdy, Boyle, and Stover (2003).

The results of Bartholdy, Boyle, and Stover (2003) imply that the there is a negative relationship between the percentage of the amount of the bank deposit covered by deposit insurance and the risk premium. Because of the similarity of deposit insurance and insurance guaranty funds, this should hold for life insurance contracts as well.

***B. Model***

In this section we model the effect of default risk on the price of a term life insurance contract using a two-period expected value model. In doing so, we first assume that the face value of the contract is equal to or less than the maximum amount paid by the guaranty fund. We first present the case of no default. Then, we consider the case of insurer default with no guarantor. Then, we look at insurer default when the guarantor always pays in a timely manner. Finally, we consider the case in which there is a non-zero probability that the guarantor will not pay in a timely manner.[6]

Consider a two-period model. At $t = 0$, an individual, the insured, purchases a term life insurance contract. At $t = 1$, the beneficiary of the contract collects the face value of the policy, $F$, if and only if the insured has died between $t = 0$ and $t = 1$. The insured dies with probability $\pi$ and lives with probability $(1-\pi)$, which is known to both the insured and the insurer. If there is no probability of default, then the expected value of the contract is

$$F\pi . \qquad (3)$$

Next, we consider the case of default by the insurer in which there is no guarantor. The insurer remains solvent with probability $q$ and defaults with probability $(1\text{-}q)$. If the insurer defaults, then the beneficiary receives nothing; if the insurer does not default then the beneficiary receives $F$. Thus, the expected value of the insurance contract is

[6] Throughout, we assume that there are no transactions cost and that there is no loading factor.

$$Fq\pi \,. \tag{4}$$

If the price of the insurance contract is equal to its expected value, then the difference in price between a risk-free contract and a risky contract is the probability of default, (1-*q*).

Next, we introduce a guarantor that may or may not pay out on time. When the guarantor always pays the face value of the contract in a timely manner, it is trivial to show that the expected value of the contract is equal to (3). Finally, we consider the case in which the guarantor does not pay in a timely manner. In this case, the guarantor pays on time with probability $\lambda$ and does not with probability $(1-\lambda)$. If the guarantor pays on time, the beneficiary receives *F*; if not, the present value of benefits received by the beneficiary is $\frac{F}{(1+r)^t}$. Obviously, if the guarantor does not pay out on time, the payoff is worth less to the beneficiary. We assume that the beneficiary must borrow funds until the policy is paid. Therefore, *r* represents the interest rate at which the beneficiary borrows the funds and *t* represents the term of the loan. The expected value of the policy is then:

$$\pi q F + \pi(1-q)\lambda F + \pi(1-q)(1-\lambda)\frac{F}{(1+r)^t} \tag{5}$$

which equals

$$\pi\frac{F}{(1+r)^t} + \pi q\left(F - \frac{F}{(1+r)^t}\right) + \pi\lambda\left(F - \frac{F}{(1+r)^t}\right) - \pi q\lambda\left(F - \frac{F}{(1+r)^t}\right). \tag{6}$$

Obviously, the timing of the payout affects the expected value. As *t* goes to zero, (6) converges to the expected value with no risk of insurer default. As *t* increases, the expected value decreases, as does the price.

However, this assumes that one purchases a policy at or below the threshold of the guaranty fund. We now model the expected value for a policy greater than the amount guaranteed by the guaranty fund. To do this, we first split the face value of the policy, $F$, into a guaranteed component, $G$, and a non-guaranteed component, $N$, so that

$$F = G + N \tag{7}$$

and

$$G = F - N. \tag{8}$$

Buying a policy above the guaranteed amount has a relatively large effect when there is a guarantor. In the absence of a guarantor, the beneficiary receives all or nothing, no matter the face value of the policy; the expected value is the same.

However, this is not true when there is a guarantor. The problem is that the guarantor is only going to pay the guaranteed amount. In the case in which the guarantor always pays on time, the expected value is

$$\pi qF + \pi(1-q)(F-N), \tag{9}$$

which equals

$$\pi F - \pi N + \pi qN . \tag{10}$$

If we set the expected value equal to the price, which is in terms of price per thousand dollars of coverage, we can compare (3) and (10). For a policy above the guaranteed amount, any non-zero default risk will cause the price per thousand dollars of coverage to be less than that of a policy at or below that guaranteed by a state guaranty fund.

Finally, we consider the case in which the guarantor may not pay out on time. In this case, the expected value is

$$\pi qF + \pi(1-q)\lambda G + \pi(1-q)(1-\lambda)\frac{G}{(1+r)^t}, \tag{11}$$

$$\pi \frac{F-N}{(1+r)^t} + \pi q(F - \frac{F-N}{(1+r)^t}) + \pi\lambda[(F-N) - \frac{(F-N)}{(1+r)^t}] - \pi q\lambda[(F-N) - \frac{(F-N)}{(1+r)^t}]. \quad (12)$$

Comparing (6) and (12), going term by term, we see that the first term is smaller by $\frac{\pi N}{(1+r)^t}$, the second term is larger by $\frac{\pi q N}{(1+r)^t}$, the third term is smaller by $\pi\lambda(N - \frac{N}{(1+r)^t})$, and the fourth term is larger by $\pi q\lambda(N - \frac{N}{(1+r)^t})$.

As long as $\pi$, $q$, and $\lambda$ are strictly between zero and one, then

$$\frac{\pi N}{(1+r)^t} > \frac{\pi q N}{(1+r)^t}, \text{ and } \pi\lambda(N - \frac{N}{(1+r)^t}) > \pi q\lambda(N - \frac{N}{(1+r)^t}),$$

and the price per thousand dollars of coverage for a policy with a face value above the guaranteed amount is always less than the price per thousand dollars of coverage for a policy with a face value at or below the guaranteed amount.

## IV. Results

### *A. Empirical Model*

Above, we noted that the existence of guaranty funds and the limits placed on the payment of death benefits in the event of an insurer insolvency could explain, for a given risk class, the non-convexity of the offer curve of term life insurance policies. In addition to this, we provided evidence that, for a similar risky asset, a bank deposit, there is a negative relationship between the percentage of the amount of the risky asset covered by deposit insurance and the risk premium. Finally, we proved that, under certain conditions, the price per thousand dollars of coverage for term life insurance will always be less when the face value of the policy is greater than the guaranteed amount. In this section, we investigate whether this holds empirically.

In doing so, we look at the California term life insurance market for the period 2003-2007. We look at California for several reasons. First, it would be difficult econometrically to control for variations in state guaranty funds over all fifty states and Washington, D.C. Second, California has a relatively large insurance market. For our sample period, according to the California Department of Insurance, the California market represented approximately 8.7% of the total life insurance premiums written in the United States. In addition to this, the California Department of Insurance provides a plethora of information on insurance sales and market structure.

The California Life & Health Guarantee Association guarantees 80% of the stated death benefit of a single life insurance policy, up to $312,500.[7] In other words, it will pay up to $250,000 in death benefits. See Table 1 in Appendix A, we provide the face value of the policies included in our sample, and the percentage and dollar amount of the policy covered by the guaranty fund.

Thus, in California, policies with a face value above $312,500 are riskier than those with a face value equal to or less than $312,500 because the proportion of the policy face value paid out begins to decline above $312,500. Controlling for risk, both on the part of the insured and the insurer, policy size, and economies of scale, in terms of price per thousand dollars of coverage, there should be a statistically significant difference in price per $1000 of coverage between policies that have face values equal to or less than $312,500 and those with face values greater than $312,500. We test for this by including a dummy variable that equals one for policies above the guaranteed amount and zero for those at or below the guaranteed amount.

In doing so, we estimate the following model:

[7] According to California Code Section 1067.02.02.B(ii).

$$
\begin{aligned}
P(I_i) &= \alpha + \beta_1 SMOKE + \beta_2 HEALTH + \beta_3 GENDER + \beta_4 PROJECTED \\
&+ \beta_5 SCALE + \beta_6 POLICYSIZE + \beta_7 GROUP + \beta_8 STOCK + \beta_9 AGENCY \\
&+ \beta_{10} REALASSETS + \beta_{11} NY + \beta_{12} LICENSES + \beta_{13} BEST + \beta_{14} GROUPRATING \\
&+ \beta_{15} MSHARE + \beta_{16} YEAR + \varepsilon.
\end{aligned} \tag{13}
$$

The dependent variable, which is defined below, includes quotes of term life insurance coverage from Compulife, an online provider of term life insurance quotes, and a measure of the quantity of insurance purchased.[8] The Compulife data used are yearly prices of 10-year level term life insurance policies for 38-year-old men and women ranging in size from $50,000 to $1 million in the California market for the period 2003-2007. According to LIMRA International, the average policy size for our sample period was $384,553.6; the average (median) age for the period 2001-2005, which was the last available data, ranged from 36-39 (36-38); and the mode term for term insurance was twenty years.[9] We chose 10 policies because the uncertainty for 20 year policies was too high;[10] and, we chose age 38 because this was the median age for 2005, which is the mid-point of the sample. We include policies for all different health, smoking, and A.M. Best rating classes.

Ligon and Cather (1997, p. 998) explain that the "quantity of insurance is defined in relation to the financial return which the consumer receives from the insurance contract." In measuring the quantity of insurance, we use, in addition to the quotes from Compulife, two measures of the ratio of premiums earned to losses incurred in order to compute the premium per dollar of expected economic loss. The first measure is the loss ratio, which equals benefits paid

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[8] We use the December quote in order to match monthly data with yearly data.

[9] Ten-year policies were the second-most chosen term period.

[10] The increased uncertainty comes from two channels. First, life insurance needs for the insured are more likely to change over twenty than ten years; second, all other things remaining constant, the insurer has a higher likelihood of default over a period of twenty years.

divided by premium income. Because the loss ratio is computed over the different lines of life insurance an insurer offers, we compute a second measure, the combined ratio, which is the sum of the loss and expense ratios.[11] The data for these measures come *Best's Reports* (2004-2008).

We compute the discount rate $R_L$ by using the insurance CAPM, which is given by

$$R_L = R_F + \beta_L [R_M - R_F], \qquad (14)$$

where $R_L$ is the required rate of return on the insurance contract. Because the underwriting losses incurred by life insurers should be uncorrelated with the market, we assume $\beta_L$ , the underwriting beta, equals zero.[12] The risk-free rate, $R_F$ , is obtained using the yearly geometric average of two six-month (January and July) Treasurys found in series TB6MS from the Board of Governors of the Federal Reserve System and accessed from the Federal Reserve Bank of St. Louis.

In order to obtain the dependent variable, we take the following steps. First, we take the individual quote and transform it into the price per thousand dollars of coverage. To obtain our first price measure, we take the price per thousand dollars of coverage and divide by the loss ratio. Dividing the price per thousand dollars of coverage by the loss ratio is equivalent to multiplying the price per thousand dollars of coverage by the reciprocal of the loss ratio, which is the ratio of premiums earned to benefits paid. We define this price measure as $P(I_1)$. To obtain our second price measure, we take the price per thousand dollars of coverage and divide by the sum of the loss and expense ratios. Dividing the price per thousand dollars of coverage by the sum of the loss and expense ratios allows us to put a measure of premiums earned in the numerator and a measure of losses incurred in the denominator. We define this price measure as

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[11] Because the expense ratio is defined as expenses divided by premium income, we can sum the two.

[12] Property-Liability firms have been found to have a negative underwriting Beta because losses increase slightly when the market falls. Deaths should not be expected to significantly increase as the market declines in value.

$P(I_2)$. Thus, both ($I_1$) and ($I_2$) allow us to compute the premium per dollar of economic loss. Finally, to adjust for the time value of loss payments, we divide both $P(I_1)$ and $P(I_2)$ by $(1+R_L)^m$, where *m* is a weighted probability of dying during a given year over the life of the term life insurance contract, and is given by

$$\sum_{i=1}^{10} \frac{Prob_i}{\sum_{i=1}^{10} Prob_i} * year_i, \qquad (15)$$

where $Prob_i$ is the probability of dying in a given year and $year_i$ is the number of years the policy has been in force beginning in year one when the policy is purchased. Data on the probability of dying in a given year come from Arias (2007), who estimates life tables for 2004, the most recent year available. In calculating the probability of dying for each gender, year one is found by taking the probability of dying for 38-39 year olds and dividing by the sum of the probability of dying for those 38-39 years to those 47-48 years of age and multiply by one (since it is considered the first year of the policy). We repeat this up to year ten (47-48 years of age) and take the summation.[13]

Explanatory variables include insured characteristics such as a dummy variable that equals one if the insured is a smoker and a dummy variable equal to one if the insured is male. We expect the signs of the coefficients for these variables to be positive. We also include a dummy variable equal to one if the policy is projected.[14] A qualitative variable for health is included and ranges from zero to three for those in “regular,” “regular plus,” “preferred,” and “preferred plus” health, respectively. We expect the sign on this coefficient to be negative.

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[13] For men, *m* equals 6.19299; for women, *m* equals 6.210362.
[14] A projected policy is one in which the premium projected, and may not equal the premium charged.

As noted above in equation (2), economies of scale could be responsible for non-convexity in the term life insurance offer curve. In order to control for this, we include several different measures of the face value of the policy.[15]

We include three variables in order to control for organizational structure, the data for which come from *Best's Key Rating Guide* (2006 and 2008). First, we include a dummy equal to one if the insurer offering the policy is a member of a group. In a multi-line firm, profitable lines can subsidize unprofitable lines; however, in a single-line firm, subsidization is not possible. Therefore, a group could be seen as safer and the sign on the coefficient of this variable should be positive.

Second, we include a dummy variable that equals one if the insurer is a stock company. To clarify, this is not used to denote whether the insurer is publicly or privately held; it is used to denote whether the firm is owned by shareholders or policyholders. We include this because several papers find evidence that stock property-liability insurers take on more risk than mutual insurers. Most papers look at the insurer's point of view when discussing at this. Lamm-Tennant and Starks (1993) find the loss ratios of stock insurers (the measure of risk) to be higher than those of mutual insurers. If stock insurers are associated with more risk, they may have to sell policies at lower prices to compensate for the increase in risk. Boose (1990) makes the point that because shareholders are aware of the agency problem in stock companies, they do a better job of keeping tabs on management, which leads to expenses being lower. Finally, Pottier and Sommer (1997) find that stock life insurers offer different types of policies than mutual insurers. Ligon and Thistle (2005), however, look at it from the point of view of the insured. They find that low-risk individuals are better off purchasing contracts from mutual insurers while high-risk

[15] Economies of scale are controlled for using the inflation-adjusted policy face value, the natural log of the inflation-adjusted face value, and the inflation-adjusted policy face value squared. See Brown and Goolsbee (2002).

individuals are at least no worse off (and sometimes better off) purchasing contracts from stock insurers. Thus, the coefficient for this variable could be either positive or negative.

The third dummy variable included to control for organizational structure equals one if the insurer sells policies through an independent agency. Kim, Mayers, and Smith (1996) look at the distribution system of property-liability firms and find that insurers that distribute through an exclusive agency have lower costs. The coefficient of this variable should be negative.

In order to control for firm risk, we include a dummy that equals one if the firm has an A rating (A++, A+, A, A-) and zero otherwise. We expect the sign to be positive, indicating that insured are willing to pay more for a reduction in firm risk.[16]

A.M. Best modifies their ratings with several "affiliation codes." One way the firm modifies its ratings is with a group rating. A group rating is assigned to a corporate parent of a group and certain subsidiaries. In order to prevent a subsidiary from obtaining an unwarranted rating upgrade based on the financial strength of the parent, a subsidiary "must be deemed integral to the group's business strategy, generally operates under common management and/or ownership, and serves as a strategic marketing or distribution arm of its parent." To control for this, we include a dummy variable that is equal to one if the insurer receives a group rating.[17] All ratings data come from *Best's Reports* (2004-2008).

We also control for firm risk using other measures. First, we include real assets. As noted by Sommer (1996), larger firms should be more diversified. Thus, on average, larger firms should be considered to have a lower risk of insolvency and should be able to charge higher

[16] Any rating changes have been verified using Lexis-Nexis to find the exact date of change. It also should be noted that data such as assets for a given year and firm may change over each edition. Sometimes, it appears that the data are updated to reflect more accurate information; other times, however, the data change to reflect a merger. We use the data originally reported. We test this hypothesis in another chapter of the dissertation.

[17] An insurer that receives a group rating must be a member of a group. However, being a member of a group does not necessarily mean that it will receive a group rating. The correlation coefficient between *GROUP* and *GROUPRATING* is .3255.

prices.[18] Next, we include a dummy variable that equals one if the insurer is licensed in New York. We include this because New York is generally considered to have the most stringent insurance regulations in the country. In addition to this, we include the number of jurisdictions in which each insurer is licensed, which can range from one to 51 (we include Washington, D.C.). This acts as a measure of geographic diversification.

Next, we include a dummy variable for each year that equals one if the policy was written in that year in order to control for any intertemporal price changes that cannot be explained by any of the variables above and deflate the nominal price of the policy and assets by the December CPI-U, with 2003 as the base year.

Finally, we include data on market structure. To do so, we include the market for life insurance, as calculated by the California Department of Insurance. This variable measures the percentage of life insurance premiums written by a particular insurer in a given year. There should be a positive relationship between price and market share, indicating that firms with greater market power are able to charge higher prices.

We discard observations in the following manner. We discard any observations from firms that do not have an A.M. Best rating or do not fall into one of fifteen size classes as designated by A.M. Best. Finally, we discard any observations that are either missing data for any of the explanatory variables or for which the loss and expense ratios are not available.

[18] While AIG may be considered to be an exception to this, it is not. The failure of AIG was not caused by the life and property-casualty insurance companies but by a division of AIG that was not licensed to sell insurance. AIG's state-licensed insurers have remained relatively healthy since they are limited in the amount of funds they can remit to the parent firm.

***B. Summary Statistics***

In this section, we provide summary statistics for the dependent and explanatory variables used.[19] Tables 1A and 1B (See Appendix A) provide a glimpse of the different components of the dependent variable. Table 1A (in Appendix A) provides the mean values for the two measures of premium per dollar of economic loss, and the discount rate.

Table 1B (in Appendix A) shows the average nominal and inflation-adjusted price per $1000 of coverage, and the deflator.

In inflation-adjusted terms, the price per $1000 of term life insurance falls from $1.52 to $1.33. Table 2 (in Appendix A) shows the mean and standard deviation for the explanatory variables.

The average policy is priced, in inflation-adjusted terms, at $1.44 per $1000 of coverage over the five years of the sample, with, on average, 35% of the policies offered being for smokers, 50% for males, and the health level being between that of "regular plus" and "preferred."

Companies in the sample tend to be part of a group and owned by stockholders (and not policyholders), offer policies through an independent agency, and, on average, are licensed in approximately 49 of the 51 jurisdictions represented.

Finally, we see that 95% of the policies in our sample are from insurers with an A rating (A++, A+, A, or A-) from A.M. Best. It also turns out that none have below a B- rating, even though in downloading the data from Compulife all companies were selected. While that may seem high, it is not much higher than the population of life and health insurers. According to *Best's Key Rating Guide* (2008), 93% of all life and health insurers (no distinction between the

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[19] These figures are for all policies in our sample, not just those between $50,000 and $300,000

two is made) have a B- rating or higher. The summary statistics for the remaining variables can be seen in Table 2.

***C. Regression Results***

In order to determine whether policies above the guaranteed amount are sold at a discount to reflect a perceived increase in risk relative to policies below the guaranteed amount, we estimate linear and log-linear specifications of (13) incorporating the three different measures of price, $P(I_1)$, $P(I_2)$, and the inflation-adjusted price per $1,000 of coverage, and the three measures of economies of scale, the inflation-adjusted face value, the natural log of the inflation-adjusted face value, and the square of the inflation-adjusted face value.[20] If policies above the amount guaranteed are riskier than those below the amount guaranteed, then the coefficient for *POLICYSIZE* should be negative and statistically significant. These results can be seen in Tables 3-8 (in Appendix A).

For the variable at the center of our hypothesis, *POLICYSIZE*, we obtain some interesting results. For each linear specification, when either the inflation-adjusted face value or the square of the inflation-adjusted face value is used to control for economies of scale, the coefficient for *POLICYSIZE* is negative and statistically significant, which is as expected. However, when the natural log of the inflation-adjusted face value is used to control for economies of scale, the coefficient for *POLICYSIZE* is positive and statistically significant, which means that policies with a face value above the amount guaranteed sell at a premium relative to those with a face value below the amount guaranteed. For each log-linear specification, when either the inflation-adjusted face value or the square of the inflation-adjusted face value is used to control for economies of scale, the coefficient for *POLICYSIZE* is negative and statistically significant,

[20] Thus, for each price measure, results for six regressions are reported.

which is as expected. When the natural log of the inflation-adjusted face value is used to control for economies of scale, the coefficient for *POLICYSIZE* is positive but statistically insignificant.

One possible explanation for the unexpected results when including the natural log of the inflation-adjusted face value to control for economies of scale is the interaction between this independent variable, the dependent variable, and *POLICYSIZE*. As noted above, when including either the inflation-adjusted face value or the square of the inflation-adjusted face value as a measure of economies of scale, the sign and statistical significance of the coefficient for *POLICYSIZE* does not change between linear and log-linear specifications (the coefficient is negative and statistically significant). However, when including the natural log of the inflation-adjusted face value as a measure of economies of scale, the statistical significance of coefficient for *POLICYSIZE* does change between linear and log-linear specifications (in the linear specifications, the coefficient is positive and statistically significant, while in the log-linear specifications, it is positive and statistically insignificant). This indicates that the relationship between the functional form of the dependent variable and this specific measure of economies of scale is the best explanation for why the coefficient for *POLICYSIZE* has the unexpected sign.

Next, we look at the results of our control variables. In each regression, the coefficients for the variables *SMOKER*, *GENDER*, *HEALTH*, *SCALE*, *GROUP*, and *REALASSETS* are as expected. In each regression, the coefficients for the variables *NY*, *STOCK*, *AGENCY*, *MSHARE* and *YEAR* dummy variables are negative. Finally, the coefficients for the variables *PROJECTED*, *LICENSES*, *BEST*, and *GROUPRATING* vary in both statistical significance and sign.

Another issue that should be considered is the considerable loss of observations due to the use of the two measures of the quantity of insurance. If we used the full sample, we would have 41,992 observations instead of 19,989. To ensure that we are not excluding any information, we re-estimate the linear and log-linear specifications of (13) using the price per $1000 of coverage as the dependent variable. For each linear specification, when either the inflation-adjusted face value or the square of the inflation-adjusted face value is used to control for economies of scale, the coefficient for *POLICYSIZE* is negative and statistically significant; when the natural log of the inflation-adjusted face value is used to control for economies of scale, the coefficient for *POLICYSIZE* is positive and statistically significant. For each log-linear specification, when either the inflation-adjusted face value or the square of the inflation-adjusted face value is used to control for economies of scale, the coefficient for *POLICYSIZE* is negative and statistically significant; when the natural log of the inflation-adjusted face value is used to control for economies of scale, the coefficient for *POLICYSIZE* is positive and statistically significant. These results can be seen in Tables 9-10 in Appendix A.

***D. Additional Regressions***

While the focus of this paper has been to estimate the risk premium of insurance contracts, regardless of insurer, it is worthwhile to check whether other risk factors affect the risk premium. As shown above, policies with a face value above the amount guaranteed are riskier than those with a face value at or below the guaranteed amount, and the risk premium shows up in the reduction in the price per thousand dollars of coverage. Another interesting question is whether the relative insolvency risk of the insurer underwriting a relatively riskier policy further increases the risk premium. One way to answer this question is by creating an interaction term between the *POLICYSIZE* dummy variable and the A.M. Best dummy variable.

To do so, we first change the *BEST* variable to equal one if the insurer has any B rating (B or B-) instead of an A rating.[21] Then, following Wooldridge (2006), we subtract the mean of each variable, and then multiply *BEST* and *POLICYSIZE* to create the variable *INTERACTION*. For most linear and log-linear specifications, the coefficient for *INTERACTION* is positive, but statistically insignificant. The coefficient for *INTERACTION* is statistically significant for log-linear specifications when the measure of economies of scale is the natural log of the inflation-adjusted face value. However, the sign on the coefficient *INTERACTION* is positive, which is different than expected. These results are presented in Table 11.[22] in Appendix A.

Finally, we look at how smoking affects policies above the amount guaranteed. On the one hand, insurers may try to reduce the discount on policies above the guaranteed amount because smokers are riskier. However, smokers may be more price sensitive to increases in the price of life insurance contracts, causing insurers to discount policies above the guaranteed amount even more. To test this, we subtract the mean of each variable, *SMOKE* and *POLICYSIZE*, and then multiply the two variables to create the variable *INTERACTION*. For all linear and log-linear specifications, we find that the coefficient for *INTERACTION* is statistically significant. However, in every linear specification, the coefficient for *INTERACTION* is negative while in every log-linear specification, the coefficient is positive. These results are presented in Tables 12-17 in Appendix A.

## V. Conclusion

Previous research has provided an informal reason as to why the offer curve of term life insurance is not convex. Articles such as Cawley and Philipson (1999) simply assume that

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[21] If the interaction term equals one, it is the product of a lower-rated insurer and a policy with a face value above the amount guaranteed.

[22] We only present the results for the regressions in which the coefficient for *INTERACTION* is statistically significant.

insurers have some type of information advantage that mitigates the costs associated with adverse selection.

However, it is difficult to believe that adverse selection plays no part in the pricing of term life insurance. Some other factor, independent of adverse selection, must be influencing term life insurance prices. One possible factor is the existence and structure of state guaranty funds that can cause some policies, regardless of the insurer, to be relatively riskier than others.

In this paper, we have provided evidence, both theoretical and empirical, that the structure of state guaranty funds, in terms of price per thousand dollars of coverage, causes policies above the guaranteed amount to sell at a discount compared to those at or below the guaranteed amount. In other words, we find evidence of market discipline in the term life insurance market.

## CHAPTER 3

## THE COST OF TAXATION: HOW THE PREMIUM TAX AFFECTS THE PRICE OF TERM LIFE INSURANCE

### Abstract

In this paper, we investigate the effect of the state premium tax on the price of term life insurance. In doing so, we provide a background on the history of the premium tax and insurance regulation. In order to measure how the premium tax is shifted to consumers, if at all, we bifurcate the premium tax into the domestic premium tax and the retaliatory premium tax. Because we only have data for states in which there is a discernable premium tax, what we actually measure is inter-state differences in the levels of the domestic and retaliatory premium taxes. Over all regression specifications, we find that both the inter-state differences in the domestic premium tax and the retaliatory premium tax are undershifted to consumers.

### I. Introduction

A frequently discussed topic in the insurance literature is the taxation of insurance premiums. Most of the literature in this area is either 1) a discussion on how the insurance premium tax differs from state to state and how it has changed over time; [23] 2) theoretical; [24] or 3) a discussion of how premium taxes affect growth in the industry or growth in a state.[25] Noticeably absent from the literature is any empirical work on how the taxation of insurance premiums affects the premium itself.

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[23] Skipper (1987)
[24] Bodily (1977) and Boyer (2000)
[25] Castillo (1997)

Currently, each state sets its premium tax rate on different lines of insurance, which can vary based on the line of insurance and the domicile of the particular insurer. Employing a policy-level dataset of term life insurance policies, this paper has two main objectives: to estimate the costs incurred by policyholders and to identify whether the insurance premium tax is undershifted, fully shifted, or overshifted to policyholders. This paper is the first that we know of that directly estimates the effects of the premium tax on the premium itself and adds a unique perspective to the literature on tax shifting.

The paper is divided into the following sections: In the next section, we provide a discussion on the life insurance industry, and the determinants of the price of life insurance. In Section III, we discuss the legal history of the insurance industry, the current regulatory structure of the industry, and the current tax structure of insurance premiums. In Section IV, we discuss the effects of taxation on the price of goods. In Section V, we provide an overview of the data, model specification and state our hypothesis. In Section VI, we provide results, and we conclude in Section VII.

## II. Price Determinants of Term Life Insurance

Life insurance can be separated into two broad categories, cash value life insurance and term life insurance. Cash value insurance has both a mortality component and a savings component, while term life insurance has only a mortality coverage component. Term life insurance provides mortality coverage for a specific period of time; level term life insurance provides insurance at a constant premium and is the most popular form of term life insurance (American Council of Life Insurers (ACLI), 2007). If the insured dies during the term of the policy, the beneficiary receives the face value of the policy; otherwise, no payout is made to the beneficiary. In 2006, according to the ACLI (2007), term life policies made up 41% of new life insurance policies issued, representing 71% ($1.3 trillion) of the total face value of life insurance issued.

The determinants of the price of term life insurance can be divided into two categories: those that affect the level of the premium and those that affect the slope of the offer curve. According to Brown and Goolsbee (2002), the actuarially fair price of a one-year term life insurance policy that pays a face value of $F$ on the final day of the year is a function of the individual's probability of dying during that year, and the interest rate and is given by

$$P = \frac{q_a F}{(1+r)}, \tag{1}$$

where $q_a$ is the mortality risk and $r$ is the interest rate. If either the interest rate falls (rises) or mortality risk increases (decreases), then the price of insurance increases (decreases).

One determinant of the level of the premium is market structure. Brown and Goolsbee (2002) hypothesize that the advent of insurance comparison websites reduced search costs for individuals and in turn reduced the market power of firms, causing the price of term life insurance to fall. Using policy data from LIMRA International, they find that the increase in Internet usage has reduced term life insurance premiums 8-15%.

One determinant of the slope of the offer curve should be the cost structure. From a theoretical standpoint, asymmetric information should have a relatively large effect on the slope of the offer curve. Individuals who are of high risk will desire to purchase more insurance than those of low risk at any price exceeding the actuarially fair price to low risks. Insurers must charge higher prices than those that are actuarially fair to an average risk in order to avoid losing money on relatively large policies bought by bad risks. However, using three data sets with varying levels of aggregation that include information on self-perceived risk, actual risk, and prices, Cawley and Philipson (1999) find a negative covariance between risk and quantity; in other words, they find no evidence of adverse selection. In addition to this, they find that individuals tend to purchase multiple contracts instead of one, large policy; thus, even if firms want to charge individuals higher prices for larger policies, they cannot because individuals would instead buy multiple policies from multiple firms.

Pauly, Withers, Subramanian-Viswanathan, Lemaire, Hershey, Armstrong and Asch (2003), hereafter Pauly, *et al*, also find no evidence of adverse selection. In determining the risk elasticity (the change in risk with respect to a change in price) for a given risk class and the price elasticity of demand, they investigate whether an individual's demand for life insurance depends only on the loading percentage, which is the ratio of premiums to expected benefits; if it does, then the price elasticity of demand for a given risk class should equal the risk elasticity of demand given a certain price. They find the price elasticity of demand, using different measures and definitions of price, to be between -0.3 and -0.5, and the risk elasticity to be between .16 and .29, and find no evidence of adverse selection.

If cost structure does not affect the slope of the offer curve via asymmetric information, it may do so through other channels. One channel is economies of scale. The three papers mentioned above look at this as well. Pauly, *et al* hypothesize, and Cawley and Philipson (1999) and Brown and Goolsbee find empirical evidence, that the annual premium for term life insurance has both a fixed and a constant marginal cost component and is given by

$$P = c + bX, \qquad (2)$$

and the average price of coverage falls as a member of a given risk class purchases more insurance.

## III. Insurance Regulation and Taxation

### *A. Legal History*

Three United States Supreme Court cases have greatly affected how the insurance industry is regulated and taxed. The first case, decided in 1944, is *United States v. South-Eastern Underwriters Association* (322 U.S. 533 1944). In this case, the Supreme Court looked at three things: first, whether a fire insurance company that conducts a large amount of its business across state lines is engaged in interstate commerce and is thus subject to regulation by Congress under the Commerce Clause; second, whether a conspiracy to restrain interstate trade by engaging in price fixing on fire and allied lines of insurance violates the Sherman Antitrust Act; third, whether or not Congress intended for insurance companies to be exempt from the Sherman Antitrust Act. In its ruling, a majority of the Court held that the insurance industry was not beyond federal oversight under the Commerce Clause and that Congress did not intend to exempt the insurance business from the Sherman Act. In doing so, the court rejected the argument that the sales contract was the only commerce occurring and held that the collection and investment of premiums were interstate in nature. This case, according to Friedman (2005), repudiated *Paul v. Virginia*. In that case, the Supreme Court held that insurance was not commerce and thus a state could impose a discriminatory tax against foreign insurers. In response to *United States v. South-Eastern Underwriters Association*, Congress, in 1945, passed the McCarran-Ferguson Act. This law, according to Danzon (2008), provided a limited exception to the insurance industry from antitrust laws such as the Sherman Antitrust Act, the Clayton Act, and the Federal Trade Commission Act and essentially gave regulatory authority to the states. Up to this point, many states already taxed insurance premiums and regulated insurers, but this ruling gave the states almost complete control over insurance regulation. The Act gave the states three years to pass laws regulating insurance companies; in doing so, according to Section 2(b), all federal antitrust laws would be preempted by state regulation.

The second Supreme Court case is *Western & Southern Life Ins. Co. v. Board of Equalization* (451 U.S. 648 1981). In this case, an Ohio insurer sued the state of California, arguing that the retaliatory tax imposed on foreign insurers violated the Commerce Clause and the Equal Protection Clause of the Fourteenth Amendment. The Court held that the passage of the McCarran-Ferguson Act allowed states to regulate and tax insurance companies without violating the Commerce Clause. In addition to this, the Court ruled that the retaliatory tax does not violate the Equal Protection Clause and that the implementation of the retaliatory tax is a legitimate state interest because it is used as a deterrent against other states imposing discriminatory or excessive taxes on domestic insurers.

The third case is *Metropolitan Life Ins. Co. v. Ward* (470 U.S. 869 1985). In this case, a foreign insurance company, commonly known as Met Life, sued because, as a foreign insurance company, it faced a higher insurance premiums tax than domestic firms. The court ruled that the discriminatory tax, otherwise known as the differential premium tax, did violate the Equal Protection Clause because neither discriminating against nonresidents nor encouraging investment in assets within the state of Alabama are legitimate state interests. However, the Court did not rule the law unconstitutional; it simply remanded the case back to state court.

### *B. Insurance Regulation*

Insurance regulation at the state level falls into two general categories: financial regulation and market regulation. The main goal of financial regulation is to reduce the likelihood of insurer insolvency.[26] In general, insurance regulators use measures of risk-based

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[26] Financial regulation of insurers is described in more detail in the two other chapters.

capital developed by the National Association of Insurance Commissioners (NAIC) such as total adjusted capital, which is assets minus liabilities plus the asset valuation reserve, to determine the financial health of an insurer. These measures of risk-based capital are compared to benchmarks set by insurance regulators and, if they are lower than certain benchmarks, regulators can take action to reduce the likelihood of insolvency. If necessary, regulators can seize an insurer to either manage its funds or sell it in order to guarantee that the contracts between the insurance company and insured are upheld.

The main goal of market regulation is to ensure that insurance companies, in their day-to-day dealings with policyholders (thus excluding solvency concerns), act equitably towards policyholders, mainly in the areas of advertising and contracts. In fulfilling this objective, insurers are licensed and forms and non-life insurance premiums are regulated to varying degrees by state insurance commissions. For life insurance, regulators generally set an indirect price floor on premiums by regulating mortality tables, interest rates, and valuation methods (Wright, 1992).

### *C. Structure of State Premium Taxes*

According to Skipper (1987), for over a hundred years, insurance companies have been taxed at the state level. The most popular form of state-level insurance taxation is the taxation of insurance premiums. The majority of states subject insurers to premium taxes in lieu of other taxes, such as the corporate income tax.

There are three main types of insurance premiums taxes and they are, for the most part, solely based on premium revenue. The most basic form of premium taxation occurs when a resident of State *A* buys an insurance policy from an insurer domiciled in State *A* and the insurer pays a percentage of the premiums to the government of State *A*. In addition to this, in some states, an insurance company that sells insurance (and is licensed) in State *A*, but is domiciled in any other state besides State *A*, is taxed at a higher rate. This tax, known as either a foreign tax, discriminatory tax, or differential premium tax, is meant to protect domestic insurance companies and encourage firms to domicile in the state in which they do business. This tax scheme charges a lower rate to so-called foreign companies that invest reserves in that state, but the tax, as measured as a percentage of the premium, is still higher for foreign firms. The final type of premium tax assessed to insurance companies is the retaliatory tax, which is unique to the insurance industry. Retaliatory taxes are used by states to help domestic firms compete abroad by discouraging other states from implementing relatively higher taxes on foreign companies. We present an example of this below: [27]

> Assume that State *A* taxes all insurers at three percent of gross premiums written in State *A*. Assume that State *B* taxes all insurers at two percent of gross premiums written in State *B* and has a retaliatory tax. Insurers domiciled and doing business in State *B* would be taxed at two percent while insurers domiciled in State *A* doing business in State *B* would be taxed at three percent. (p. 133)

Companies that are domiciled in states with a relatively high premium tax are put at a disadvantage when they attempt to write insurance in a state that has both a relatively low premium tax and a retaliatory tax.

## IV. Taxes and Life Insurance

The standard discussion on the effects of taxes on the price of a good deals with the tax incidence—which party, the buyer or the seller, bears what percentage of the tax. Textbooks tell us that when the price elasticity of demand for a good is perfectly inelastic (elastic) then the consumer (seller) bears the tax perfectly. For a good that is between these two extremes the

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[27] This example is based on that of Skipper (1987, p. 133). The main difference is that that example looks at the retaliatory tax in the context of a differential premium tax scheme while ours does not due to the fact that only two states during the sample period, Colorado and Idaho, have a differential premium tax.

consumer bears at least some of the tax burden. Of course, this is a static model under perfect competition.

The literature, both theoretical and empirical, looks at the change in the price of a good relative to the tax imposed. In percentage terms, if the price of a good increases less than the tax imposed on it, then the tax is undershifted; if the price of a good increases by the full amount of the tax, then the tax is fully shifted to the consumer; finally, if the price of good increases by more than the amount of the tax, then the tax is overshifted to the consumer. Below, we present a model that examines the effect of a tax on the price of good.

Seade (1985) considers the effect of a tax on the price of a good using a model of conjectural variations, but the scope is limited to the case of an oligopoly with a fixed number of firms. The first conclusion reached (using a symmetric model) is that an increase in the marginal cost always leads to a decrease in output. As a result of a decrease in output, the price of the good increases and some shifting occurs. The nature of the shifting depends on the curvature of the demand curve. Under a linear cost structure, whenever the elasticity of the slope of inverse demand is greater than one overshifting will occur and if the elasticity of the slope of inverse demand is greater than two (which implies that price elasticity of demand is inelastic), the tax is overshifted and profits will increase.

A model of asymmetric costs is then presented. In this case, some firms may reduce output more than others. Under linear technology, if the elasticity of the slope of the demand curve is greater than zero then the firms with the greatest market share (and thus the lowest costs) are actually punished because the uniform tax has a greater effect on firms with higher output than those with lower output.

While Seade (1985) focuses mainly on the elasticity of the slope of the demand curve, two general conclusions are made regarding the price elasticity of demand. First, whenever the price elasticity of demand is less than one, there is a positive relationship between costs and profits. Second, as the elasticity of demand falls, the greater is the ability of firms to cut output and raise prices as costs increase.

## V. Hypothesis, Model Specification and Data

### *A. Hypothesis*

Pauly, *et al* (2003, p. 15) make the following comment in explaining the characteristics of an exogenous price measure for term life insurance:

> The problem here is that term life insurance at any point in time is generally sold in a national market. While posted or quoted prices may vary across firms, there is no obvious reason why buyers with the same set of risk characteristics cannot all have access to the same set of prices, and would therefore all choose the same (lowest) price. If they do not do so, we do not know why.

One reason why prices may vary across consumers with similar personal attributes is that the market for term life insurance is not a true national market because firms face different cost structures in different states due to state-specific tax schemes. Not only does an insurer face a nominal tax rate (which may differ across each state in which it sells life insurance contracts), it also must take into account its relative tax rate (which is its tax rate compared to that of all other insurers in a particular state). An insurer domiciled in State *A* may face a different relative tax rate in States *B* and *C* not only because the nominal rate differs from state to state but also because the relative tax rate an insurer faces may differ from state to state depending on the tax scheme of the state in which it is domiciled (the retaliatory tax). Therefore, we hypothesize that the price of term life insurance can be thought of as a function of personal characteristics, the interest rate, the face value of the policy, market structure, *and* tax structure.

The premium tax can be linearly bifurcated into a domestic premium tax, which remains constant for all insurers (regardless of domicile) in a given state and year, and a retaliatory premium tax. Domestic insurers and foreign insurers domiciled in states with a domestic premium tax equal to or less than that of the state in question pay a domestic premium tax and a retaliatory tax rate equal to zero while foreign insurers domiciled in states with a domestic premium tax greater than that of the state in question pay a domestic premium tax and a positive retaliatory tax rate that differs based on the state of domicile.

This leads us to the following hypothesis: inter-state differences in the domestic premium tax faced by all insurers will be overshifted to consumers while inter-state differences in the retaliatory tax will be undershifted to consumers. This hypothesis comes from the previously described model of Seade (1985). While the term life insurance market is highly competitive, term life insurance, with a price elasticity of demand of between -0.3 and -0.5, according to Pauly, *et al* (2003), is inelastic. Insurers will, in a sense, collude to overshift the domestic premium tax to consumers due to the fact that the price elasticity of demand is less than one. Insurers, which are aware of the inelastic nature of term life insurance, are able to profit from this by overshifting the domestic premium tax. Foreign insurers that pay a retaliatory tax, on the other hand, will undershift to consumers the retaliatory component of the premium tax in order to compete with domestic and foreign insurers who pay no retaliatory tax.

### *B. Model Specification and Data*

In order to test our hypothesis, the following model is estimated for the period 2003-2007:

$$\begin{aligned} P(I_i) &= \alpha + \beta_1 SMOKE + \beta_2 HEALTH + \beta_3 GENDER + \beta_4 PROJE \\ &+ \beta_5 DOMTAX + \beta_6 RETALIATORY + \beta_7 GROUP + \beta_8 STOCK \\ &+ \beta_9 AGENCY + \beta_{10} REALASSETS + \beta_{11} NY + \beta_{12} LICENSES + \beta_{13} \\ &+ \beta_{14} GROUPRATING + \beta_{15} PERDOMESTIC + \beta_{16} YEAR + \varepsilon. \end{aligned} \tag{3}$$

The dependent variable, which is defined below, includes quotes of term life insurance coverage from Compulife, an online provider of term life insurance quotes, and a measure of the quantity of insurance purchased.[28] The Compulife data used are yearly prices of $350,000, 10-year level term life insurance policies for thirty-eight year old men and women. According to LIMRA International, the average policy size for our sample period was $384,553.6; the average (median) age for the period 2001-2005, which was the last available data, ranged from 36-39 (36-38); and the mode term for term insurance was twenty years.[29] We chose a face value of $350,000 because it was the first option below the average amount. We chose ten-year policies because the uncertainty for twenty-year policies was too high.[30] Finally, we chose age thirty-eight because this was the median age for 2005, which is the mid-point of our sample. We include policies for all different health, smoking, and A.M. Best rating classes. The only policies we exclude are those written in the states of Illinois, Louisiana, Michigan, and Oregon, and policies sold by firms domiciled in these states for all states except Hawaii. We do this because the appropriate domestic and retaliatory premium tax rates cannot be determined for these

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[28] We use the December quote in order to match monthly data with yearly data.
[29] Ten-year policies were the second-most chosen term period.
[30] The increased uncertainty comes from two channels. First, life insurance needs for the insured are more likely to change over twenty than ten years; second, all other things remaining constant, the insurer has a higher likelihood of default over a period of twenty years.

policies. Policies written in Hawaii by firms domiciled in these states are included because all firms, regardless of domicile, face the same premium tax rate.

Ligon and Cather (1997, p. 998) explain that the "quantity of insurance is defined in relation to the financial return which the consumer receives from the insurance contract." In measuring the quantity of insurance, we use, in addition to the quotes from Compulife, two measures of the ratio of premiums earned to losses incurred in order to compute the premium per dollar of expected economic loss. The first measure is the loss ratio, which equals benefits paid divided by premium income. Because the loss ratio is computed over the different lines of life insurance an insurer offers, we compute a second measure, the combined ratio, which is the sum of the loss and expense ratios. The data for these measures come from *Best's Reports* (2004-2008).

We compute the discount rate $R_L$ by using the insurance CAPM, which is given by

$$R_L = R_F + \beta_L [R_M - R_F], \qquad (4)$$

where $R_L$ is the required rate of return on the insurance contract. Because underwriting losses incurred by life insurers should be uncorrelated with the market, we assume $\beta_L$ , the underwriting beta, equals zero.[31] The risk-free rate, $R_F$ , is obtained using the yearly geometric average of two six-month (January and July) Treasurys found in series TB6MS from the Board of Governors of the Federal Reserve System and accessed from the Federal Reserve Bank of St. Louis.

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[31] Property-Liability firms have been found to have a negative underwriting Beta because losses increase slightly when the market falls. Deaths should not be expected to significantly increase as the market declines in value.

In order to obtain the dependent variable, we take the following steps. First, we take the individual quote and transform it into the price per thousand dollars of coverage. To obtain our first price measure, we take the price per thousand dollars of coverage and divide by the loss ratio. Dividing the price per thousand dollars of coverage by the loss ratio is equivalent to multiplying the price per thousand dollars of coverage by the reciprocal of the loss ratio, which is the ratio of premiums earned to benefits paid. We define this price measure as $P(I_1)$. To obtain our second price measure, we take the price per thousand dollars of coverage and divide by the combined ratio, which is the sum of the loss and expense ratios. Dividing the price per thousand dollars of coverage by the sum of the loss and expense ratios allows us to put a measure of premiums earned in the numerator and a measure of losses incurred in the denominator. We define this price measure as $P(I_2)$. Thus, both $(I_1)$ and $(I_2)$ allow us to compute the premium per dollar of expected economic benefit.[32] Finally, to adjust for the time value of expected policy payments, we divide both $P(I_1)$ and $P(I_2)$ by $(1+R_L)^m$, where $m$ is a weighted probability of dying during a given year over the life of the term life insurance contract, and is given by

$$\sum_{i=1}^{10} \frac{Prob_i}{\sum_{i=1}^{10} Prob_i} * year_i, \qquad (5)$$

where $Prob_i$ is the probability of dying in a given year and $year_i$ is the number of years the policy has been in force beginning in year one when the policy is purchased. Data on the probability of dying in a given year come from Arias (2007), who estimates life tables for 2004, the most recent year available. In calculating the probability of dying for each gender, year one is found by taking the probability of dying for 38-39 year olds and dividing by the sum of the

[32] The benefit to the policyholder is, of course, a loss to the insurer.

probability of dying for those 38-39 years to those 47-48 years of age and multiply by one. We repeat this up to year ten (47-48 years of age) and take the summation.[33]

Explanatory variables include insured characteristics such as a dummy variable that equals one if the insured is a smoker and a dummy variable equal to one if the insured is male. We expect the signs of the coefficients for these variables to be positive. We also include a dummy variable equal to one if the policy is projected.[34] A health index qualitative variable is included and ranges from zero to three for those in "regular," "regular plus," "preferred," and "preferred plus" health, respectively. We expect the sign on this coefficient to be negative.

Employing the methodology of Petroni and Shackelford (1999), who look at the shifting of premium taxes on multi-state policies from relatively high-tax states to relatively low-tax states by property-liability insurers, we use statutory tax rates, and not actual tax rates faced by firms. As they note, the statutory tax rate measures the marginal tax rate with error due to the existence of various tax credits.[35] We assume, as they do, that if a particular insurer is domiciled in a particular state it qualifies for the lowest statutory rate; otherwise, it does not. Statutory tax rates come from the appropriate state statute.

For this sample period, forty-six states and the District of Columbia have a clearly discernable premium tax. Those without a clearly discernable premium tax are Illinois, Louisiana, Michigan, and Oregon. In Illinois, insurers are subject to the income tax; in Louisiana, insurers pay a fee based on volume; in Michigan, insurers pays the greater of either the Single Business Tax or the retaliatory tax; and in Oregon, insurers pay an excise tax. Colorado and Idaho, interestingly, effectively have a differential premium tax. In Colorado,

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[33] For men, $m$ equals 6.19299; for women, $m$ equals 6.210362.
[34] A projected policy is one in which the premium is projected and not guaranteed.
[35] It is actually much more complicated than this. In some states, relatively small insurers face a greatly reduced tax rate; in others, there is a minimum, fixed fee.

insurers that have a home or regional office in the state pay a lower premium tax those that do not; in Idaho, insurers that invest a certain percentage of their assets in Idaho pay a lower premium tax than those that do not.[36]

Using both the law and the methodology described above, we apply the premium tax rate as follows. If an insurer is domiciled in the state in which its policy is sold, it pays the lowest rate allowed by law in that particular state and we call this the domestic tax rate. If the insurer is not domiciled in the state in which it sells the policy *and* the state in which it is domiciled has a tax rate that is less than or equal to that of the state in which it sells the policy, then that insurer pays only the domestic tax. If the insurer is not domiciled in the state in which it sells the policy *and* the state in which it is domiciled has a higher tax rate than the state in which it sells the policy, then that insurer pays the domestic tax and the retaliatory tax, which is the difference between the tax rate of the state in which it is domiciled and the tax rate of the state in which it sells the policy. For Hawaii, all insurers face the same tax rate because it does not have a retaliatory tax.

We include three variables in order to control for organizational structure and they come from *Best's Key Rating Guide* (2006 and 2008). First, we include a dummy variable equal to one if the insurer offering the policy is a member of a group. In a multi-line firm, profitable lines can subsidize unprofitable lines; however, in a single line firm, subsidization is not possible. Therefore, a group should be seen as safer and the sign on the coefficient of this variable should be positive.

Second, we include a dummy variable that equals one if the insurer is a stock company. To clarify, this is not used to denote whether the insurer is publicly or privately held; it is used to denote whether the firm is owned by shareholders or policyholders. We include this because

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[36] In our sample, however, there are no Colorado- or Idaho-domiciled insurers.

several papers find evidence that stock property-liability insurers take on more risk than mutual insurers. Most papers take the insurer's point of view when looking at this. Lamm-Tennant and Starks (1993) find the loss ratios of stock insurers (the measure of risk) to be higher than those of mutual insurers. If stock insurers are associated with more risk, they may have to sell policies at lower prices to compensate for the increase in risk. Boose (1990) makes the point that because shareholders are aware of the agency problem in stock companies, they do a better job of keeping tabs on management, which leads to expenses being lower. Finally, Pottier and Sommer (1997) find that stock life insurers offer different types of policies than mutual insurers. Ligon and Thistle (2005), however, look at it from the point of view of the insured. They find that low-risk individuals are better off purchasing contracts from mutual insurers while high-risk individuals are at least no worse off (and sometimes better off) purchasing contracts from stock insurers. Thus, the coefficient for this variable could be either positive or negative.

The third dummy variable included to control for organizational structure equals one if the insurer sells policies through an independent agency. Kim, Mayers, and Smith (1996) look at the distribution system of property-liability firms and find that insurers that distribute through an exclusive agency have lower costs. The coefficient of this variable should be negative.

We also include variables to control for firm risk. First, we include real assets. As noted by Sommer (1996), larger firms should be more diversified. Thus larger firms should be considered to have a lower risk of insolvency and should be able to charge higher prices. Next, we include a dummy variable that equals one if the insurer is licensed in New York. We include this because New York is generally considered to have the most stringent insurance regulations in the country. Then, we include the number of jurisdictions in which each insurer is licensed, which can range from one to fifty-one (we include Washington, D.C.). This acts as a measure of geographic diversification. Finally, we include dummy for a firm's A.M. Best rating that equals one if the firm has an A rating (A++, A+, A, A-) and zero otherwise. We expect the sign of each of the three to be positive, indicating that the insured is willing to pay more for a reduction in firm risk.[37]

A.M. Best modifies their ratings with several "affiliation codes." One way the firm modifies its ratings is with a group rating. A group rating is assigned to a corporate parent of a group and certain subsidiaries. In order to prevent a subsidiary from obtaining an unwarranted rating upgrade based on the financial strength of the parent, a subsidiary "must be deemed integral to the group's business strategy, generally operates under common management and/or ownership, and serves as a strategic marketing or distribution arm of its parent." To control for this, we include a dummy variable that is equal to one if the insurer receives a group rating.[38] All ratings data come from *Best's Reports* (2004-2008).

We also include data on the percentage of life insurers in a given state and year that are domestic insurers. Data for this come from the National Association of Insurance Commissioners (NAIC).

Finally, we include a dummy variable for each year that equals one if the policy was written in that year in order to control for any intertemporal price changes that cannot be explained by any of the variables above and deflate the nominal price and assets by the December CPI-U, with 2003 as the base year.

We discard observations in the following manner. First, as mentioned above, we discard any observations from firms domiciled in states that do not have a measurable premium tax

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[37] We discuss A.M. Best ratings more thoroughly in another chapter.

[38] An insurer that receives a group rating must be a member of a group. However, being a member of a group does not necessarily mean that it will receive a group rating. The correlation coefficient between *GROUP* and *GROUPRATING* is .3961

unless the policy is sold in Hawaii. Second, we discard any observations from firms that do not have an A.M. Best rating or do not fall into 1 of 15 size classes as designated by A.M. Best. Finally, we discard any observations that are either missing data for any of the explanatory variables or for which the loss and expense ratios are not available.

## VI. Results

### *A. Summary Statistics*

In this section, we provide summary statistics for the dependent and explanatory variables used. Tables 1A and 1B provide a glimpse of the different components of the dependent variable. Table 1A (in Appendix B) provides the mean values for the two measures of premium per dollar of economic loss, and the discount rate.

Table 1B (in Appendix B) shows the average nominal and inflation-adjusted price per $1000 of coverage, and the deflator.

In inflation-adjusted terms, the price per $1000 of term life insurance falls from $1.40 to $1.18. This means that, for $350,000 of coverage, the consumer, on average, sees the price fall more than $75 between 2003 and 2007.

Table 2 (in Appendix B) shows the mean and standard deviation for the dependent and independent variables.

The average policy is priced, in inflation-adjusted terms, at $1.30 per $1000 of coverage over the 5 years of the sample, with, on average, 33% of the policies offered being for smokers, 50.1% for males, and the health level being between that of "regular plus" and "preferred."

Companies in the sample tend to be part of a group and owned by stockholders, offer policies through an independent agency, and, on average, are licensed in approximately 49 of the 51 jurisdictions represented.

The average domestic tax is just above two percent, and it ranges from .7% (New York) to 3.5% (Nevada). The retaliatory tax ranges from zero percent to 2% (which occurs when a Hawaii-domiciled insurer sells policies in either South Carolina or Wyoming) and has a mean of .0928%.

We find that 94% of the companies in our sample have an A rating (A++, A+, A-, or A) from A.M. Best. It also turns out that none have less than a B- rating, even though in downloading the data from Compulife all companies were selected. While that may seem high, it is not much higher than the population of life and health insurers. According to *Best's Key Rating Guide* (2008), 93% of all life and health insurers (no distinction between the two is made) have a B- rating or higher. Finally, a little less than four percent of insurers that sell policies in a given state are domiciled in that particular state. The summary statistics for the remaining variables can be seen in Table 2 (in Appendix B)

***B. Regression Results***

In this section, we estimate (3) using both linear and log-linear regressions and three different measures of price: $P(I_1)$, $P(I_2)$, and the inflation-adjusted price per $1,000 of coverage.

Before examining the coefficients for the tax variables in depth across all specifications, we first look at the general pattern of results for the control variables. First, all the coefficients for the individual characteristics (*SMOKE*, *HEALTH*, and *GENDER*) are as expected. Insurers that are a member of a group command higher prices while stock insurers, insurers that distribute through an agency, insurers licensed in the state of New York, and insurers with an A rating from A.M. Best charge lower prices, on average. The coefficients for *PROJECTED, LICENSES*, and *GROUPRATING* are all significant but change sign depending on the regression specification while the coefficients for *REALASSETS* and *PERDOMESTIC* change sign and are not always statistically significant. Finally, all the year dummies are negative and statistically significant.

We first estimate linear regressions using $P(I_1)$, $P(I_2)$, and the inflation-adjusted price per $1000 of coverage as the dependent variable. These results can be seen in Table 3 in Appendix B.

We want to determine how the domestic premium tax and retaliatory premium tax are shifted to consumers. We do this by obtaining the elasticity of the domestic premium tax with respect to each price measure and the elasticity of the retaliatory premium tax with respect to each price measure. In order to calculate the elasticity of the domestic premium tax with respect to the price measure in a linear regression, we multiply the coefficient of the domestic premium tax variable by the ratio of the sample mean of the domestic premium tax to the sample mean of the price measure (the dependent variable); in order to calculate the elasticity of the retaliatory premium tax with respect to the price measure in a linear regression, we multiply the coefficient of the retaliatory premium tax variable by the ratio of the sample mean of the retaliatory tax to the sample mean of the price measure (the dependent variable).[39]

For $P(I_1)$, the elasticity of the domestic premium tax with respect to the price measure is 0.0128112 while the elasticity of the retaliatory premium tax with respect to the price measure is 0.00001792. Thus, a 1% increase in the domestic premium tax leads to an increase in the price measure of 0.0128112% and a 1% increase in the retaliatory premium tax leads to a 0.00001792% increase in the price measure. In other words, both the inter-state differences in the

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[39] For this set of linear regressions, the mean of $P(I_1)$ is 1.519022, the mean of $P(I_2)$ is .927664, and the mean of the inflation-adjusted price per thousand dollars of coverage is 1.302599; the sample means of the tax variables can be found in Table 2.

domestic premium tax and the retaliatory premium tax are undershifted to consumers. However, these results are statistically insignificant.

For $P(I_2)$, the elasticity of the domestic premium tax with respect to the price measure is 0.0789364 while the elasticity of the retaliatory premium tax with respect to the price measure is 0.0111261. Thus, a 1% increase in the domestic premium tax leads to an increase in the price measure of 0.0789364% and a 1% increase in the retaliatory premium tax leads to a 0.0111261% increase in the price measure. Again, both the inter-state differences in the domestic premium tax and the retaliatory premium tax are undershifted to consumers.

For the inflation-adjusted price per $1000 of coverage, the elasticity of the domestic premium tax with respect to the price measure is 0.0507367 while the elasticity of the retaliatory premium tax with respect to the price measure is 0.0068289. Thus, a 1% increase in the domestic premium tax leads to an increase in the price measure of 0.0507367% and a 1% increase in the retaliatory premium tax leads to a 0.0068289% increase in the price measure. Here, both the inter-state differences in the domestic premium tax and the retaliatory premium tax are undershifted to consumers.

Next, we estimate log-linear regressions using $P(I_1)$, $P(I_2)$, and the inflation-adjusted price per $1000 of coverage as the dependent variable. These results can be seen in Table 4 in Appendix B)

In order to determine how the domestic premium tax is shifted to consumers in a log-linear regression, we compute the elasticity of the domestic premium tax with respect to the natural log of each price measure by multiplying the coefficient of the domestic premium tax variable by the sample mean of the domestic premium tax. In order to determine how the retaliatory premium tax is shifted to consumers in a log-linear regression, we compute the elasticity of the retaliatory premium tax with respect to the log of each price measure by multiplying the coefficient of the retaliatory tax premium variable by the sample mean of the retaliatory premium tax.[40]

For ln ($P(I_1)$), the elasticity of the domestic premium tax with respect to the price measure is 0.068342 while the elasticity of the retaliatory premium tax with respect to the price measure is 0.009564656. Thus, a 1% increase in the domestic premium tax leads to an increase in the price measure of 0.068342% and a 1% increase in the retaliatory premium tax leads to a 0.009564656% increase in the price measure. In other words, both the inter-state differences in the domestic premium tax and the retaliatory premium tax are undershifted to consumers.

For ln ($P(I_2)$), the elasticity of the domestic premium tax with respect to the price measure is 0.081933 while the elasticity of the retaliatory premium tax with respect to the price measure is 0.0120422. Thus, a 1% increase in the domestic premium tax leads to an increase in the price measure of 0.081933% and a 1% increase in the retaliatory premium tax leads to a 0.0120422% increase in the price measure. In this case, both the inter-state differences in the domestic premium tax and the retaliatory premium tax are undershifted to consumers.

For the natural log of the inflation-adjusted price per $1000 of coverage, the elasticity of the domestic premium tax with respect to the price measure is .0532203 while the elasticity of the retaliatory premium tax with respect to the price measure is .007388. Thus, a 1% increase in the domestic premium tax leads to an increase in the price measure of 0.05032203% and a 1% increase in the retaliatory premium tax leads to a 0.007388% increase in the price measure. Here, both the inter-state differences in the domestic premium tax and the retaliatory premium tax are undershifted to consumers.

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[40] The sample means of the tax variables can be found in Table 2.

Before concluding, it is important that we check these results. In obtaining the measures of the quantity of insurance, our sample size was reduced from 168,382 observations to 81,386 observations. Here, we estimate (3) using the full sample with the inflation-adjusted price per $1000 of coverage and the natural log of the inflation-adjusted price per $1000 of coverage as the dependent variable. These results can be seen in Table 5 in Appendix B.

In order to determine the elasticity of the two tax variables with respect to the inflation-adjusted price per thousand dollars of coverage, we multiply the coefficient of the tax variable by the ratio of the sample mean of the tax variable to the sample mean of the price per thousand dollars of coverage; to determine the elasticity of the two tax variables with respect to the natural log of the inflation-adjusted price per thousand dollars of coverage, we multiply the coefficient of the tax variable by the sample mean of the tax variable.

In this sample, the mean domestic premium tax is 2.038413, the mean retaliatory tax is .096414, the mean inflation-adjusted price per thousand dollars of coverage is 1.345383, and the mean of the natural log of the inflation-adjusted price per thousand dollars of coverage is .139047.

For the inflation-adjusted price per $1000 of coverage, the elasticity of the domestic premium tax with respect to the price measure is 0.035336625 while the elasticity of the retaliatory premium tax with respect to the price measure is 0.004016201. Thus, a 1% increase in the domestic premium tax leads to an increase in the price measure of 0.035336625% and a 1% increase in the retaliatory premium tax leads to a 0.004016201% increase in the price measure. Here, both the inter-state differences in the domestic premium tax and the retaliatory premium tax are undershifted to consumers.

Finally, for the natural log of the inflation-adjusted price per $1000 of coverage, the elasticity of the domestic premium tax with respect to the price measure is 0.0339516 while the elasticity of the retaliatory premium tax with respect to the price measure is 0.004064. Thus, a 1% increase in the domestic premium tax leads an increase in the price measure of 0.0339516% and a 1% increase in the retaliatory premium tax leads to increase in the price measure of 0.004064%. Like in the linear case, both the inter-state differences in the domestic premium tax and the retaliatory premium tax are undershifted to consumers.

## VII. Conclusion

In this paper, we investigate the effect of the state premium tax on the price of term life insurance. In doing so, we provide a background on the history of the premium tax and insurance regulation. In order to measure how the premium tax is shifted to consumers, if at all, we bifurcate the premium tax into the domestic premium tax and the retaliatory premium tax. Because we only have data for states in which there is a discernable premium tax, what we actually measure is inter-state differences in the levels of the domestic and retaliatory premium taxes. Over all regression specifications, we find that both the inter-state differences in the domestic premium tax and the retaliatory premium tax are undershifted to consumers.

## CHAPTER 4

## A.M. BEST RATINGS AND THE PRICE OF LIFE INSURANCE

### Abstract

This paper looks at the effect of insurer solvency, as measured by A.M. Best ratings, on term life insurance premiums. While previous papers have investigated how measures of firm solvency affect the price of insurance, our paper differs in three ways. First, we use A.M. Best ratings as a measure of firm solvency. Second, we look at the price of term life insurance, and not the price of property-liability insurance. Third, we measure the quantity of insurance using individual quotes instead of company-level data. We find strong evidence that insurers with a relatively higher A.M. Best rating actually charge lower prices.

### I. Introduction

This paper looks at the effect of insurer solvency, as measured by A.M. Best ratings, on term life insurance premiums. While previous papers have investigated how measures of firm solvency affect the price of insurance, our paper differs in three ways. First, we use A.M. Best ratings as a measure of firm solvency. Second, we look at the price of term life insurance, and not the price of property-liability insurance. Third, we measure the quantity of insurance using individual quotes instead of company-level data. Life insurance contracts, as Rejda (2008) notes, have a longer duration than property-liability contracts. Because of the matching principle, a life insurer holds assets whose duration matches those of its liabilities. Thus, life insurers tend to invest more in bonds, mortgages, and real estate, while property-liability insurers tend to hold more cash and cash equivalents. This makes life insurers an interesting case study on the effects of insolvency risk on the price of insurance.

In the next section, we review the literature in three areas: the relationship between insurance demand and probability of default, the relationship between price and probability of ruin, and the ability of A.M. Best ratings and other measures to predict insurer insolvency. In section III, we provide an overview of the regulation of insurance companies, especially in the area of financial regulation. In section IV, we show how A.M. Best rates insurers. In section V, we present our hypothesis, the econometric model estimated and the data used to estimate the model. In section VI, we provide summary statistics and results. Finally, we conclude in section VII.

## II. Literature Review

### *A. Relationship Between Demand and Risk of Ruin*

Several theoretical papers have looked at the effects of insolvency on the demand for, and price of, insurance. Doherty and Schlesinger (1990) look at the effect of contract non-performance on the demand for insurance. Because policyholders only care about insurer insolvency if a claim is filed, the demand for insurance depends on the level and structure of premiums, the availability of information on the probability of insolvency, and the loss probability. The case in which the premium is actuarially fair is discussed first. If there is no risk of insurer insolvency, the insured will purchase full coverage; if there is an uninsurable risk of insurer insolvency, then the insured will purchase less than full coverage, but the relationship between the optimal level of coverage and the probability of insolvency is not necessarily monotonic. Interestingly, the risk of insurer default does not necessarily lead to less coverage being purchased when premiums are actuarially unfair, and a higher degree of risk aversion does not necessarily mean more coverage will be purchased.

Schlesinger and Schulenburg (1987) look at this result more carefully. Virtually the same assumptions are made in this paper about contract non-performance as in Doherty and Schlesinger (1990): contract non-performance occurs either because of insurer ruin or because contract conditions invoke a waiting period; in addition to this, there are “questionable perils and hazards” that may or may not be legally covered in the policy. They find that the optimal level of coverage can be either higher or lower given a more risk-averse utility function.

While the papers mentioned above model contract non-performance in a world both with and without loading and different measures of risk aversion, they do so in a model free of adverse selection, which is a significant issue in insurance markets. In filling this void, Agarwal and Ligon (1998) revisit the model of Doherty and Schlesinger (1990) and look at the effects of adverse selection on the demand for insurance when consumers have CARA utility.

In doing so, they note that the structure of the certainty equivalence of a risk indemnity payment suggests that, in the presence of default risk, a separating equilibrium is more likely than a pooling equilibrium. However, because the cost of insurance falls for good risks as default risk increases, pooling for this risk class becomes cheaper and thus more of a viable option than under no risk of default.

Next, they analyze the effects of default risk beginning with a pooling equilibrium when there is no risk of default. Moving from one pooling equilibrium to another, they show that, because coverage falls for both groups, both good and bad risks are always worse off. Moving from a pooling equilibrium to a separating equilibrium with the introduction of default risk, it is shown that while both the premium per dollar of coverage and welfare fall for good risks, the amount of coverage does not necessarily fall (as it normally would with the introduction of a separating equilibrium). However, for bad risks, both welfare and the amount of coverage fall.

Finally, they analyze the effects of default risk beginning with a separating equilibrium when there is no risk of default. Moving from one separating equilibrium to another, the price of coverage and welfare fall for both groups. With the introduction of default risk, moving from a separating equilibrium to a pooling equilibrium leads to an unambiguous fall in both the premium per dollar of coverage and the level of coverage for bad risks. However, welfare does not necessarily decrease for bad risks. For good risks, however, while welfare does fall, the change in price and level of coverage are not known.

***B. Relationship Between Price and Probability of Default***

Doherty and Tinic (1981) informally describe the relationship between insurance premiums and insolvency risk in evaluating the value of a publicly traded insurer. Because policyholders are, by definition, risk-averse and incompletely diversified, they will pay less for a risky insurance policy than a riskless one. The authors note that, in this way, policyholders act like owners of risky debt. Reinsurance has the same effect as the policyholder buying many small contracts from numerous firms. Thus, an insurer can charge higher prices by reinsuring.

Sommer (1996) looks at the effects of the probability of ruin on prices for property-liability insurers using an option pricing model. Accordingly, the value of insurance is equal to the discounted value of liabilities minus a put option, which is referred to as the insolvency put, which perfectly measures the probability of ruin. However, the existence of guaranty funds mitigate some, but not all, of the insolvency risk. Thus, the value (or price) of insurance with guaranty funds is somewhere between the price with no default risk and the price with default risk and no guaranty funds. In order to determine the effect of insolvency risk on the price of insurance, the following hedonic regression is estimated using an autoregressive two-stage least squares (A2SLS) regression:

$$\begin{aligned} PRICE_{jt} &= \alpha_0 + \alpha_1 CAP_{j,t-1} + \alpha_2 SIGMA_{j,t-1} + \alpha_3 SIZE_{j,t} + \alpha_4 SINGLE_{j,t} \\ &+ \alpha_5 HERF_{j,t} + \alpha_6 LTAIL_{j,t} + \alpha_7 NYREG_{j,t} + \alpha_8 NATIONAL_{j,t} + \alpha_9 AGENCY_{j,t} \\ &+ \alpha_{10} CHELD_{j,t} + \alpha_{11} RATEREG_{j,t} + \gamma_{j,t}, \end{aligned} \tag{1}$$

where *PRICE* is defined as the ratio of premiums written net of underwriting expenses and policyholder dividends to the discounted value of losses and loss adjustment expenses incurred, *CAP* is the ratio of statutory capital with GAAP adjustments to total assets, *SIGMA* is the estimated portfolio standard deviation, *SIZE* is the natural logarithm of assets, *SINGLE* is a dummy variable that equals one if the firm is an unaffiliated single company and equals zero otherwise, *HERF* is a Herfindahl index based on net premiums written, *LTAIL* is the percent of premiums written in schedule P lines, *NYREG* is a dummy variable that equals one if the firm is licensed in New York and is included because the state, according to the author, has some of the most stringent insurance regulations in the country, *NATIONAL* is a dummy variable that equals one if the firm is a national firm, *AGENCY* equals one if the firm uses an independent agency, *CHELD* is a dummy variable that equals one if the firm is closely held, and *RATEREG* is the percent of premiums written in workers' compensation and auto liability and is estimated for the period 1979-1988 using all insurer groups that existed for the whole period and unaffiliated firms with net premiums greater than or equal to .0085 percent of total industry premiums.

The first two variables, *CAP* and *SIGMA*, are used to directly measure the effect of a firm's insolvency risk on price; a firm with a relatively higher capital-to-assets ratio is perceived to have a lower default risk because it is more likely to have the necessary capital to pay claims and a firm with a greater portfolio variance is perceived as more risky because, in a given year, the firm's portfolio may decline such that it is not able to meet its obligations to policyholders. In estimating the regression, *CAP* is found to be positive and significant and *SIGMA* is found to be negative and significant. This indicates that policyholders are willing to pay more to insure against insolvency. In addition to this, firm size is found to be positively related to price, possibly indicating that larger firms are perceived to be "safer" than smaller firms (although larger firms may be able to command higher prices due to market power or name recognition).

Cummins and Danzon (1997) develop and test a model that incorporates insolvency risk into a pricing model for insurance. In testing their theoretical results, the authors use a panel of 45 general liability insurers (who accounted for 85% of general liability premium volume) for the period 1976-1987. Price is measured by the ratio of premiums paid to the discounted present value of expected losses. Financial quality is measured in two ways: first by decomposing capital into its components and lagging it one period and also by a dummy variable that equals one if the insurer has either an A or A+ rating in that year. Also included are variables that measure capacity constraint (because other papers have argued that price and capacity constraint are inversely related), new capital, the firm's market share of general liability insurance and a dummy variable used to differentiate stock insurers from mutual insurers. They find a negative relationship between prices and loss shocks and a positive relationship between price and the ratio of equity to liabilities.

Finally, Carson, Doran, and Dumm (forthcoming) investigate the relationship between A.M. Best ratings and the price of individual annuities as measured by the negative of each annuity's annualized rate of return. Controlling for size, leverage, asset risk, organizational form, interest rates, distribution system, and barriers to entry, they find a negative relationship between price and A.M. Best rating. In other words, the higher the A.M. Best rating of the issuing firm, which implies a lower risk of insolvency, the lower is the price of the annuity.

### *C. A.M. Best Ratings as a Predictor of Insolvency*

Singh and Power (1992) look at whether A.M. Best is simply an insurance company monitor or if it is a provider of new information to the marketplace. In order to determine which role the rating agency plays, the authors look at the effects a change in an insurer's A.M. Best rating on its stock price. They hypothesize that if A.M. Best is simply a monitor that gathers publicly available information then there will be no significant abnormal return (positive for an upgrade, negative for a downgrade) following a change in the firm's rating. However, if the rating contains information not publicly known then a change in a particular firm's rating will lead to a significant abnormal return after the rating change. In order to test this hypothesis, the authors employ event study methodology. During the period 1980-1998, they find 76 publicly traded firms whose rating changed (32 upgrades, 44 downgrades) and estimate the abnormal return before, during, and after the event date, which is defined as the release date of the *Advanced Ratings Release* (which is mailed to full-service subscribers before being released through *Best's Insurance Management Reports*). They find no abnormal performance in stock returns either at or following the release date. This indicates that the ratings reveal no new information.

Two main explanations are offered for this result. First, because the insurance industry is highly regulated, any information regarding the solvency or insolvency of the firm may be known by financial markets before it is reported by A.M. Best. Second, the intended audience for its reports is not financial markets but those either involved in the purchase or sale of insurance products.

Pottier and Sommer (1999) look at the determinants of the rating models of the top three insurer ratings agencies, A.M. Best, Moody's Investor Services, and Standard and Poor's (S&P), and why a rating of a specific property-liability company might differ from one rating agency to another using Heckman's sample selection bias method for a cross-section of 1,678 individual property-liability insurers. The authors discuss why ratings are important. First, insurance companies use their rating as an advertisement of the firm's strength. Second, insurance agents will typically steer a client away from an unrated or under-rated insurer. Finally, consumers use ratings as a guide to selecting an insurance company *and* when deciding how much to pay for insurance. This usage of insurer ratings differs from that of bond ratings, which are used by investors and regulators, and not consumers who might purchase the firm's product. In order to test both hypotheses, a first-stage probit model using the same explanatory variables is employed to estimate the choice of deciding to be rated. Because the primary role of a rating agency is to reduce *ex ante* insolvency risk, the greater the variance in opinion of an insurer's default risk by investors, consumers and regulators, the greater the demand should be for a rating by that particular insurer. These results are then used in the ordered probit regressions that estimate the rating given by (at least one of) the three ratings agencies and the difference in the rating of a specific firm by (at least two of) the ratings agencies.

In estimating the second part of the ratings determinants model, the explanatory variables, in general, are ones that have been shown to be predictors of insolvency in other papers. These variables include measures of capitalization, asset and liability risk, liquidity, size, growth, diversification, reinsurance usage, and profitability. They find for all three ratings agencies that the size (which is measured by the natural log of assets) of the insurer and the rating assigned by a particular agency are positively related and that the amount invested in junk bonds (which is a proxy for investment risk) by an insurer and the rating assigned are negatively related. In order to estimate why ratings differ between the ratings agencies, the authors test for statistical differences between the rating determinants model estimated above for S&P and Moody's and find that the ratings are not the same.

Pottier (1998) uses 3 sets of insolvency predictor variables for 2 estimation samples to predict insurer insolvency for 48 insolvent life insurance firms for the period 1990-1992 using stepwise logistic regressions. The first set of predictor variables are financial ratios; the second set of predictor variables are different ratings and include A.M. Best ratings, rating changes, and total assets; the third set combines financial ratios with A.M. Best ratings and rating changes. The robustness of the results for the estimation samples are checked using two time-series holdout samples. Finally, the expected cost of misclassification (ECM) is used to compare the performance of three sets of predictors. The author finds that that the three sets of insolvency predictor variables have "comparable forecasting ability" and that rating changes should be included in insolvency prediction models.

BarNiv and Hershbarger (1990) look at the models and variables that most accurately identify companies that eventually become insolvent. In doing so, the authors include solvent firms as well and put them into one of two sets: a matched set that matches solvent firms with insolvent ones based on asset size and state of domicile and a random sample of 49 insurers that had at least $60 million in assets and were listed in Best's Reports in 1986. A third set of 31 solvent, publicly traded insurers is used as a holdout set, and the final set of 31 firms identified by the NAIC-IRIS as priority companies is used to determine variables and models that could identify firms at risk of becoming insolvent. This study includes the Insurance Regulatory Information System (IRIS). In their univariate analysis, the authors find that the IRIS system is not a good predictor of insolvency; only 16 of 31 insolvent firms in the sample have more than 4 variables outside the desired range (which leads to a firm being listed as a priority firm for increased regulatory attention) a year before becoming insolvent. In comparing insolvent firms to solvent ones, they find that insolvent firms have significantly lower profitability characteristics (net gain to total income, net gain to premium and net gain from operation), are more leveraged and grow at a faster rate in terms of premiums. In their multivariate analysis, the authors employ three models: multidiscriminant analysis, a probabalistic logit model and a nonparametric multivariate model. They estimate both four- and eight-variable versions of each model for the sample of insolvent firms and find that each model accurately predicts insolvency at least 80% of the time up to two years before insolvency.

Ambrose and Carroll (1994) use a logit model to both predict insolvencies and test which variables are best at predicting insolvencies. In their study, they use 26 firms that were either declared insolvent or placed either in receivership, conservatorship or liquidation, and match them based on the size of policyholder surplus the year before insolvency. As predictors, financial ratios and dummy variables that represent Best’s recommendation status are employed. They find that Best’s recommendations correctly predict insolvency 55% of the time. In estimating the logit model for financial ratios (which includes IRIS), they find that this model correctly predicts insolvency 80.8% of the time. Finally, they combine financial ratios with Best’s recommendations and find that this combined model correctly predicted insurer insolvencies 88.5% of the time.

# III. Insurer Solvency

## A. *Ex Ante* Measures

Regulation of insurance companies is handled mostly at the state level and can be divided into two general categories, financial regulation and market regulation. According to the U.S. Dept. of the Treasury (2008), the main goal of financial regulation is to prevent insurer insolvency and to reduce the harm done to policyholders when insolvency occurs.

Regulators have put in place several *ex ante* measures to reduce the likelihood of an insurer becoming insolvent (Black and Skipper 2000). One measure is the requirement that all insurers, at the very least, file annual financial statements, and file more frequently if regulators suspect that an insurer is facing financial problems that may prevent it from fulfilling its contractual obligations. The annual filing of financial statements allows state regulators to ensure that insurance companies are compliant in four areas: the valuation of assets and restrictions on the investment of assets; the valuation of liabilities; minimum requirements on capital and surplus; and risk-based capital requirements. Most states distinguish between capital and surplus and reserve investments, where the minimum amount of capital and surplus must be invested in relatively low-risk and highly liquid assets such as cash, bonds, and mortgages, while capital and surplus above the required amount can be invested in riskier and less-liquid investments.

While different states have different rules regarding the valuation of these assets, the NAIC, through its Securities Valuation Office, uses a uniform methodology to value these assets (Black and Skipper 2000). Insurance policies are liabilities on the balance sheet for insurers and are known as policy reserves; to ensure that these liabilities are properly valued all states require that insurers follow the NAIC's Standard Valuation Law. While regulators have minimum capital and surplus requirements, insurers often set their own minimum level above that which is required by regulators based on their size, the number of lines of insurance they wrote and the riskiness of those lines, the extent to which they are reinsured, the quality of their investments, and the amount of reserves (Black and Skipper 2000). Finally, risk-based capital (RBC) requirements were developed by the NAIC in response to several insurers becoming insolvent. RBC compares an insurer's total adjusted capital, which is assets minus liabilities plus the asset valuation reserve, to five different levels. If total adjusted capital falls below a certain level, the insurer could be required to deal with solvency concerns itself or it could prompt regulators to institute measures (U.S. Dept. of the Treasury 2008). A second measure put into place to prevent (or at least limit significantly) insurer insolvency is the implementation of the NAIC's Insurance Regulatory Information System (IRIS). IRIS is a two-stage program (Black and Skipper 2000). In the first stage, twelve financial ratios are employed to determine the financial health of the insurer. If four or more of these ratios are outside the desired range, the second stage of IRIS is implemented. In the second stage, an in-depth analysis is undertaken and state regulators are notified (Wright 1992). Another *ex ante* measure is a triennial examination of an insurer. This examination, conducted by state regulators, checks the accuracy of the financial reports filed by insurers.

***B. Ex Post* Measures**

In the event that an insurer does become insolvent, regulators have several tools available to minimize the cost to policyholders. One tool is a guaranty fund, which all states have. In one way, a state guaranty fund is similar to FDIC insurance for bank accounts: it, like FDIC insurance, provides coverage up to a certain amount. Typically, life insurance is covered up to $300,000 in death benefits. In another way, however, a state guaranty fund is completely different from FDIC insurance. FDIC insurance is paid by banks even if no bank becomes insolvent while insurers only pay into the guaranty fund if an insurer becomes insolvent. All insurers pay into the fund once an insurer becomes insolvent and the amount paid into the fund can be up to two percent of premiums written (Wright 1992).

## IV. A.M. Best Ratings

With its Financial Strength Ratings, A.M. Best measures an insurer's ability to pay insurance contracts. In general, life and health insurance companies are split into two general ratings categories: "secure" and "vulnerable." According *Best's Key Rating Guide* (2008), the reason for the bifurcation is that "secure" insurers are significantly less likely to fail than are "vulnerable" firms. As of June 18, 2008, 974 of the 1163 rated life and health insurance companies (84.4%) had a "secure" rating. "Secure" firms are broken down even further into three nominal categories which have two letter-grade rankings associated with each: *Superior* (A++ and A+), *Excellent* (A and A-), and *Good* (B++ and B+). These three nominal categories describe the ability of a firm to pay the insurance contracts it has underwritten. For example, insurers in the *Excellent* nominal category have "an excellent ability to meet their ongoing obligations to policyholders." The second category, "Vulnerable," is broken down further into seven nominal categories with the first three nominal categories having two letter-grades associated with each and the last four having one letter-grade associated with them: *Fair* (B and B-), *Marginal* (C++ and C+) *Weak* (C and C-), *Poor* (D), *Under Regulatory Supervision* (E), *In Liquidation* (F) and *Rating Suspended* (S). These seven nominal categories also describe an insurer's ability to its contractual obligations to policyholders.

In providing a rating, A.M. Best analysts look at an insurer's balance sheet, which the firm considers to be the most important of the three areas, operations, and business profile. Four different types of leverage are looked at in analyzing the balance sheet: underwriting leverage, financial leverage, operating leverage and asset leverage. In addition to this, different measures of capitalization are analyzed in order to assess an insurer's ability to cope with changes to the economy, interest rates, asset markets, and more-frequent adverse events. Several different measures of profitability are used to measure operating performance. For life insurers, these include the ratios of benefits paid and the sum of commissions and expenses to the sum of net premiums written and deposits, the ratios of net operating gain to total assets and total revenue, operating return on equity, net yield, and total return. Finally, in analyzing an insurer's business profile, analysts look at diversification in the areas of geographical reach, products offered and distribution, revenue composition, competitive advantage, management, insurance market risk, and event risk.

## V. Hypothesis, Model Specification and Data

### *A. Hypothesis*

If purchasers of insurance contracts worry about default risk, how do they delineate between a "safe" insurance company and an "unsafe" insurance company? As noted above by Pottier and Sommer (1999), one way could be through published ratings. One benefit of A.M. Best ratings is that they are easy to obtain. One can go to the A.M. Best website and look up an insurer, look it up on the insurer's website, or ask an insurance agent. Either way, there is very little cost to obtaining this information. If there is value to a higher rating, then purchasers of insurance contracts should be willing to pay more for an insurance contract from an insurer with a relatively higher rating.

***B. Model Specification and Data***

In order to test our hypothesis, the following model is estimated for the period 2003-2007:

$$
\begin{aligned}
P(I_i) &= \alpha + \beta_1 SMOKE + \beta_2 HEALTH + \beta_3 GENDER + \beta_4 PROJECTED \\
&+ \beta_5 DOMTAX + \beta_6 RETALIATORY + \beta_7 GROUP + \beta_8 STOCK \\
&+ \beta_9 AGENCY + \beta_{10} REALASSETS + \beta_{11} NY + \beta_{12} LICENSES + \beta_{13} BEST \\
&+ \beta_{14} GROUPRATING + \beta_{15} PERDOMESTIC + \beta_{16} YEAR + \varepsilon.
\end{aligned}
\tag{2}
$$

The dependent variable, which is defined below, includes quotes of term life insurance coverage from Compulife, an online provider of term life insurance quotes, and a measure of the quantity of insurance purchased.[41] The Compulife data used are yearly prices of $350,000, 10-year level term life insurance policies for 38 year old men and women. According to LIMRA International, the average policy size for our sample period was $384,553.6; the average (median) age for the period 2001-2005, which was the last available data, ranged from 36-39 (36-38); and the mode term for term insurance was 20 years.[42] We chose a face value of $350,000 because it was the first option below the average amount. We chose 10 year policies because the uncertainty for twenty-year policies was too high.[43] Finally, we chose age 38t because this was the median age for 2005, which is the mid-point of the sample. We include policies for all different health, smoking, and A.M. Best rating classes. The only policies we exclude are those written in the states of Illinois, Louisiana, Michigan, and Oregon, and policies sold by firms domiciled in these

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[41] We use the December quote in order to match monthly data with yearly data.
[42] Ten-year policies were the second-most chosen term period.
[43] The increased uncertainty comes from two channels. First, life insurance needs for the insured are more likely to change over twenty than ten years; second, all other things remaining constant, the insurer has a higher likelihood of default over a period of twenty years.

states for all states except Hawaii. We do this because the appropriate domestic and retaliatory premium tax rate cannot be determined for these policies. Policies written in Hawaii by firms domiciled in these states are included because all firms, regardless of domicile, face the same premium tax rate.

Ligon and Cather (1997, p. 998) explain that the "quantity of insurance is defined in relation to the financial return which the consumer receives from the insurance contract." In measuring the quantity of insurance, we use, in addition to the quotes from Compulife, two measures of the ratio of premiums earned to losses incurred in order to compute the premium per dollar of expected economic loss. The first measure is the loss ratio, which equals benefits paid divided by premium income. Because the loss ratio is computed over the different lines of life insurance an insurer offers, we compute a second measure, the combined ratio, which is the sum of the loss and expense ratios.[44] The data for these measures come from *Best's Reports* (2004-2008).

We compute the discount rate $R_L$ by using the insurance CAPM, which is given by

$$R_L = R_F + \beta_L [R_M - R_F], \qquad (3)$$

where $R_L$ is the required rate of return on the insurance contract. Because the underwriting losses incurred by life insurers should be uncorrelated with the market, we assume $\beta_L$ , the underwriting beta, equals zero.[45] The risk-free rate, $R_F$, is obtained using the yearly geometric average of two six-month (January and July) Treasurys found in series TB6MS from the Board of Governors of the Federal Reserve System and accessed from the Federal Reserve Bank of St. Louis.

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[44] Because the expense ratio is defined as expenses divided by premium income, we can sum the two.

[45] Property-Liability firms have been found to have a negative underwriting Beta because losses increase slightly when the market falls. Deaths should not be expected to significantly increase as the market declines in value.

In order to obtain the dependent variable, we take the following steps. First, we take the individual quote and transform it into the price per thousand dollars of coverage. To obtain our first price measure, we take the price per thousand dollars of coverage and divide by the loss ratio. Dividing the price per thousand dollars of coverage by the loss ratio is equivalent to multiplying the price per thousand dollars of coverage by the reciprocal of the loss ratio, which is the ratio of premiums earned to benefits paid. We define this price measure as $P(I_1)$. To obtain our second price measure, we take the price per thousand dollars of coverage and divide by the sum of the loss and expense ratios. Dividing the price per thousand dollars of coverage by the sum of the loss and expense ratios allows us to put a measure of premiums earned in the numerator and a measure of losses incurred in the denominator. We define this price measure as $P(I_2)$. Thus, both $(I_1)$ and $(I_2)$ allow us to compute the premium per dollar of economic loss. Finally, to adjust for the time value of loss payments, we divide both $P(I_1)$ and $P(I_2)$ by $(1+R_L)^m$, where $m$ is a weighted probability of dying during a given year over the life of the term life insurance contract, and is given by

$$\sum_{i=1}^{10} \frac{Prob_i}{\sum_{i=1}^{10} Prob_i} * year_i, \qquad (4)$$

where $Prob_i$ is the probability of dying in a given year and $year_i$ is the number of years the policy has been in force beginning in year one when the policy is purchased. Data on the probability of dying in a given year come from Arias (2007), who estimates life tables for 2004, the most recent year available. In calculating the probability of dying for each gender, year one is found by taking the probability of dying for 38-39 year olds and dividing by the sum of the probability of dying for those 38-39 years to those 47-48 years of age and multiply by one. We repeat this up to year ten (47-48 years of age) and take the summation.[46]

Explanatory variables include insured characteristics such as a dummy variable that equals one if the insured is a smoker and a dummy variable equal to one if the insured is male. We expect the signs of the coefficients for these variables to be positive. We also include a dummy variable equal to one if the policy is projected.[47] A health index qualitative variable is included and ranges from zero to three for those in "regular," "regular plus," "preferred," and "preferred plus" health, respectively. We expect the sign on this coefficient to be negative.

Employing the methodology of Petroni and Shackelford (1999), who look at the shifting of premium taxes on multi-state policies from relatively high-tax states to relatively low-tax states by property-liability insurers, we use statutory tax rates, and not actual tax rates faced by firms, in order to control for taxes. As they note, the statutory tax rate measures the marginal tax rate with error due to the existence of various tax credits. [48] We assume, as they do, that if a particular insurer is domiciled in a particular state it qualifies for the lowest statutory rate; otherwise, it does not. Statutory tax rates come from the appropriate state statute.

Using both the law and the methodology described above, we apply the premium tax rate as follows. If an insurer is domiciled in the state in which its policy is sold, it pays the lowest rate allowed by law in that particular jurisdiction and we call this the domestic tax rate. If the insurer is not domiciled in the state in which it sells the policy *and* the state in which it is domiciled has a tax rate that is less than or equal to that of the state in which it sells the policy, then that insurer pays only the domestic tax. If the insurer is not domiciled in the state in which it sells the policy

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[46] For men, *m* equals 6.19299; for women, *m* equals 6.210362.
[47] A projected policy is one in which the premium is not guaranteed.
[48] It is actually much more complicated than this. In some states, relatively small insurers face a greatly reduced tax rate; in others, there is a minimum, fixed fee.

*and* the state in which it is domiciled has a higher tax rate than the state in which it sells the policy, then that insurer pays the domestic tax and the retaliatory tax, which is the difference between the tax rate of the state in which it is domiciled and the tax rate of the state in which it sells the policy. For Hawaii, all insurers face the same tax rate because it does not have a retaliatory tax.

We include three variables in order to control for organizational structure, which come from *Best's Key Rating Guide* (2006 and 2008). First, we include a dummy variable equal to one if the insurer offering the policy is a member of a group. In a multi-line firm, profitable lines can subsidize unprofitable lines; however, in a single line firm, subsidization is not possible. Therefore, a group should be seen as safer and the sign on the coefficient of this variable should be positive.

Second, we include a dummy variable that equals one if the insurer is a stock company. To clarify, this is not used to denote whether the insurer is publicly or privately held; it is used to denote whether the firm is owned by shareholders or policyholders. We include this because several papers find evidence that stock property-liability insurers take on more risk than mutual insurers. Most papers take the insurer's point of view when looking at this. Lamm-Tennant and Starks (1993) find the loss ratios of stock insurers (the measure of risk) to be higher than those of mutual insurers. If stock insurers are associated with more risk, they may have to sell policies at lower prices to compensate for the increase in risk. Boose (1990) makes the point that because shareholders are aware of the agency problem in stock companies, they do a better job of keeping tabs on management, which leads to expenses being lower. Finally, Pottier and Sommer (1997) find that stock life insurers offer different types of policies than mutual insurers. Ligon and Thistle (2005), however, look at it from the point of view of the insured. They find that low-risk individuals are better off purchasing contracts from mutual insurers while high-risk individuals are at least no worse off (and sometimes better off) purchasing contracts from stock insurers. Thus, the coefficient for this variable could be either positive or negative.

The third dummy variable included to control for organizational structure equals one if it sells policies through an independent agency. Kim, Mayers, and Smith (1996) look at the distribution system of property-liability firms and find that insurers that distribute through an exclusive agency have lower costs. The coefficient of this variable should be negative.

To test our hypothesis, we use four different measures of A.M. Best ratings. First, we include a dummy variable that equals one if the insurer has an A rating (A-, A, A+, A++) and zero if the insurer has a B rating (B-, B, B+, B++).[49] The second measure employs a single qualitative variable that range from zero to three. If the insurer has a "fair" rating (B- or B), then the qualitative variable equals zero; if the insurer has a "good" rating (B+ or B++), then the qualitative variable equals one; if the insurer has an "excellent" rating (A- or A), then the qualitative variable equals two; finally, if the insurer has a "superior" rating (A+ or A++), then the qualitative variable equals three. Next, we include a dummy variable that equals one if the insurer has an A++ rating, which is the highest rating offered by A.M. Best, and zero otherwise.

Finally, we test our hypothesis using six dummy variable categories. This allows us to measure marginal effect of having a particular letter grade while controlling for all other letter grade categories.[50] Each dummy variable category has a dummy variable that equals one for insurers with that particular letter-grade rating and zero otherwise, ranging from B rating to A+.[51]

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[49] However, in our sample, no insurers have a B- rating.
[50] The dummy variable categories range from B equals 1, zero otherwise, to A+ equals one, zero otherwise. As noted above, there are no insurers with a B- rating.
[51] Any rating changes have been verified using Lexis-Nexis to find the exact date of change. It also should be noted that data such as assets for a given year and firm may change over each edition. Sometimes, it appears that the data

A.M. Best modifies their ratings with several "affiliation codes." One way the firm modifies its ratings is with a group rating. A group rating is assigned to a corporate parent of a group and certain subsidiaries. In order to prevent a subsidiary from obtaining an unwarranted rating upgrade based on the financial strength of the parent, a subsidiary "must be deemed integral to the group's business strategy, generally operates under common management and/or ownership, and serves as a strategic marketing or distribution arm of its parent." To control for this, we include a dummy variable that is equal to one if the insurer receives a group rating.[52] All ratings data come from *Best's Reports* (2004-2008).

We also control for firm risk using other measures. First, we include real assets. As noted by Sommer (1996), larger firms should be more diversified. Thus larger firms should be considered to have a lower risk of insolvency and should be able to charge higher prices. Next, we include a dummy variable that equals one if the insurer is licensed in New York. We include this because New York is generally considered to have the most stringent insurance regulations in the country. In addition to this, we include the number of jurisdictions in which each insurer is licensed, which can range from one to fifty-one (we include Washington, D.C.). This acts as a measure of geographic diversification.

Next, we include data on the percentage of life insurers in a given state and year that are domestic insurers. Data for this come from the National Association of Insurance Commissioners (NAIC).

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are updated to reflect more accurate information; other times, however, the data change to reflect a merger. We use the data originally reported.

[52] An insurer that receives a group rating must be a member of a group. However, being a member of a group does not necessarily mean that it will receive a group rating. The correlation coefficient between "Group" and "Group Affiliation" is .3961.

Finally, we include a dummy variable for each year that equals one if the policy was written in that year in order to control for any intertemporal price changes that cannot be explained by any of the variables above and deflate the nominal price of the policy and assets by the December CPI-U, with 2003 as the base year.

We discard observations in the following manner. First, as mentioned above, we discard any observations from firms domiciled in states that do not have a measurable premium tax. Second, we discard any observations from firms that do not have an A.M. Best rating or do not fall into one of fifteen size classes as designated by A.M. Best. Finally, we discard any observations that are either missing data for any of the explanatory variables or for which the loss and expense ratios are not available.

## VI. Results

### *A. Summary Statistics*

In this section, we provide summary statistics for the dependent and explanatory variables used. Tables 1A and 1B (in Appendix C) provide a glimpse of the different components of the dependent variable. Table 1A (in Appendix C) provides the mean values for the two measures of premium per dollar of economic loss, and the discount rate.

Table 1B (in Appendix C) shows the average nominal and inflation-adjusted price per $1000 of coverage, and the deflator.

In inflation-adjusted terms, the price per $1000 of term life insurance falls from $1.40 to $1.18. This means that, for $350,000 of coverage, the consumer, on average, sees the price fall more than $75 between 2003 and 2007.

Table 2 (in Appendix C) shows the mean and standard deviation for the dependent and independent variables.

The average policy is priced, in inflation-adjusted terms, at $1.30 per $1000 of coverage over the five years of the sample, with, on average, 33% of the policies offered being for smokers, 50.1% for males, and the health level being between that of "regular plus" and "preferred."

Companies in the sample tend to be part of a group and owned by stockholders, offer policies through an independent agency, and, on average, are licensed in approximately 49 of the 51 jurisdictions represented.

The average domestic tax is just above two percent, and it ranges from .7% (New York) to 3.5% (Nevada). The retaliatory tax ranges from zero percent to 2% (which occurs when a Hawaii-domiciled insurer sells policies in either South Carolina or Wyoming) and has a mean of .0928%.

Finally, we see that 94% of the companies in our sample have an A rating (A++, A+, A-, or A) from A.M. Best. It also turns out that none have less than a B- rating, even though in downloading the data from Compulife all companies were selected. While that may seem high, it is not much higher than the population of life and health insurers. According to *Best's Key Rating Guide* (2008), 93% of all life and health insurers (no distinction between the two is made) have a B- rating or higher. The summary statistics for the remaining variables can be seen in Table 2 (in Appendix C).

***B. Regression Results***

In this section, for each measure of A.M. Best ratings, we estimate (2) using both linear and log-linear equations and three different measures of price: $P(I_1)$, $P(I_2)$, and the inflation-adjusted price per $1,000 of coverage.

For our first set of regressions, we test whether any A-rated insurers (A-, A, A+, A++) charge higher prices than any B-rated (B, B+, B++) insurers. The results for the linear specifications can be seen in Table 3 and the results for the log-linear specifications can be seen in Table 4 (in Appendix C).

We find that, in both the linear and log-linear case, A-rated insurers actually charge lower prices on average than B-rated insurers. As seen in the log-linear case, A-rated insurers charge between 16% and 40% less than any B-rated insurer.[53]

Before moving on, we look at the results for the control variables. First, all the coefficients for the individual characteristics (*SMOKE, HEALTH, and GENDER*) are as predicted. If an insurer is a member of a group then it commands a higher price, which is what was predicted above. Next, insurers that distribute through an independent agency charge lower prices, while insurers that are members of a group charge higher prices, on average. The coefficients for *PROJECTED*, *DOMTAX*, *RETALIATORY*, *REALASSETS*, *LICENSES*, *GROUPRATING*, and *PERDOMESTIC* either change sign, are the wrong sign, or are statistically insignificant.

As described above, we then create a single qualitative variable that places each policy into one of four nominal categories, based on the A.M. Best rating of the issuing firm. This allows us to capture the marginal effect of an increase in an insurer's A.M. Best rating on price for the four nominal categories of "fair" = 0, "good" = 1, "excellent" = 2, and "superior" = 3.[54] In estimating (2), we find a negative and statistically significant relationship between an insurer's A.M. Best rating and the three measures of price for both the linear and log-linear specifications.

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[53] We use $e^{(b)}$-1 to calculate marginal effects.
[54] Because there is only one variable, which ranges from zero to three, there is only one coefficient.

The results for the linear specification appear in Table 5 and the results for the log-linear specification appear in Table 6 (in Appendix C).

We then include a dummy variable that equals one if the insurer has an A++ rating, and zero if it does not. We find that insurers with an A++ rating actually charge lower prices than insurers without an A++ rating. These results can be seen in Tables 7 and 8 (in Appendix C).

Finally, we include six dummy variable categories for A.M. Best ratings ranging from B to A+ (with A++ as the base category). The first dummy variable category equals one if the insurer has a B rating, and zero otherwise. The second dummy variable category equals one if the insurer has a B+ rating, and zero otherwise. The third dummy variable category equals one if the insurer has a B++ rating, and zero otherwise. The fourth dummy variable category equals one if the insurer has an A- rating, and zero otherwise. The fifth dummy variable category equals one if the insurer has an A rating, and zero otherwise. Finally, the sixth dummy variable category equals one if the insurer has an A+ rating, and zero otherwise. These results can be seen in Tables 9 and 10 (in Appendix C).

Insurers with either a B, B+, B++, A or A+ rating consistently charge a higher price than insurers with an A++ rating, while insurers with a an A- rating consistently charge lower prices over all linear and log-linear specifications.

Before looking at the implications of these results, it is important to note that over half of the original observations were lost when including the measures of the quantity of insurance. Because of this, for the first three sets of regressions, we look at the results for the full sample using the price per $1000 of coverage and the natural log of the price per $1000 of coverage as the dependent variables.[55] We find that, for the full sample, insurers with any A rating charge lower prices on average and that there is a negative relationship between an insurer's rating and the price it charges when including the four nominal categories. These results are the same as those using the truncated sample. Finally, using the full sample, we find that insurers with an A++ rating charge higher prices on average. These results differ from those of the truncated sample. These results can be seen in Tables 11-13 (in Appendix C).

The results above provide strong evidence that higher-rated insurers actually charge lower prices, which is different than what was hypothesized. While the results are different than what was hypothesized, as noted above, there is evidence of this negative relationship between perceived quality and price in the individual annuities market. One explanation for these results is that insurers with a relatively high rating are able to offer term life insurance contracts at a lower price because an independent third party has stated the insurer is financially sound. This allows these insurers to undercut competitors in order to gain market share and increase the size of the pool of customers.

## VII. Conclusion

When purchasing term life insurance, consumers want to know that the company through which the term life policy is being offered will be around, at least until the end of the term. Because term life insurance contracts tend to last a relatively long period of time, this can be a cause for concern. One way that consumers may hedge against insurer insolvency is by looking at an insurer's A.M. Best rating. If this is true, then individuals should be willing to pay more for a contract from an insurer with a relatively higher rating.

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[55] We do not include results for the last set of regressions with the six dummy variables using the full sample because the full sample includes insurers with a B- rating while the truncated sample does not.

This paper tests this hypothesis. In testing this hypothesis over a five-year period, we find strong evidence that insurers with a higher rating actually charge lower prices, contrary to our hypothesis. One explanation is that insurers use the higher rating as a catalyst to charge lower prices and gain market share, something a lower-rated insurer may be unable to do.

## REFERENCES


Agarwal, V. and James Ligon (1998), "Insurer Contract Nonperformance in a Market with Adverse Selection," Journal of Risk and Insurance, 135-150.

American Council of Life Insurers (ACLI) (2007), ACLI Factbook 2007, Washington: American Council of Life Insurers.

A.M. Best, Best's Insurance Reports Life/Health United States & Canada (2004-2008), Oldwick, NJ: A.M. Best.

A.M. Best, Best's Key Rating Guide Life/Health United States & Canada (2006 and 2008), Oldwick, NJ: A.M. Best.

Ambrose, Jan M. and Anne M. Carroll (1994), "Using Best's Ratings in Life Insurer Insolvency Prediction," Journal of Risk and Insurance, 317-327.

Arias, Elizabeth (2007), "United States Life Tables, 2004," National Vital Statistics Reports, Vol. 56, No. 9. Washington: DC.

BarNiv, Ran and Robert A. Hershbarger (1990), "Classifying Financial Distress in the Life Insurance Industry," Journal of Risk and Insurance, 110-136.

Bartholdy, Jan, Glenn Boyle and Roger Stover (2003), "Deposit Insurance and the Risk Premium in Bank Deposit Rates," Journal of Banking and Finance, 699-717.

Berger, Lawrence A. J. David Cummins, and Sharon Tennyson (1992), "Reinsurance and the Liability Insurance Crisis," Journal of Risk and Uncertainty, 253-272.

Black, Kenneth, Jr. and Harold D. Skipper, Jr., Life & Health Insurance (2000), 13$^{th}$ edition Prentice Hall.

Bodily, Jerry (1990), "The Effects of Retaliation on the State Taxation of Life Insurers," The Journal of Risk and Insurance, 21-36.

Boose, Mary Ann (1990), "Agency Theory and Alternative Predictions for Life Insurers: An Empirical Test," The Journal of Risk and Insurance, 499-518.

Boyer, M. Martin (2000), "Insurance Taxation and Insurance Fraud," Journal of Public Economic Theory, 101-134.

Brown, Jeffrey R. and Austan Goolsbee (2002), "Does the Internet Make Markets More Competitive? Evidence from the Life Insurance Industry," Journal of Political Economy, 481-506.

Carson, James M. and Robert E. Hoyt (1995), "Life Insurer Financial Distress: Classification Models and Empirical Evidence," Journal of Risk and Insurance, 764-775.

Carson, James M., James Doran and Randy Dumm (forthcoming), "Market Discipline in the Individual Annuity Market," Risk Management and Insurance Review (forthcoming).

Castillo, Marci K.(1997), "Essays on the State Taxation of the Life Insurance Industry," Ph.D. thesis, Massachusetts Institute of Technology, Cambridge, MA.

Cawley, John and Tomas Philipson (1999), "An Empirical Examination of Information Barriers to Trade in Insurance," The American Economic Review, 827-846.

Cook, Douglas and Lewis Spellman (1991), "Federal Financial Guarantees and the Occasional Market Pricing of Default Risk: Evidence from Insured Deposits," Journal of Banking and Finance, 1113-1130.

Cook, Douglas and Lewis Spellman (1996), "Firm Guarantor Risk, Risk Contagion, and the Interfirm Spread Among Insured Deposits," Journal of Financial and Quantitative Analysis, 265-281.

Cummins, J. David and Patricia Danzon (1997), "Price, Financial Quality, and Capital Flows in Insurance Markets," Journal of Financial Intermediation, 3-38.

Cummins, J. David and Richard Phillips (2000), "Applications of Financial Pricing Models in Property-Liability Insurance," in Georges Dionne, ed., Handbook of Insurance, Boston: Kluwer Academic Publishers.

Danzon, Patricia M. (2008), "The McCarran-Ferguson Act: Anticompetitive or Procompetitive?" The CATO Review of Business and Government, Retrieved March 8, 2007, from www.cato.org/pubs/regulation/reg15n2b.html, accessed 3/7/2008.

Doherty, Neil A. and Harris Schlesinger (1990), "Rational Insurance Purchasing: Consideration of Contract Nonperformance," Quarterly Journal of Economics, 243-253.

Doherty, Neil A. and S. M. Tinic (1981), "Reinsurance under Conditions of Capital Market Equilibrium: A Note," Journal of Finance, 949-953.

Friedman, Lawrence M. (2005), A History of American Law, 3rd edition, New York: Touchstone Books.

Garber, Harry D.(2007), "Ratings," in Edward E. Graves, ed., McGill's Life Insurance, Bryn Mawr, PA: The American College Press.

Gorton, Gary and Anthony Santomero (1990), "Market Discipline and Subordinated Debt: Note," Journal of Money, Credit, and Banking, 119-128.

Hendel, Igal and Alessandro Lizzeri (2003), "The Role of Commitment in Dynamic Contracts: Evidence from Life Insurance," Quarterly Journal of Economics, 299-325.

Kim, Won-Joong, David Mayers and Clifford Smith, Jr.(1996), "On the Choice of Insurance Distribution Systems," The Journal of Risk and Insurance, 207-227.

Lamm-Tennant, Joan and Laura Starks (1993), "Stock versus Mutual Ownership Structures: The Risk Implications," Journal of Business, 29-46.

Ligon, James and David Cather (1997), "The Informational Value of Insurance Purchases: Evidence from the Property-Liability Market," Journal of Banking and Finance, 989-1016.

Ligon, James and Paul Thistle (2005), "The Formation of Mutual Insurers in Markets with Adverse Selection," Journal of Business, 529-555.

Ligon, James and Paul Thistle (2007), "The Organizational Structure of Insurance Companies: The Role of Heterogeneous Risks and Guaranty Funds," Journal of Risk and Insurance, 851-861.

Malkiel, Burton (1999), A Random Walk Down Wall Street: The Best Investment Advice for the New Century, New York: W.W. Norton.

Nicholson, Walter (2002), Microeconomic Theory: Basic Principles and Extensions, Mason, Ohio: Thomso South-Western.

Pauly, Mark V., Kate H. Withers, Krupa Subramanian-Viswanathan, Jean Lemaire, John C. Hershey, Katrina Armstrong and David A. Asch (2003), "Price Elasticity of Demand for Term Life Insurance and Adverse Selection," NBER working paper No. 9925.

Petroni, Kathy R. and Douglas A. Shackelford (1999), "Managing Annual Accounting Reports to Avoid State Taxes: An Analysis of Property-Casualty Insurers," The Accounting Review, 371-393.

Pottier, Steven W. (1998), "Life Insurer Financial Distress, Best's Ratings and Financial Ratios," Journal of Risk and Insurance, 275-288.

Pottier, Steven, and David Sommer, "Agency Theory and Life Insurer Ownership Structure," The Journal of Risk and Insurance, 1997, 529-543.

Pottier, Steven W. and David W. Sommer (1999), "Property-Liability Insurer Financial Strength Ratings: Differences across Ratings Agencies," Journal of Risk and Insurance, 621-642.

Rejda, George E. (2008), Principles of Risk Management and Insurance, 10th edition, Boston: Addison-Wesley.

Schlesinger, Harris and J.-Matthias Graf v. d. Schulenburg (1987), "Risk Aversion and the Purchase of Risky Insurance," Journal of Economics, 309-314.

Seade, J. (1985), "Profitable Cost Increases and the Shifting of Taxation: Equilibrium Responses of Markets in Oligopoly," Working Paper No. 260, University of Warwick.

Singh, Ajai K. and Mark L. Power (1992), "The Effects of Best's Rating Changes on Insurance Company Stock Prices," Journal of Risk and Insurance, 310-317.

Skipper, Harold D. Jr. (1987), "State Taxation of Insurance Companies: Time for a Change," Journal of Insurance Regulation, 121-137

Sommer, David W.(1996), "The Impact of Firm Risk on Property-Liability Insurance Prices," Journal of Risk and Insurance, 501-514.

The Life & Health Guaranty Association System (2009), The Answers You Need. Retrieved January 5, 2009 from www.nolhga.com/resource/file/2009GABrochureFINAL.pdf

U.S. Dept. of the Treasury (2008), The Department of the Treasury Blueprint for a Modernized Financial Regulatory Structure, Washington: DC.

Wooldridge, Jeffrey (2006), Introductory Econometrics: A Modern Approach, 3rd edition, Mason: Ohio, Thompson South-Western.

Wright, Kenneth (1992), "The Life Insurance Industry in the United States: An Analysis of Economic and Regulatory Issues," World Bank Policy Research Working Papers WPS 857, Washington, DC:

# APPENDIX A

Table 1

Guaranty Fund Coverage

| Face Value | Percent Guaranteed | Amount Guaranteed |
|---|---|---|
| $50,000 | 80% | $40,000 |
| $100,000 | 80% | $80,000 |
| $150,000 | 80% | $120,000 |
| $200,000 | 80% | $160,000 |
| $250,000 | 80% | $200,000 |
| $300,000 | 80% | $240,000 |
| $350,000 | 71.43% | $250,000 |
| $400,000 | 62.50% | $250,000 |
| $500,000 | 50.00% | $250,000 |
| $750,000 | 33.33% | $250,000 |
| $1,000,000 | 25.00% | $250,000 |
| Dollar Values in Nominal Terms | | |

Table 1A

| Year | Loss Ratio* | Combined Ratio* | $R_L$ |
|---|---|---|---|
| 2003 | 1.515311153 | 0.89367374 | 0.010749227 |
| 2004 | 1.486432422 | 0.877306501 | 0.056035132 |
| 2005 | 1.366819819 | 0.899532635 | 0.030142039 |
| 2006 | 1.506234227 | 0.899190167 | 0.046843283 |
| 2007 | 1.721343512 | 0.918406652 | 0.048899828 |
| * denotes mean value | | | |

Dependent Variable Components

Table 1B

Dependent Variable Components

| Year | Nominal Price per $1000* | Inflation-Adjusted Price per $1000* | Deflator |
|---|---|---|---|
| 2003 | 1.522031098 | 1.522031098 | 1 |
| 2004 | 1.552272263 | 1.503330416 | 1.032555616 |
| 2005 | 1.526766352 | 1.429791863 | 1.0678242 |
| 2006 | 1.540425494 | 1.406840528 | 1.09495388 |
| 2007 | 1.525113679 | 1.338239402 | 1.139641888 |
| *denotes mean value | | | |

Table 2

Summary Statistics

| Explanatory Variables | Mean {Standard Deviation} |
|---|---|
| *SMOKE* | 0.3525939<br>{0.4777896} |
| *HEALTH* | 1.203562<br>{1.17897} |
| *GENDER* | 0.5007754<br>{0.5000119} |
| *PROJECTED* | 0.0972535<br>{0.29631} |
| *SCALE*<br>(INFLATION-ADJUSTED FACE VALUE) | 384982.1<br>{256131.5} |
| *SCALE*<br>LN (INFLATION-ADJUSTED FACE VALUE) | 12.63545<br>{0.6963807} |
| *SCALE*<br>(INFLATION-ADJUSTED FACE VALUE SQUARED) | 2.14E+11<br>{2.71E+11} |
| *POLICYSIZE*<br>(POLICIES > $300,000) | 0.5183351<br>{0.4996762} |
| *GROUP* | 0.9779879<br>{0.1467264} |
| *STOCK* | 0.8899395<br>{0.312973} |
| *AGENCY* | 0.4276352<br>{0.494748} |
| *REALASSETS* | 2.64E+10<br>{4.5E+10} |
| *NY* | 0.2483866<br>{0.432088} |
| *LICENSES* | 49.49512<br>{3.919344} |
| *BEST* | 0.9521237<br>{0.2135099} |
| *GROUPRATING* | 0.8247536<br>{0.3801872} |
| *MSHARE* | 0.007620527<br>0.01212889 |
| Observations | 19,989 |

Table 3

Linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | $P(I_1)$ | $P(I_1)$ | $P(I_1)$ |
| CONSTANT | 2.764859** | 9.328275** | 2.660701** |
| | {0.1387105} | {.2636208} | {0.1390131} |
| *SMOKE* | 1.436498** | 1.435245** | 1.436803** |
| | {.0177094} | {.0174264} | {.0177733} |
| *HEALTH* | -.3001179** | -.2897611** | -.3017596** |
| | {.0072481} | {.0071432} | {.0072732} |
| *GENDER* | .3503943** | .350068** | .350428** |
| | {.0160388} | {.0157825} | {.0160967} |
| *PROJECTED* | .1509289** | .1416841** | .1529343** |
| | {.0285182} | {.0280647} | {.0286207} |
| *SCALE* | -6.82e-07** | - | - |
| FACE VALUE | {4.67e-08} | | |
| *SCALE* | - | -.5583671** | - |
| LN (FACE VALUE) | | {.0188851} | |
| *SCALE* | - | - | -3.13e-13** |
| FACE VALUE SQUARED | | | {3.79e-14} |
| *POLICYSIZE* | -.2280891** | .1293997** | -.3806784** |
| (POLICIES > $300,000) | {.0238515} | {.0261337} | {.0205102} |
| *GROUP* | .7464115** | .7798465** | .7395851** |
| | {.0662712} | {.0652248} | {.0665083} |
| *STOCK* | -.9602567** | -.960376** | -.9603454** |
| | {.0322056} | {.0316908} | {.0323219} |
| *AGENCY* | -.6615385** | -.6506824** | -.6648704** |
| | {.0192673} | {.0189638} | {.019335} |
| *REALASSETS* | 2.93e-12** | 3.11e-12** | 2.90e-12** |
| | {3.74e-13} | {3.68e-13} | {3.76e-13} |
| *NY* | -.7022467** | -.6861317** | -.7030815** |
| | {.0252242} | {.0248237} | {.0253192} |
| *LICENSES* | .0120234** | .0118701** | .0118652** |
| | {.0022022} | {.0021667} | {.0022103} |
| *BEST* | .0655359 | .0866769* | .0616352 |
| | {.040991} | {.0403439} | {.041138} |
| *GROUPRATING* | -.7800121** | -.7789434** | -.7794117** |
| | {.0250236} | {.0246232} | {.0251144} |
| *MSHARE* | -.1127804** | -.1196405** | -.1116969** |
| | {.0135493} | {.0133352} | {.0135981} |
| *2004* | -.5570592** | -.5653818** | -.5531314** |
| | {.0254278} | {.0250212} | {.0255192} |
| *2005* | -.4454644** | -.4665913** | -.4359101** |
| | {.0251422} | {.024742} | {.0252282} |
| *2006* | -.5039706** | -.5344573** | -.4910487** |
| | {.0255669} | {.0251682} | {.0256478} |
| *2007* | -.3485303** | -.3958252** | -.3296503** |
| | {.025419} | {.025049} | {.0254808} |
| F-Statistic | 938.42 | 1003.57 | 924.13 |
| $R^2$ | 0.4717 | 0.4885 | 0.4679 |
| Adj. $R^2$ | 0.4712 | 0.4880 | 0.4674 |
| Observations | 19,989 | 19,989 | 19,989 |
| ** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {} | | | |

# Table 4

# Linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | $P(I_2)$ | $P(I_2)$ | $P(I_2)$ |
| CONSTANT | 2.301009** | 5.976952** | 2.2397** |
| | {0.0458909} | {.0846548} | {0.0463236} |
| *SMOKE* | .8357247** | .835031** | .835905** |
| | {.005859} | {.005596} | {.0059226} |
| *HEALTH* | -.1714062** | -.1656567** | -.1723663** |
| | {.002398} | {.0022938} | {.0024237} |
| *GENDER* | .2009742** | .2007907** | .2009956** |
| | {.0053063} | {.0050681} | {.0053639} |
| *PROJECTED* | -.0039586 | -.0090505 | -.0028083 |
| | {.009435} | {.0090122} | {.0095373} |
| *SCALE* | -4.02e-07** | - | - |
| FACE VALUE | {1.54e-08} | | |
| *SCALE* | - | -.3129919** | - |
| LN (FACE VALUE) | | {.0060644} | |
| *SCALE* | - | - | -1.94e-13** |
| FACE VALUE SQUARED | | | {1.26e-14} |
| *POLICYSIZE* | -.1274999** | .0653736** | -.2143646** |
| (POLICIES > $300,000) | {.007891} | {.0083921} | {.0068347} |
| *GROUP* | .1016559** | .1201498** | .0976791** |
| | {.0219251} | {.0209452} | {.0221627} |
| *STOCK* | -.3612038** | -.3612518** | -.361278** |
| | {.0106549} | {.0101766} | {.0107707} |
| *AGENCY* | -.1852585** | -.1793339** | -.1871587** |
| | {.0063744} | {.0060897} | {.006443} |
| *REALASSETS* | 2.42e-12** | 2.52e-12** | 2.40e-12** |
| | {1.24e-13} | {1.18e-13} | {1.25e-13} |
| *NY* | -.1811681** | -.1720377** | -.1817853** |
| | {.0083452} | {.0079715} | {.0084372} |
| *LICENSES* | -.0105509** | -.010652** | -.0106333** |
| | {.0007286} | {.0006958} | {.0007365} |
| *BEST* | -.1446188** | -.1328913** | -.1469103** |
| | {.0135615} | {.0129554} | {.0137085} |
| *GROUPRATING* | .008249 | .008919 | .0085482 |
| | {.0082788} | {.0079071} | {.0083689} |
| *MSHARE* | -.069421** | -.0732372** | -.0687793** |
| | {.0044826} | {.0042822} | {.0045313} |
| *2004* | -.3448108** | -.3492215** | -.3426376** |
| | {.0084125} | {.0080349} | {.0085038} |
| *2005* | -.1903288** | -.2015748** | -.1850193** |
| | {.008318} | {.0079452} | {.0084068} |
| *2006* | -.3265825** | -.3428904** | -.3193753** |
| | {.0084585} | {.0080821} | {.0085467} |
| *2007* | -.3490376** | -.3744468** | -.3384664** |
| | {.0084096} | {.0080438} | {.008491} |
| F-Statistic | 2449.10 | 2785.78 | 2374.25 |
| $R^2$ | 0.6997 | 0.7261 | 0.6932 |
| Adj. $R^2$ | 0.6994 | 0.7258 | 0.6929 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

## Table 5

## Linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | Inflation-Adj. Price Per $1000 | Inflation-Adj. Price Per $1000 | Inflation-Adj. Price Per $1000 |
| CONSTANT | 2.006715** | 7.262487** | 1.918422** |
| | {0.0445018} | {.0773679} | {0.045492} |
| *SMOKE* | 1.111625** | 1.110635** | 1.111885** |
| | {.0056816} | {.0051143} | {.0058163} |
| *HEALTH* | -.2296098** | -.2214** | -.2309917** |
| | {.0023254} | {.0020964} | {.0023801} |
| *GENDER* | .2730953** | .2728328** | .2731264** |
| | {.0051456} | {.0046319} | {.0052677} |
| *PROJECTED* | .1302482** | .1229861** | .1319008** |
| | {.0091494} | {.0082365} | {.0093661} |
| *SCALE* | -5.79e-07** | - | - |
| FACE VALUE | {1.50e-08} | | |
| *SCALE* | - | -.4475649** | - |
| LN (FACE VALUE) | | {.0055424} | |
| *SCALE* | - | - | -2.81e-13** |
| FACE VALUE SQUARED | | | {1.24e-14} |
| *POLICYSIZE* | -.1902665** | .0839503** | -.3149807** |
| (POLICIES > $300,000) | {.0076521} | {.0076698} | {.006712} |
| *GROUP* | .3142787** | .3406719** | .308557** |
| | {.0212614} | {.0191423} | {.0217648} |
| *STOCK* | -.3315637** | -.3316285** | -.3316735** |
| | {.0103323} | {.0093007} | {.0105774} |
| *AGENCY* | -.0958203** | -.0873823** | -.0985489** |
| | {.0061814} | {.0055655} | {.0063274} |
| *REALASSETS* | 6.07e-13** | 7.50e-13** | 5.78e-13** |
| | {1.20e-13} | {1.08e-13} | {1.23e-13} |
| *NY* | -.0970613** | -.0839848** | -.0979667** |
| | {.0080925} | {.0072853} | {.0082857} |
| *LICENSES* | -.007929** | -.0080768** | -.0080463** |
| | {.0007065} | {.0006359} | {.0007233} |
| *BEST* | .0033211 | .020065 | .0000217** |
| | {.0131509} | {.0118402} | {.0134624} |
| *GROUPRATING* | .0347319** | .035705** | .0351557** |
| | {.0080282} | {.0072264} | {.0082187} |
| *MSHARE* | -.0193418** | -.0247927** | -.018417** |
| | {.004347} | {.0039136} | {.00445} |
| *2004* | -.0421191** | -.0483725** | -.0390074** |
| | {.0081579} | {.0073433} | {.0083512} |
| *2005* | -.0979552** | -.1139107** | -.0903496** |
| | {.0080662} | {.0072613} | {.0082559} |
| *2006* | -.1382236** | -.1613786** | -.127896** |
| | {.0082025} | {.0073864} | {.0083932} |
| *2007* | -.2136032** | -.249705** | -.1984495** |
| | {.008155} | {.0073514} | {.0083386} |
| F-Statistic | 4321.94 | 5580.02 | 4075.93 |
| $R^2$ | 0.8044 | 0.8415 | 0.7950 |
| Adj. $R^2$ | 0.8042 | 0.8414 | 0.7948 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

Table 6

Log-linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | $\ln(P(I_1))$ | $\ln(P(I_1))$ | $\ln(P(I_1))$ |
| CONSTANT | 1.40981** | 4.846344** | 1.3411** |
| | {0.0510996} | {.0961141} | {0.0514962} |
| *SMOKE* | .7757319** | .7751142** | .7759361** |
| | {.006524} | {.0063535} | {.006584} |
| *HEALTH* | -.2010353** | -.1958553** | -.20209** |
| | {.0026701} | {.0026043} | {.0026943} |
| *GENDER* | .1769596** | .1767853** | .1769893** |
| | {.0059085} | {.0057542} | {.0059629} |
| *PROJECTED* | .0056935 | .0012617 | .0068792 |
| | {.0105058} | {.0102322} | {.0106023} |
| *SCALE* | -4.53e-07** | - | - |
| FACE VALUE | {1.72e-08} | | |
| *SCALE* | - | -.2936386** | - |
| LN (FACE VALUE) | | {.0068854} | |
| *SCALE* | - | - | -2.51e-13** |
| FACE VALUE SQUARED | | | {1.40e-14} |
| *POLICYSIZE* | -.1431534** | .0090728 | -.2303512** |
| (POLICIES > $300,000) | {.0087866} | {.0095282} | {.0075978} |
| *GROUP* | .2481259** | .2645285** | .2438113** |
| | {.0244136} | {.0237805} | {.0246374} |
| *STOCK* | -.5575221** | -.5574954** | -.5576812** |
| | {.0118642} | {.0115542} | {.0119734} |
| *AGENCY* | -.3285156** | -.3235717** | -.3304352** |
| | {.0070979} | {.0069141} | {.0071625} |
| *REALASSETS* | 1.97e-12** | 2.06e-12** | 1.95e-12** |
| | {1.38e-13} | {1.34e-13} | {1.39e-13} |
| *NY* | -.2775601** | -.268623** | -.2786852** |
| | {.0092923} | {.0090505} | {.0093793} |
| *LICENSES* | -.0005857 | -.0007387 | -.0006412 |
| | {.0008113} | {.00079} | {.0008188} |
| *BEST* | -.072553** | -.0620209** | -.0751057** |
| | {.0151007} | {.0147091} | {.0152392} |
| *GROUPRATING* | -.2284378** | -.2275379** | -.2282889** |
| | {.0092185} | {.0089774} | {.0093034} |
| *MSHARE* | -.0937396** | -.0972086** | -.0930068** |
| | {.0049914} | {.0048619} | {.0050373} |
| *2004* | -.3315467** | -.3347117** | -.3295886** |
| | {.0093674} | {.0091225} | {.0094534} |
| *2005* | -.2250505** | -.233321** | -.2201815** |
| | {.0092621} | {.0090208} | {.0093456} |
| *2006* | -.2950727** | -.3073864** | -.2883673** |
| | {.0094186} | {.0091761} | {.009501} |
| *2007* | -.2216557** | -.241283** | -.2116724** |
| | {.0093641} | {.0091327} | {.0094391} |
| F-Statistic | 2168.34 | 2343.40 | 2109.91 |
| $R^2$ | 0.6735 | 0.6904 | 0.6675 |
| Adj. $R^2$ | 0.6732 | 0.6901 | 0.6672 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

## Table 7

## Log-linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln ($P(I_2)$) | ln ($P(I_2)$) | ln ($P(I_2)$) |
| CONSTANT | 0.9997508** | 4.361999** | .9318864** |
| | {0.0389097} | {.0719215} | {0.039447} |
| *SMOKE* | .7615851** | .7609825** | .7617869** |
| | {.0049677} | {.0047543} | {.0050434} |
| *HEALTH* | -.2012419** | -.1961848** | -.2022824** |
| | {.0020332} | {.0019488} | {.0020639} |
| *GENDER* | .1765447** | .176374** | .1765743** |
| | {.004499} | {.0043058} | {.0045677} |
| *PROJECTED* | -.0508241** | -.0551416** | -.0496585** |
| | {.0079997} | {.0076567} | {.0081216} |
| *SCALE* | -4.48e-07** | - | - |
| FACE VALUE | {1.31e-08} | | |
| *SCALE* | - | -.2873493** | - |
| LN (FACE VALUE) | | {.0051523} | |
| *SCALE* | - | - | -2.50e-13** |
| FACE VALUE SQUARED | | | {1.08e-14} |
| *POLICYSIZE* | -.1389396** | .0084136 | -.2245245** |
| (POLICIES > $300,000) | {.0066906} | {.0071298} | {.0058201} |
| *GROUP* | .133612** | .14961** | .1293581** |
| | {.0185897} | {.0177947} | {.0188727} |
| *STOCK* | -.4150045** | -.4149743** | -.4151657** |
| | {.009034} | {.0086459} | {.0091718} |
| *AGENCY* | -.1734524** | -.168649** | -.1753373** |
| | {.0054047} | {.0051737} | {.0054866} |
| *REALASSETS* | 2.77e-12** | 2.86e-12** | 2.75e-12** |
| | {1.05e-13} | {1.00e-13} | {1.07e-13} |
| *NY* | -.1671932** | -.1584268** | -.1683275** |
| | {.0070756} | {.0067725} | {.0071847} |
| *LICENSES* | -.0065557** | -.0067087** | -.0066086** |
| | {.0006177} | {.0005911} | {.0006272} |
| *BEST* | -.1184525** | -.1081724** | -.1209729** |
| | {.0114984} | {.0110067} | {.0116735} |
| *GROUPRATING* | .0015639 | .0024598 | .0017011 |
| | {.0070194} | {.0067177} | {.0071266} |
| *MSHARE* | -.0963344** | -.0997228** | -.0956098** |
| | {.0038007} | {.0036381} | {.0038587} |
| *2004* | -.3329671** | -.3360097** | -.3310585** |
| | {.0071328} | {.0068263} | {.0072415} |
| *2005* | -.1882489** | -.1962143** | -.1834972** |
| | {.0070526} | {.0067502} | {.0071589} |
| *2006* | -.3153364** | -.3272187** | -.3087864** |
| | {.0071718} | {.0068664} | {.0072779} |
| *2007* | -.3679458** | -.3869163** | -.3581844** |
| | {.0071303} | {.0068339} | {.0072305} |
| F-Statistic | 3364.19 | 3769.42 | 3232.50 |
| $R^2$ | 0.7620 | 0.7820 | 0.7546 |
| Adj. $R^2$ | 0.7617 | 0.7818 | 0.7544 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

Table 8

Log-linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln (Inflation-Adj. Price Per $1000) | ln (Inflation-Adj. Price Per $1000) | ln (Inflation-Adj. Price Per $1000) |
| CONSTANT | 0.6233704** | 4.040933** | .5528178** |
| | {0.0276592} | {.0487735} | {.0284842} |
| *SMOKE* | .7372566** | .7366484** | .7374667** |
| | {.0035313} | {.0032241} | {.0036418} |
| *HEALTH* | -.1925749** | -.1874618** | -.1936533** |
| | {.0014453} | {.0013216} | {.0014903} |
| *GENDER* | .1759823** | .1758084** | .1760139** |
| | {.0031982} | {.00292} | {.0032983} |
| *PROJECTED* | .097708** | .0933652** | .0989037** |
| | {.0056866} | {.0051924} | {.0058645} |
| *SCALE* | -4.66e-07** | - | - |
| FACE VALUE | {9.31e-09} | | |
| *SCALE* | - | -.2922205** | - |
| LN (FACE VALUE) | | {.003494} | |
| *SCALE* | - | - | -2.65e-13** |
| FACE VALUE SQUARED | | | {7.76e-15} |
| *POLICYSIZE* | -.1434714** | .00239 | -.2308743** |
| (POLICIES > $300,000) | {.004756} | {.0048351} | {.0042026} |
| *GROUP* | .2420086** | .2581462** | .2376083** |
| | {.0132146} | {.0120675} | {.0136278} |
| *STOCK* | -.2503611** | -.2503204** | -.2505405** |
| | {.0064219} | {.0058632} | {.0066229} |
| *AGENCY* | -.0583358** | -.0535363** | -.0602629** |
| | {.0038419} | {.0035086} | {.0039618} |
| *REALASSETS* | 6.24e-13** | 7.12e-13** | 6.02e-13** |
| | {7.46e-14} | {6.81e-14} | {7.69e-14} |
| *NY* | -.0668017** | -.057835** | -.0680479** |
| | {.0050298} | {.0045927} | {.005188} |
| *LICENSES* | -.0042347** | -.0043984** | -.0042841** |
| | {.0004391} | {.0004009} | {.0004529} |
| *BEST* | -.0048269 | .0055621 | -.0074448 |
| | {.0081737} | {.0074642} | {.0084293} |
| *GROUPRATING* | .0339063** | .0348551** | .03402 |
| | {.0049898} | {.0045556} | {.005146} |
| *MSHARE* | -.0211437** | -.0245741** | -0.0203883** |
| | {.0027018} | {.0024672} | {.0027863} |
| *2004* | -.0347492** | -.0377082** | -.0328389** |
| | {.0050704} | {.0046293} | {.005229} |
| *2005* | -.0762786** | -.0840623** | -.0715062** |
| | {.0050134} | {.0045776} | {.0051693} |
| *2006* | -.1085193** | -.1201883** | -.1019223** |
| | {.0050981} | {.0046565} | {.0052553} |
| *2007* | -.1719341** | -.1906413** | -.1620747** |
| | {.0050686} | {.0046344} | {.0052211} |
| F-Statistic | 5782.93 | 7147.17 | 5374.43 |
| $R^2$ | 0.8462 | 0.8718 | 0.8364 |
| Adj. $R^2$ | 0.8461 | 0.8717 | 0.8363 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

Table 9

Full-sample Linear Regression Results

| Table 9 | | | |
|---|---|---|---|
| Explanatory | Dependent Variable | | |
| Variables | Inflation-Adjusted Price per $1000 | Inflation-Adjusted Price per $1000 | Inflation-Adjusted Price per $1000 |
| CONSTANT | 2.070642** | 7.503198** | 1.977074** |
| | {.0363958} | {.0958716} | {0.0368794} |
| *SMOKE* | 1.11254** | 1.112268** | 1.11271** |
| | {.0057845} | {.0054637} | {.0058572} |
| *HEALTH* | -.2272342** | -.219011** | -.2285925** |
| | {.0020413} | {.0019141} | {.0020714} |
| *GENDER* | .2818084** | .2816026** | .2818638** |
| | {.0049262} | {.0046452} | {.0049897} |
| *PROJECTED* | .2608837** | .2453427** | .2638148** |
| | {.0106676} | {.0099501} | {.0108249} |
| *SCALE* | -5.77e-07** | - | - |
| FACE VALUE | {1.36e-08} | | |
| *SCALE* | - | -.4610691** | - |
| LN (FACE VALUE) | | {.0072359} | |
| *SCALE* | - | - | -2.66e-13** |
| FACE VALUE SQUARED | | | {1.02e-14} |
| *POLICYSIZE* | -.1828498** | .1124452** | -.3127155** |
| (POLICIES > $300,000) | {.0065265} | {.008288} | {.0058705} |
| *GROUP* | .2071589** | .2258955** | .2035865** |
| | {.0204113} | {.0188473} | {.0206966} |
| | -.197127** | -.2005843** | -.1965734** |
| *STOCK* | {.0109872} | {.0102051} | {.0111695} |
| | -.0942484** | -.0906192** | -.0950897** |
| *AGENCY* | {.0057126} | {.0054407} | {.0057753} |
| | -5.25e-13** | -3.69e-13** | -5.61e-13** |
| *REALASSETS* | {9.55e-14} | {8.64e-14} | {9.78e-14} |
| | -.1441899** | -.1352955** | -.1439207** |
| *NY* | {.0057921} | {.0053304} | {.0059059} |
| | -.0031432** | -.0033852** | -.0032101** |
| *LICENSES* | {.0006754} | {.0006163} | {.0006883} |
| | -.2647544** | -.2444044** | -.268212** |
| *BEST* | {.0165155} | {.0156411} | {.0166787} |
| | .0011607 | .0013834 | .0016712 |
| *GROUPRATING* | {.0068336} | {.006408} | {.0069246} |
| | .0137788 | .0098201** | .0140574** |
| *MSHARE* | {.003386} | {.0029674} | {.0034775} |
| | -.0274245** | -.0374503** | -.0241074** |
| *2004* | {.0078388} | {.0074621} | {.0079251} |
| | -.0570933** | -.0801754** | -.0482968** |
| *2005* | {.0081125} | {.0076603} | {.0082163} |
| | -.1466911** | -.1714754** | -.1362743** |
| *2006* | {.00764} | {.0072495} | {.0077293} |
| | -.2197428** | -.2573786** | -.2046983** |
| *2007* | {.0074784} | {.0071201} | {.0075612} |
| $R^2$ | .6829 | .7180 | .6747 |
| Observations | 41,992 | 41,992 | 41,992 |
| ** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; standard errors are in {} | | | |

Table 10

Full-sample Log-linear Regression Results

| Explanatory Variables | Dependent Variable | | |
|---|---|---|---|
| | LN (Inflation-Adjusted Price) | LN (Inflation-Adjusted Price) | LN (Inflation-Adjusted Price) |
| CONSTANT | 0.6808761** | 4.056879** | .6087967** |
| | {0.0205383} | {.0447419} | {0.0209061} |
| *SMOKE* | .7341528** | .7340193** | 0.7342755** |
| | {.0027864} | {.0026343} | {.0028318} |
| *HEALTH* | -.1833558** | -.1784875** | -.1843706** |
| | {.0012982} | {.0012258} | {.0013243} |
| *GENDER* | .1743469** | .1742317** | .1743859** |
| | {.0028425} | {.0026907} | {.0028953} |
| *PROJECTED* | .1650407** | .1559853** | .167157** |
| | {.0058864} | {.005659} | {.0059716} |
| *SCALE* FACE VALUE | -4.52e-07** | - | - |
| | {8.75e-09} | | |
| *SCALE* LN (FACE VALUE) | - | -0.2878967** | - |
| | | {.0033613} | |
| *SCALE* FACE VALUE SQUARED | - | - | -2.51e-13** |
| | | | {7.00e-15} |
| *POLICYSIZE* (POLICIES > $300,000) | -.135428** | .0140633** | -.2230838** |
| | {.0041} | {.0044172} | {.0035597} |
| *GROUP* | .1692958** | .1802287** | .1666927** |
| | {.0091065} | {.008295} | {.0093354} |
| *STOCK* | -.1722777** | -.1742413** | -.17195** |
| | {.0057363} | {.0053548} | {.0058758} |
| *AGENCY* | -.064703** | -.0625732** | -.0653599** |
| | {.0033026} | {.0031637} | {.0033526} |
| *REALASSETS* | -3.07e-14 | 5.83e-14 | -5.67e-14 |
| | {5.81e-14} | {5.30e-14} | {6.01e-14} |
| *NY* | -.0944047** | -.0883249** | -.0946731** |
| | {.0033934} | {.0031184} | {.0034975} |
| *LICENSES* | -.0025578** | -.0027496** | -.0025803** |
| | {.0003779} | {.0003564} | {.0003855} |
| *BEST* | -.1138073** | -.1017069** | -.1164612** |
| | {.0067069} | {0.0063906} | {.0068081} |
| *GROUPRATING* | -.0063038 | -.0059393 | -.0060467 |
| | {.0036199} | {.0034066} | {.0036923} |
| *MSHARE* | -.0013698 | -.0038824** | -.0010672 |
| | {.0021524} | {.0019274} | {.0022283} |
| *2004* | -.022698** | -.0279655** | -.0205596** |
| | {.0043843} | {.0041835} | {.0044537} |
| *2005* | -.0484615** | -.0601433** | -.0428885** |
| | {.0045034} | {.0042686} | {.0045842} |
| *2006* | -.1060387** | -.1181916** | -.0995273** |
| | {.0044528} | {.0042308} | {.0045308} |
| *2007* | -.1659327** | -.1847501** | -.1564133** |
| | {.0044513} | {.004222} | {.0045329} |
| $R^2$ | .7610 | .7858 | .7520 |
| Observations | 41,992 | 41,992 | 41,992 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; standard errors are in {}

Table 11

Log-linear regression results with *BEST-POLICYSIZE* interaction term

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln ($P(I_1)$) | ln ($P(I_2)$) | ln (Inflation-Adj. Price Per $1000) |
| CONSTANT | 4.787943** | 4.256946** | 4.049823** |
| | 0.0943466 | .0705965 | 0.0478657 |
| *SMOKE* | .7751348** | .7610002** | .7366673** |
| | .0063531 | .0047538 | .0032232 |
| *HEALTH* | -.1958421** | -.1961734** | -.1874496** |
| | .0026042 | .0019486 | .0013212 |
| *GENDER* | .1767613** | .1763533** | .1757863** |
| | .0057537 | .0043053 | .0029191 |
| *PROJECTED* | .0011745 | -.0552167** | .0932851** |
| | .0102315 | .0076559 | .0051909 |
| *SCALE* | -.2939792** | -.2876428** | -.2925336** |
| LN (FACE VALUE) | 0.006887 | .0051533 | 0.003494 |
| *POLICYSIZE* | .0094397 | .0087298 | .0027273 |
| (POLICIES > $300,000) | .0095292 | .0071304 | .0048346 |
| *INTERACTION* | .0536954* | .0462747* | .0493639** |
| (B-rated policy & face value > $300k) | .0269952 | .0201996 | .0136957 |
| *GROUP* | .2647393** | .1497917** | .25834** |
| | .0237789 | .017793 | .012064 |
| *STOCK* | -.5575637** | -.4150331** | -.2503832** |
| | .0115534 | .008645 | .0058615 |
| *AGENCY* | -.3234479** | -.1685423** | -.0534225** |
| | .0069138 | .0051734 | .0035077 |
| *REALASSETS* | 2.06e-12** | 2.86e-12** | 7.14e-13** |
| | 1.34e-13 | 1.00e-13 | 6.81e-14 |
| *NY* | -.2685981** | -.1584053** | -.0578121** |
| | .0090499 | .0067717 | .0045914 |
| *LICENSES* | -.0007359 | -.0067063** | -.0043958** |
| | .0007899 | .0005911 | .0004008 |
| *BEST* | -.0007359** | .1100795** | -.0035276 |
| Any B rating equals 1 | .01475 | .011037 | .0074833 |
| *GROUPRATING* | -.2273936** | .0025842 | .0349878** |
| | .008977 | .0067172 | .0045544 |
| *MSHARE* | -.0973011** | -.0998025** | -.0246591** |
| | .0048618 | .0036379 | .0024666 |
| *2004* | -.3346791** | -.3359816** | -.0376782** |
| | .0091219 | .0068256 | .0046279 |
| *2005* | -.2333039** | -.1961995** | -.0840465** |
| | .0090201 | .0067494 | .0045763 |
| *2006* | -.3073608** | -.3271967** | -.1201648** |
| | .0091755 | .0068657 | .0046551 |
| *2007* | -.2411466** | -.3867987** | -.1905159** |
| | .0091322 | .0068334 | .0046331 |
| F-Statistic | 2226.75 | 3581.97 | 6794.54 |
| $R^2$ | 0.6904 | 0.7820 | 0.8719 |
| Adj. $R^2$ | 0.6901 | 0.7818 | 0.8718 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

Table 12

Linear regression results with *SMOKE-POLICYSIZE* interaction term

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | $P(I_1)$ | $P(I_1)$ | $P(I_1)$ |
| CONSTANT | 2.763634** | 9.29929** | 2.659813** |
| | {0.1385916} | {.2634818} | 0.1388907 |
| *SMOKE* | 1.434931** | 1.433826** | 1.435209** |
| | {.0176962} | {.0174156} | {.0177597} |
| *HEALTH* | -.3006722** | -.290311** | -.302317** |
| | {.0072425} | {.0071387} | {.0072674} |
| *GENDER* | .3503324** | .3500131** | .350365** |
| | {.016025} | {.015771} | {.0160826} |
| *PROJECTED* | .151082** | .1418661** | .1530817** |
| | {.0284938} | {.0280443} | {.0285955} |
| *SCALE* | -6.79e-07** | - | - |
| FACE VALUE | 4.66e-08 | | |
| *SCALE* | - | -.5560072** | - |
| LN (FACE VALUE) | | {.0188762} | |
| *SCALE* | - | - | -3.12e-13** |
| FACE VALUE SQUARED | | | {3.79e-14} |
| *POLICYSIZE* | -.228776** | .1269541** | -.3807222** |
| (POLICIES > $300k) | {.0238313} | {.0261185} | {.0204922} |
| *INTERACTION* | -.1994787** | -.1812994** | -.2026919** |
| (Smoking & Polices > $300k) | {.0335622} | {.0330375} | {.0336817} |
| *GROUP* | .7463786** | .779665** | .7395768** |
| | {.0662143} | {.0651773} | {.0664497} |
| *STOCK* | -.9602222** | -.9603433** | -.9603109** |
| | {.0321779} | {.0316677} | {.0322935} |
| *AGENCY* | -.6615955** | -.6507868** | -.6649142** |
| | {.0192508} | {.01895} | {.0193179} |
| *REALASSETS* | 2.92e-12** | 3.11e-12** | 2.89e-12** |
| | {3.74e-13} | {3.68e-13} | {3.75e-13} |
| *NY* | -.7022518** | -.6862004** | -.7030894** |
| | {.0252025} | {.0248057} | {.0252969} |
| *LICENSES* | .0120308** | .0118769** | .0118738** |
| | {.0022003} | {.0021652} | {.0022083} |
| *BEST* | .066069 | .087067* | .0621905 |
| | {.0409559} | {.0403146} | {.0411019} |
| *GROUPRATING* | -.7793357** | -.7783303** | -.7787289** |
| | {.0250024} | {.0246055} | {.0250925} |
| *MSHARE* | -.1125563** | -.1194065** | -.1114726** |
| | {.0135377} | {.0133256} | {.0135861} |
| *2004* | -.5574077** | -.5656529** | -.5535051** |
| | {.0254061} | {.025003} | {.0254968} |
| *2005* | -.4458162** | -.4667971** | -.4363143** |
| | {.0251207} | {.0247241} | {.0252061} |
| *2006* | -.5043147** | -.5346089** | -.4914603** |
| | {.025545} | {.0251499} | {.0256253} |
| *2007* | -.349237** | -.3962221** | -.3304571 |
| | {.0253975} | {.0250308} | {.0254587} |
| F-Statistic | 894.80 | 956.29 | 881.28 |
| $R^2$ | 0.4726 | 0.4892 | 0.4688 |
| Adj. $R^2$ | 0.4721 | 0.4887 | 0.4683 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

Table 13

Linear regression results with *SMOKE-POLICYSIZE* interaction term

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | $P(I_2)$ | $P(I_2)$ | $P(I_2)$ |
| CONSTANT | 2.300431** | 5.963537** | 2.23928** |
| | {0.0458099} | {.0845414} | {0.0462402} |
| *SMOKE* | .8349863** | .8343744** | .8351514** |
| | {.0058493} | {.005588} | {.0059126} |
| *HEALTH* | -.1716674** | -.1659112** | -.1726299** |
| | {.0023939} | {.0022905} | {.0024195} |
| *GENDER* | .200945** | .2007653** | .2009658** |
| | {.0052969} | {.0050603} | {.0053543} |
| *PROJECTED* | -.0038865 | -.0089663 | -.0027386 |
| | {.0094183} | {.0089984} | {.0095202} |
| *SCALE* | -4.01e-07** | - | - |
| FACE VALUE | {1.54e-08} | | |
| *SCALE* | - | -.3118996** | - |
| LN (FACE VALUE) | | {.0060567} | |
| *SCALE* | - | - | -1.94e-13** |
| FACE VALUE SQUARED | | | {1.26e-14} |
| *POLICYSIZE* | -.1278235** | .0642417** | -.2143853** |
| (POLICIES > $300k) | {.0078772} | {.0083804} | {.0068224} |
| *INTERACTION* | -.0939936** | -.0839124** | -.0958667** |
| (Smoking and Polices > $300k) | {.0110936} | {.0106005} | {.0112135} |
| *GROUP* | .1016403** | .1200658** | .0976752** |
| | {.0218864} | {.020913} | {.0221228} |
| *STOCK* | -.3611875** | -.3612367** | -.3612617** |
| | {.010636} | {.010161} | {.0107513} |
| *AGENCY* | -.1852853** | -.1793822** | -.1871794** |
| | {.0063631} | {.0060803} | {.0064314} |
| *REALASSETS* | 2.42e-12** | 2.52e-12** | 2.40e-12** |
| | {1.24e-13} | {1.18e-13} | {1.25e-13} |
| *NY* | -.1811705** | -.1720695** | -.1817891** |
| | {.0083304} | {.0079592} | {.008422} |
| *LICENSES* | -.0105474** | -.0106489** | -.0106292** |
| | {.0007273} | {.0006947} | {.0007352} |
| *BEST* | -.1443676** | -.1327108** | -.1466476** |
| | {.0135375} | {.0129354} | {.0136839} |
| *GROUPRATING* | .0085677 | .0092028 | .0088711 |
| | {.0082643} | {.007895} | {.0083539} |
| *MSHARE* | -.0693154** | -.073129** | -.0686732** |
| | {.0044747} | {.0042757} | {.0045232} |
| *2004* | -.344975** | -.3493469** | -.3428144** |
| | {.0083977} | {.0080225} | {.0084885} |
| *2005* | -.1904946** | -.20167** | -.1852105** |
| | {.0083034} | {.007933} | {.0083917} |
| *2006* | -.3267446** | -.3429606** | -.3195699** |
| | {.0084436} | {.0080697} | {.0085313} |
| *2007* | -.3493706** | -.3746305** | -.338848** |
| | {.0083948} | {.0080315} | {.0084758} |
| F-Statistic | 2338.48 | 2657.80 | 2267.33 |
| $R^2$ | 0.7008 | 0.7269 | 0.6943 |
| Adj. $R^2$ | 0.7005 | 0.7267 | 0.6940 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

Table 14

Linear regression results with *SMOKE-POLICYSIZE* interaction term

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | Inflation-Adj. Price Per $1000 | Inflation-Adj. Price Per $1000 | Inflation-Adj. Price Per $1000 |
| CONSTANT | 2.005999** | 7.246137** | 1.917899** |
| | {0.0443721} | {.0771698} | {0.0453596} |
| *SMOKE* | 1.110709** | 1.109835** | 1.110947** |
| | {.0056657} | {.0051008} | {.0058} |
| *HEALTH* | -.229934** | -.2217102** | -.2313199** |
| | {.0023188} | {.0020908} | {.0023734} |
| *GENDER* | .2730591** | .2728018** | .2730894** |
| | {.0051307} | {.0046191} | {.0052523} |
| *PROJECTED* | .1303377** | .1230887** | .1319876** |
| | {.0091227} | {.0082138} | {.0093389} |
| *SCALE* | -5.78e-07** | - | - |
| FACE VALUE | {1.49e-08} | | |
| *SCALE* | - | -.4462336** | - |
| LN (FACE VALUE) | | {.0055286} | |
| *SCALE* | - | - | -2.80e-13** |
| FACE VALUE SQUARED | | | {1.24e-14} |
| *POLICYSIZE* | -.1906683** | .0825707** | -.3150065** |
| (POLICIES > $300k) | {.0076299} | {.0076497} | {.0066924} |
| *INTERACTION* | -.1166682** | -.1022692** | -.1193644** |
| (Smoking and Polices > $300k) | {.0107454} | {.0096762} | {.0109999} |
| *GROUP* | .3142594** | .3405695** | .3085521** |
| | {.0211995} | {.0190895} | {.0217015} |
| *STOCK* | -.3315435** | -.33161** | -.3316532** |
| | {.0103022} | {.009275} | {.0105466} |
| *AGENCY* | -.0958536** | -.0874411** | -.0985747** |
| | {.0061634} | {.0055502} | {.0063089} |
| *REALASSETS* | 6.02e-13** | 7.46e-13** | 5.73e-13** |
| | {1.20e-13} | {1.08e-13} | {1.23e-13} |
| *NY* | -.0970643** | -.0840235** | -.0979713** |
| | {.008069} | {.0072652} | {.0082616} |
| *LICENSES* | -.0079247** | -.008073** | -.0080412** |
| | {.0007045} | {.0006341} | {.0007212} |
| *BEST* | .0036329 | .0202851 | .0003487 |
| | {.0131126} | {.0118075} | {.0134233} |
| *GROUPRATING* | .0351275** | .0360509** | .0355578** |
| | {.0080049} | {.0072066} | {.0081948} |
| *MSHARE* | -.0192107** | -.0246607** | -.018285** |
| | {.0043343} | {.0039029} | {.004437} |
| *2004* | -.0423229** | -.0485254** | -.0392275** |
| | {.0081341} | {.007323} | {.0083269} |
| *2005* | -.098161** | -.1140268** | -.0905877** |
| | {.0080428} | {.0072413} | {.0082319} |
| *2006* | -.1384249** | -.1614641** | -.1281383** |
| | {.0081786} | {.007366} | {.0083688} |
| *2007* | -.2140165** | -.2499289** | -.1989247** |
| | {.0081314} | {.0073312} | {.0083144} |
| F-Statistic | 4135.77 | 5335.99 | 3900.66 |
| $R^2$ | 0.8055 | 0.8424 | 0.7962 |
| Adj. $R^2$ | 0.8053 | 0.8422 | 0.7960 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

Table 15

Log-linear regression results with *SMOKE-POLICYSIZE* interaction term

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln ($P(I_1)$) | ln ($P(I_1)$) | ln ($P(I_1)$) |
| CONSTANT | 1.410873** | 4.875471** | 1.341849** |
| | {0.05085} | {.0955844} | {0.0512552} |
| *SMOKE* | .7770914** | .7765398** | .7772804** |
| | {.0064928} | {.0063179} | {.0065539} |
| *HEALTH* | -.2005544** | -.1953027** | -.2016198** |
| | {.0026573} | {.0025897} | {.0026819} |
| *GENDER* | .1770133** | .1768405** | .1770424** |
| | {.0058797} | {.0057213} | {.005935} |
| *PROJECTED* | .0055607 | .0010788 | .0067549 |
| | {.0104545} | {.0101738} | {.0105527} |
| *SCALE* | -4.55e-07** | - | - |
| FACE VALUE | {1.71e-08} | | |
| *SCALE* | - | -.2960102** | - |
| LN (FACE VALUE) | | {.0068478} | |
| *SCALE* | - | - | -2.52e-13** |
| FACE VALUE SQUARED | | | {1.40e-14} |
| *POLICYSIZE* | -.1425574** | .0115305 | -.2303142** |
| (POLICIES > $300k) | {.0087438} | {.0094751} | {.0075623} |
| *INTERACTION* | .1730613** | .1821894** | .1710129** |
| (Smoking and Polices > $300k) | {.0123142} | {.0119852} | {.0124296} |
| *GROUP* | .2481544** | .2647109** | .2438183** |
| | {.0242944} | {.0236447} | {.0245221} |
| *STOCK* | -.5575521** | -.5575282** | -.5577103** |
| | {.0118063} | {.0114882} | {.0119173} |
| *AGENCY* | -.3284661** | -.3234668** | -.3303983** |
| | {.0070632} | {.0068746} | {.0071289} |
| *REALASSETS* | 1.98e-12** | 2.07e-12** | 1.96e-12** |
| | {1.37e-13} | {1.34e-13} | {1.38e-13} |
| *NY* | -.2775557** | -.268554** | -.2786785** |
| | {.0092469} | {.0089989} | {.0093354} |
| *LICENSES* | -.0005921 | -.0007455 | -.0006485 |
| | {.0008073} | {.0007855} | {.0008149} |
| *BEST* | -.0730155** | -.0624129** | -.0755742** |
| | {.015027} | {.0146251} | {.0151679} |
| *GROUPRATING* | -.2290246** | -.2281541** | -.228865** |
| | {.0091735} | {.0089262} | {.00926} |
| *MSHARE* | -.0939341** | -.0974437** | -.093196** |
| | {.0049671} | {.0048342} | {.0050137} |
| *2004* | -.3312444** | -.3344393** | -.3292733** |
| | {.0093216} | {.0090704} | {.0094091} |
| *2005* | -.2247453** | -.2331142** | -.2198405** |
| | {.0092169} | {.0089692} | {.0093019} |
| *2006* | -.2947742** | -.3072341** | -.28802** |
| | {.0093726} | {.0091237} | {.0094566} |
| *2007* | -.2210426** | -.2408842** | -.2109916** |
| | {.0093185} | {.0090805} | {.0093951} |
| F-Statistic | 2090.07 | 2263.43 | 2032.78 |
| $R^2$ | 0.6767 | 0.6939 | 0.6706 |
| Adj. $R^2$ | 0.6764 | 0.6936 | 0.6703 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

Table 16

Log-linear regression results with *SMOKE-POLICY* interaction term

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln ($P(I_2)$) | ln ($P(I_2)$) | ln ($P(I_2)$) |
| CONSTANT | 1.000806** | 4.390883** | .9326299** |
| | {0.0385856} | {.0712114} | {0.0391358} |
| *SMOKE* | .7629344** | .7623961** | .7631212** |
| | {.0049268} | {.0047069} | {.0050042} |
| *HEALTH* | -.2007646** | -.1956368** | -.2018157** |
| | {.0020164} | {.0019294} | {.0020478} |
| *GENDER* | .176598** | .1764287** | .176627** |
| | {.0044616} | {.0042624} | {.0045316} |
| *PROJECTED* | -.0509559** | -.055323** | -.0497819** |
| | {.007933} | {.0075796} | {.0080575} |
| *SCALE* | -4.50e-07** | - | - |
| FACE VALUE | {1.30e-08} | | |
| *SCALE* | - | -.289701** | - |
| LN (FACE VALUE) | | {.0051017} | |
| *SCALE* | - | - | -2.50e-13** |
| FACE VALUE SQUARED | | | {1.07e-14} |
| *POLICYSIZE* | -.1383481** | .0108508** | -.2244878** |
| (POLICIES > $300k) | {.0066349} | {.0070591} | {.0057742} |
| *INTERACTION* | .1717572** | .1806657** | .1697376** |
| (Smoking and Polices > $300k) | {.0093441} | {.0089291} | {.0094906} |
| *GROUP* | .1336404** | .1497909** | .129365** |
| | {.0184349} | {.0176155} | {.0187238} |
| *STOCK* | -.4150342** | -.4150069** | -.4151945** |
| | {.0089587} | {.0085589} | {.0090995} |
| *AGENCY* | -.1734034** | -.168545** | -.1753007** |
| | {.0053597} | {.0051216} | {.0054433} |
| *REALASSETS* | 2.78e-12** | 2.87e-12** | 2.76e-12** |
| | {1.04e-13} | {9.95e-14} | {1.06e-13} |
| *NY* | -.1671889** | -.1583583** | -.1683209** |
| | {.0070167} | {.0067042} | {.007128} |
| *LICENSES* | -.0065621** | -.0067154** | -.0066158** |
| | {.0006126} | {.0005852} | {.0006222} |
| *BEST* | -.1189115** | -.1085611** | -.1214379** |
| | {.0114026} | {.0108959} | {.0115815} |
| *GROUPRATING* | .0009815 | .0018488 | .0011293 |
| | {.006961} | {.0066501} | {.0070704} |
| *MSHARE* | -.0965274** | -.0999559** | -.0957976** |
| | {.0037691} | {.0036015} | {.0038282} |
| *2004* | -.3326671** | -.3357397** | -.3307455** |
| | {.0070734} | {.0067576} | {.0071843} |
| *2005* | -.187946** | -.1960092** | -.1831588** |
| | {.0069939} | {.0066822} | {.0071024} |
| *2006* | -.3150401** | -.3270677** | -.3084418** |
| | {.0071121} | {.0067973} | {.0072205} |
| *2007* | -.3673373** | -.3865208** | -.3575087** |
| | {.007071} | {.0067651} | {.0071736} |
| F-Statistic | 3266.79 | 3674.65 | 3135.90 |
| $R^2$ | 0.7659 | 0.7863 | 0.7585 |
| Adj. $R^2$ | 0.7657 | 0.7861 | 0.7583 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

Table 17

Log-linear regression results with *SMOKE-POLICY* interaction term

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln (Inflation-Adj. Price Per $1000) | ln (Inflation-Adj. Price Per $1000) | ln (Inflation-Adj. Price Per $1000) |
| CONSTANT | 0.6244756** | 4.071143** | .5535969** |
| | {0.0271554} | {.0476046} | {0.028008} |
| *SMOKE* | .7386703** | .7381269** | .7388649** |
| | {.0034674} | {.0031466} | {.0035813} |
| *HEALTH* | -.1920748** | -.1868887** | -.1931642** |
| | {.0014191} | {.0012898} | {.0014655} |
| *GENDER* | .1760381** | .1758656** | .1760692** |
| | {.0031399} | {.0028494} | {.0032431} |
| *PROJECTED* | .0975699** | .0931755** | .0987744** |
| | {.005583} | {.0050669} | {.0057664} |
| *SCALE* | -4.68e-07** | - | - |
| FACE VALUE | {9.14e-09} | | |
| *SCALE* | - | -.2946802** | - |
| LN (FACE VALUE) | | {.0034105} | |
| *SCALE* | - | - | -2.65e-13** |
| FACE VALUE SQUARED | | | {7.63e-15} |
| *POLICYSIZE* | -.1428517** | .0049391 | -.2308358** |
| (POLICIES > $300k) | {.0046695} | {.004719} | {.0041324} |
| *INTERACTION* | .179961** | .1889607** | .1778717** |
| (Smoking and Polices > $300k) | {.0065761} | {.0059691} | {.0067921} |
| *GROUP* | .2420383** | .2583354** | .2376155** |
| | {.0129739} | {.0117759} | {.0133999} |
| *STOCK* | -.2503923** | -.2503545** | -.2505707** |
| | {.0063049} | {.0057216} | {.0065121} |
| *AGENCY* | -.0582844** | -.0534275** | -.0602245** |
| | {.003772} | {.0034238} | {.0038956} |
| *REALASSETS* | 6.31e-13** | 7.20e-13** | 6.09e-13** |
| | {7.33e-14} | {6.65e-14} | {7.57e-14} |
| *NY* | -.0667971** | -.0577634** | -.068041** |
| | {.0049381} | {.0044818} | {.0051013} |
| *LICENSES* | -.0042414** | -.0044054** | -.0042916** |
| | {.0004311} | {.0003912} | {.0004453} |
| *BEST* | -.0053079** | .0051555 | -.0079321 |
| | {.0080248} | {.0072838} | {.0082884} |
| *GROUPRATING* | .0332961** | .034216** | .0334208** |
| | {.0048989} | {.0044456} | {.00506} |
| *MSHARE* | -.0213459** | -.0248179** | -.0205851** |
| | {.0026526} | {.0024076} | {.0027397} |
| *2004* | -.0344348** | -.0374257** | -.0325109** |
| | {.004978} | {.0045174} | {.0051416} |
| *2005* | -.0759612** | -.0838478** | -.0711515** |
| | {.0049221} | {.004467} | {.0050829} |
| *2006* | -.1082089** | -.1200304** | -.1015611** |
| | {.0050052} | {.004544} | {.0051675} |
| *2007* | -.1712965** | -.1902277** | -.1613666** |
| | {.0049763} | {.0045224} | {.0051339} |
| F-Statistic | 5736.98 | 7180.33 | 5315.09 |
| $R^2$ | 0.8518 | 0.8779 | 0.8419 |
| Adj. $R^2$ | 0.8516 | 0.8778 | 0.8417 |
| Observations | 19,989 | 19,989 | 19,989 |

** Denotes statistically significant at the 1% level; * Denotes statistically significant at the 5% level; robust standard errors are in {}

# APPENDIX B

Table 1A

Dependent Variable Components

| Year | Loss Ratio* | Combined Ratio* | $R_L$ |
|---|---|---|---|
| 2003 | 1.44441332 | 0.867754716 | 0.010749227 |
| 2004 | 1.452758903 | 0.874100479 | 0.056035132 |
| 2005 | 1.262427207 | 0.863804972 | 0.030142039 |
| 2006 | 1.400949701 | 0.895955293 | 0.046843283 |
| 2007 | 1.619069832 | 0.906409767 | 0.048899828 |
| * denotes mean value | | | |

Table 1B

Dependent Variable Components

| Year | Nominal Price per $1000* | Inflation-Adjusted Price per $1000* | Deflator |
|---|---|---|---|
| 2003 | 1.405387663 | 1.405387663 | 1 |
| 2004 | 1.420783837 | 1.37598771 | 1.032555616 |
| 2005 | 1.381554556 | 1.293803378 | 1.0678242 |
| 2006 | 1.389546322 | 1.269045526 | 1.09495388 |
| 2007 | 1.346557615 | 1.181562058 | 1.139641888 |
| *denotes mean value | | | |

Table 2

Summary Statistics

| Explanatory Variables | Mean {standard deviation} |
|---|---|
| *SMOKE* | 0.3309292<br>{0.4705505} |
| *HEALTH* | 1.264394<br>{1.185248} |
| *GENDER* | 0.5010321<br>{0.500002} |
| *GUARANTEED* | 0.1132259<br>{0.3168706} |
| *DOMTAX* | 2.040712<br>{0.5662865} |
| *RETALIATORY* | 0.0928364<br>{0.255313} |
| *GROUP* | 0.9669353<br>{0.1788065} |
| *STOCK* | 0.8650751<br>{0.3416455} |
| *AGENCY* | 0.511513<br>{0.4998705} |
| *REALASSETS* | 2.86E+10<br>{4.65E+10} |
| *NY* | 0.2820633<br>{0.4500067} |
| *LICENSES* | 49.30642<br>{4.50593} |
| *BEST* *(A Rating = 1)* | 0.9475585<br>{0.2229169} |
| *BEST* *(Four Categories)* | 2.449991<br>{0.6189147} |
| *BEST* *(A++ rating = 1)* | 0.1215197<br>{0.3267322} |
| *GROUPRATING* | 0.8210257<br>{0.3833331} |
| *PERDOMESTIC* | 0.0378678<br>{.0631069} |
| Observations | 81,386 |

Table 3

Linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | P($I_1$) | P($I_2$) | Inflation-Adj. Price Per $1000 |
| *INTERCEPT* | 2.63758** | 1.98935** | 1.692759** |
| | {.0508674} | {.0170263} | {.0154774} |
| *SMOKE* | 1.303884** | .8096636** | 1.098471** |
| | {.0073199} | {.0024501} | {.0022272} |
| *HEALTH* | -.2354219** | -.1403392** | -.202182** |
| | {.0029151} | {.0009758} | {.000887} |
| *GENDER* | .3074259** | .1848179** | .2570711** |
| | {.0064687} | {.0021652} | {.0019682} |
| *PROJECTED* | -.2901196** | -.1039896** | .0216287** |
| | {.0112018} | {.0037495} | {.0034084} |
| *DOMTAX* | .0095361 | .0358828** | .0323856** |
| | {.0074798} | {.0025036} | {.0022759} |
| *RETALIATORY* | .0002932 | .1111774** | .0958178** |
| | {.0160587} | {.0053752} | {.0048862} |
| *GROUP* | .8819771** | .1620766** | .3493991** |
| | {.022056} | {.0073826} | {.006711} |
| *STOCK* | -1.081889** | -.4816158** | -.4686092** |
| | {.0131419} | {.0043989} | {.0039987} |
| *AGENCY* | -.6897092** | -.2274981** | -.1674904** |
| | {.0076146} | {.0025488} | {.0023169} |
| *REALASSETS* | 1.17e-13 | 1.32e-13** | -8.14e-14** |
| | {8.59e-14} | {2.88e-14} | {2.61e-14} |
| *NY* | -.5924646** | -.1181005** | -.084708** |
| | {.0104907} | { .0035114} | {.003192} |
| *LICENSES* | .0095674** | -.0065853** | -.0053507** |
| | {.0008068} | {.0002701} | {.0002455} |
| *BEST* | -.3091773** | -.4301554** | -.2349033** |
| (any A rating equals 1) | {.0162989} | {.0054556} | {.0049593} |
| *GROUPRATING* | -.7979829** | .0342213** | .0621207** |
| | {.010261} | {.0034346} | {.0031221} |
| *PERDOMESTIC* | .0909619 | .0628864** | -.0150633 |
| | {.0549799} | {.0184029} | {.0167288} |
| *2004* | -.4224551** | -.2910966** | -.036379** |
| | {.0105709} | {.0035383} | {.0032164} |
| *2005* | -.3721306** | -.1664441** | -.0796816** |
| | {.010381} | {.0034747} | {.0031586} |
| *2006* | -.4764105** | -.2675412** | -.120215** |
| | {.0103842} | {.0034758} | {.0031596} |
| *2007* | -.3269994** | -.3152196** | -.197847** |
| | {.0103668} | {.00347} | {.0031543} |
| F-Statistic | 4180.78 | 11899.18 | 24400.31 |
| $R^2$ | 0.494 | 0.7354 | 0.8507 |
| Adj. $R^2$ | 0.4939 | 0.7353 | 0.8507 |
| Observations | 81,386 | 81,386 | 81,386 |
| ** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {} | | | |

Table 4

Log-linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln ($P(I_1)$) | ln ($P(I_2)$) | ln (Inflation-Adj. Price Per $1000) |
| *INTERCEPT* | 1.215571** | .9145371** | .3995941** |
| | {.0221799} | {.0172251} | {.0105184} |
| *SMOKE* | .8004651** | .7921622** | .7652562** |
| | {.0031917} | {.0024787} | {.0015136} |
| *HEALTH* | -.1819703** | -.1819633** | -.1840367** |
| | {.0012711} | {.0009871} | {.0006028} |
| *GENDER* | .1805976** | .1799678** | .1797516** |
| | {.0028206} | {.0021905} | {.0013376} |
| *PROJECTED* | -.145056** | -.1478836** | .0310394** |
| | {.0048843} | {.0037932} | {.0023163} |
| *DOMTAX* | .0334893** | .0401786** | .0260793** |
| | {.0032615} | {.0025329} | {.0015467} |
| *RETALIATORY* | .103027** | .1297148** | .0795897** |
| | {.0070021} | {.0054379} | {.0033206} |
| *GROUP* | .3837593** | .1946128** | .2568443** |
| | {.0096172} | {.0074688} | {.0045608} |
| *STOCK* | -.6978066** | -.5695326** | -.3519132** |
| | {.0057303} | {.0044502} | {.0027175} |
| *AGENCY* | -.388574** | -.2505571** | -.1107854** |
| | {.0033202} | {.0025785} | {.0015746} |
| *REALASSETS* | -4.74e-13** | 7.08e-14* | 8.19e-14** |
| | {3.75e-14} | {2.91e-14} | {1.78e-14} |
| *NY* | -.2422996** | -.1313507** | -.0747257** |
| | {.0045743} | {.0035524} | {.0021693} |
| *LICENSES* | -.0014187** | -.007278** | -.0031655** |
| | {.0003518} | {.0002732} | {.0001668} |
| *BEST* | -.2718571** | -.389708** | -.1505064** |
| (any A rating equals 1) | {.0071069} | {.0055192} | {.0033703} |
| *GROUPRATING* | -.2583974** | .0329267** | .0566377** |
| | {.0044741} | {.0034747} | {.0021218} |
| *PERDOMESTIC* | .0132909 | .039106* | -.0070828 |
| | {.0239731} | {.0186177} | {.0113688} |
| *2004* | -.2686418** | -.2928381** | -.0270243** |
| | {.0046093} | {.0035796} | {.0021859} |
| *2005* | -0.1935613** | -.1651795** | -.062308** |
| | {.0045265} | {.0035153} | {.0021466} |
| *2006* | -.2676156** | -.271529** | -.0974391** |
| | {.0045279} | {.0035164} | {.0021473} |
| *2007* | -.192527** | -.3454019** | -.1638562** |
| | {.0045203} | {.0035105} | {.0021437} |
| F-Statistic | 8507.63 | 13004.11 | 29684.55 |
| $R^2$ | 0.6652 | 0.7523 | 0.8739 |
| Adj. $R^2$ | 0.6651 | 0.7522 | 0.8739 |
| Observations | 81,386 | 81,386 | 81,386 |

** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {}

Table 5

Full-sample Regression Results

| | Dependent Variables | |
|---|---|---|
| Independent Variables | Inflation-Adj. Price Per $1000 | ln (Inflation-Adj. Price Per $1000) |
| *INTERCEPT* | 1.593733** | .3138431** |
| | {.0133864} | {.0084388} |
| *SMOKE* | 1.080463** | .7602393** |
| | {.0022489} | {.0014177} |
| *HEALTH* | -.2041424** | -.1801019** |
| | {.0009141} | {.0005763} |
| *GENDER* | .259062** | .1753335** |
| | {.0020276} | {.0012782} |
| *PROJECTED* | .1663917** | .1328086** |
| | {.0040326} | {.0025421} |
| *DOMTAX* | .0233227** | .0166559** |
| | {.0023458} | {.0014788} |
| *RETALIATORY* | .0560433** | .0421535** |
| | {.0048749} | {.0030731} |
| *GROUP* | .2662476** | .1970681** |
| | {.0061988} | {.0039077} |
| *STOCK* | -.3109978** | -.2282193** |
| | {.0044558} | {.002809} |
| *AGENCY* | -.1205088** | -.0811412** |
| | {.0022489} | {.0014177} |
| *REALASSETS* | -3.22e-13** | -5.22e-14** |
| | {3.22e-14} | {2.03e-14} |
| *NY* | -.1078845** | -.0758871** |
| | {.0031851} | {.0020079} |
| *LICENSES* | -.0013011** | -.0008748** |
| | {.0002099} | {.0001324} |
| *BEST* | -.3325861** | -.1803603** |
| (any A rating equals 1) | {.0044608} | {.0028121} |
| *GROUPRATING* | .0206198** | .0020476 |
| | {.0028338} | {.0017864} |
| *PERDOMESTIC* | .0270999 | .0096638 |
| | {.0169824} | {.0107057} |
| *2004* | -.0308376** | -.0181126** |
| | {.0031428} | {.0019812} |
| *2005* | -.061279** | -.0427316** |
| | {.0031547} | {.0019888} |
| *2006* | -.13093** | -.0949825** |
| | {.003233} | {.0020381} |
| *2007* | -.1919981** | -.1464022** |
| | {.0032067} | {.0020215} |
| F-Statistic | 22675.32 | 31447.44 |
| $R^2$ | 0.719 | 0.7802 |
| Adj. $R^2$ | 0.719 | 0.7801 |
| Observations | 168,382 | 168,382 |

ites statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors a

# APPENDIX C

Table 1A

Dependent Variable Components

| Year | Loss Ratio* | Combined Ratio* | $R_L$ |
|---|---|---|---|
| 2003 | 1.44441332 | 0.867754716 | 0.010749227 |
| 2004 | 1.452758903 | 0.874100479 | 0.056035132 |
| 2005 | 1.262427207 | 0.863804972 | 0.030142039 |
| 2006 | 1.400949701 | 0.895955293 | 0.046843283 |
| 2007 | 1.619069832 | 0.906409767 | 0.048899828 |
| * denotes mean value | | | |

Table 1B

Dependent Variable Components

| Year | Nominal Price per $1000* | Inflation-Adjusted Price per $1000* | Deflator |
|---|---|---|---|
| 2003 | 1.405387663 | 1.405387663 | 1 |
| 2004 | 1.420783837 | 1.37598771 | 1.032555616 |
| 2005 | 1.381554556 | 1.293803378 | 1.0678242 |
| 2006 | 1.389546322 | 1.269045526 | 1.09495388 |
| 2007 | 1.346557615 | 1.181562058 | 1.139641888 |
| *denotes mean value | | | |

Table 2

Summary Statistics

| Explanatory Variables | Mean {standard deviation} |
|---|---|
| *SMOKE* | 0.3309292<br>{0.4705505} |
| *HEALTH* | 1.264394<br>{1.185248} |
| *GENDER* | 0.5010321<br>{0.500002} |
| *GUARANTEED* | 0.1132259<br>{0.3168706} |
| *DOMTAX* | 2.040712<br>{0.5662865} |
| *RETALIATORY* | 0.0928364<br>{0.255313} |
| *GROUP* | 0.9669353<br>{0.1788065} |
| *STOCK* | 0.8650751<br>{0.3416455} |
| *AGENCY* | 0.511513<br>{0.4998705} |
| *REALASSETS* | 2.86E+10<br>{4.65E+10} |
| *NY* | 0.2820633<br>{0.4500067} |
| *LICENSES* | 49.30642<br>{4.50593} |
| *BEST* *(A Rating = 1)* | 0.9475585<br>{0.2229169} |
| *BEST* *(Four Categories)* | 2.449991<br>{0.6189147} |
| *BEST* *(A++ rating = 1)* | 0.1215197<br>{0.3267322} |
| *GROUPRATING* | 0.8210257<br>{0.3833331} |
| *PERDOMESTIC* | 0.0378678<br>{.0631069} |
| Observations | 81,386 |

## Table 3

## Linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | $P(I_1)$ | $P(I_2)$ | Inflation-Adj. Price Per $1000 |
| *INTERCEPT* | 2.63758** | 1.98935** | 1.692759** |
| | {.0508674} | {.0170263} | {.0154774} |
| *SMOKE* | 1.303884** | .8096636** | 1.098471** |
| | {.0073199} | {.0024501} | {.0022272} |
| *HEALTH* | -.2354219** | -.1403392** | -.202182** |
| | {.0029151} | {.0009758} | {.000887} |
| *GENDER* | .3074259** | .1848179** | .2570711** |
| | {.0064687} | {.0021652} | {.0019682} |
| *PROJECTED* | -.2901196** | -.1039896** | .0216287** |
| | {.0112018} | {.0037495} | {.0034084} |
| *DOMTAX* | .0095361 | .0358828** | .0323856** |
| | {.0074798} | {.0025036} | {.0022759} |
| *RETALIATORY* | .0002932 | .1111774** | .0958178** |
| | {.0160587} | {.0053752} | {.0048862} |
| *GROUP* | .8819771** | .1620766** | .3493991** |
| | {.022056} | {.0073826} | {.006711} |
| *STOCK* | -1.081889** | -.4816158** | -.4686092** |
| | {.0131419} | {.0043989} | {.0039987} |
| *AGENCY* | -.6897092** | -.2274981** | -.1674904** |
| | {.0076146} | {.0025488} | {.0023169} |
| *REALASSETS* | 1.17e-13 | 1.32e-13** | -8.14e-14** |
| | {8.59e-14} | {2.88e-14} | {2.61e-14} |
| *NY* | -.5924646** | -.1181005** | -.084708** |
| | {.0104907} | { .0035114} | {.003192} |
| *LICENSES* | .0095674** | -.0065853** | -.0053507** |
| | {.0008068} | {.0002701} | {.0002455} |
| *BEST* | -.3091773** | -.4301554** | -.2349033** |
| (any A rating equals 1) | {.0162989} | {.0054556} | {.0049593} |
| *GROUPRATING* | -.7979829** | .0342213** | .0621207** |
| | {.010261} | {.0034346} | {.0031221} |
| *PERDOMESTIC* | .0909619 | .0628864** | -.0150633 |
| | {.0549799} | {.0184029} | {.0167288} |
| *2004* | -.4224551** | -.2910966** | -.036379** |
| | {.0105709} | {.0035383} | {.0032164} |
| *2005* | -.3721306** | -.1664441** | -.0796816** |
| | {.010381} | {.0034747} | {.0031586} |
| *2006* | -.4764105** | -.2675412** | -.120215** |
| | {.0103842} | {.0034758} | {.0031596} |
| *2007* | -.3269994** | -.3152196** | -.197847** |
| | {.0103668} | {.00347} | {.0031543} |
| F-Statistic | 4180.78 | 11899.18 | 24400.31 |
| $R^2$ | 0.494 | 0.7354 | 0.8507 |
| Adj. $R^2$ | 0.4939 | 0.7353 | 0.8507 |
| Observations | 81,386 | 81,386 | 81,386 |

** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {}

Table 4

Log-linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln ($P(I_1)$) | ln ($P(I_2)$) | ln (Inflation-Adj. Price Per $1000) |
| *INTERCEPT* | 1.215571** | .9145371** | .3995941** |
| | {.0221799} | {.0172251} | {.0105184} |
| *SMOKE* | .8004651** | .7921622** | .7652562** |
| | {.0031917} | {.0024787} | {.0015136} |
| *HEALTH* | -.1819703** | -.1819633** | -.1840367** |
| | {.0012711} | {.0009871} | {.0006028} |
| *GENDER* | .1805976** | .1799678** | .1797516** |
| | {.0028206} | {.0021905} | {.0013376} |
| *PROJECTED* | -.145056** | -.1478836** | .0310394** |
| | {.0048843} | {.0037932} | {.0023163} |
| *DOMTAX* | .0334893** | .0401786** | .0260793** |
| | {.0032615} | {.0025329} | {.0015467} |
| *RETALIATORY* | .103027** | .1297148** | .0795897** |
| | {.0070021} | {.0054379} | {.0033206} |
| *GROUP* | .3837593** | .1946128** | .2568443** |
| | {.0096172} | {.0074688} | {.0045608} |
| *STOCK* | -.6978066** | -.5695326** | -.3519132** |
| | {.0057303} | {.0044502} | {.0027175} |
| *AGENCY* | -.388574** | -.2505571** | -.1107854** |
| | {.0033202} | {.0025785} | {.0015746} |
| *REALASSETS* | -4.74e-13** | 7.08e-14* | 8.19e-14** |
| | {3.75e-14} | {2.91e-14} | {1.78e-14} |
| *NY* | -.2422996** | -.1313507** | -.0747257** |
| | {.0045743} | {.0035524} | {.0021693} |
| *LICENSES* | -.0014187** | -.007278** | -.0031655** |
| | {.0003518} | {.0002732} | {.0001668} |
| *BEST* | -.2718571** | -.389708** | -.1505064** |
| (any A rating equals 1) | {.0071069} | {.0055192} | {.0033703} |
| *GROUPRATING* | -.2583974** | .0329267** | .0566377** |
| | {.0044741} | {.0034747} | {.0021218} |
| *PERDOMESTIC* | .0132909 | .039106* | -.0070828 |
| | {.0239731} | {.0186177} | {.0113688} |
| *2004* | -.2686418** | -.2928381** | -.0270243** |
| | {.0046093} | {.0035796} | {.0021859} |
| *2005* | -0.1935613** | -.1651795** | -.062308** |
| | {.0045265} | {.0035153} | {.0021466} |
| *2006* | -.2676156** | -.271529** | -.0974391** |
| | {.0045279} | {.0035164} | {.0021473} |
| *2007* | -.192527** | -.3454019** | -.1638562** |
| | {.0045203} | {.0035105} | {.0021437} |
| F-Statistic | 8507.63 | 13004.11 | 29684.55 |
| $R^2$ | 0.6652 | 0.7523 | 0.8739 |
| Adj. $R^2$ | 0.6651 | 0.7522 | 0.8739 |
| Observations | 81,386 | 81,386 | 81,386 |

** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {}

## Table 5

## Linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | $P(I_1)$ | $P(I_2)$ | Inflation-Adj. Price Per $1000 |
| *INTERCEPT* | 2.441677** | 1.649313** | 1.513184** |
| | {.0487959} | {.0168143} | {.014989} |
| *SMOKE* | 1.310437** | .8148485** | 1.101659** |
| | {.0073176} | {.0025215} | {.0022478} |
| *HEALTH* | -.2359497** | -.1426594** | -.2033053** |
| | {.0029114} | {.0010032} | {.0008943} |
| *GENDER* | .3071288** | .1850785** | .2571524** |
| | {.0064641} | {.0022274} | {.0019856} |
| *PROJECTED* | -.2980198** | -.077562** | .0326694** |
| | {.0112111} | {.0038632} | {.0034438} |
| *DOMTAX* | .0050516 | .0270653** | .0278041** |
| | {.0074649} | {.0025723} | {.002293} |
| *RETALIATORY* | -.0167825 | .0798909** | .0794149** |
| | {.0159923} | {.0055107} | {.0049125} |
| *GROUP* | .9684164** | .2465195** | .3987587** |
| | {.0220247} | {.0075893} | {.0067655} |
| *STOCK* | -1.071079** | -.4576671** | -.4563384** |
| | {.0130915} | {.0045111} | {.0040214} |
| *AGENCY* | -.621255** | -.1638598** | -.1298742** |
| | {.007668} | {.0026423} | {.0023554} |
| *REALASSETS* | 5.66e-13** | 3.66e-13** | 8.18e-14** |
| | {8.87e-14} | {3.05e-14} | {2.72e-14} |
| *NY* | -.5884531** | -.1177755** | -.0840542** |
| | {.0104866} | {.0036135} | {.0032212} |
| *LICENSES* | .0123282** | -.0052969** | -.0044158** |
| | {.000819} | {.0002822} | {.0002516} |
| *BEST* | -.1407795** | -.0828721** | -.0554959** |
| (Four Nominal Categories) | {.006442} | {.0022198} | {.0019788} |
| *GROUPRATING* | -.813909** | -.0227417** | .0341682** |
| | {.0099659} | {.0034341} | {.0030613} |
| *PERDOMESTIC* | .1199584* | .0738479** | -.0064146 |
| | {.0549644} | {.0189398} | {.0168839} |
| *2004* | -.4314973** | -.2911177** | -.0375288** |
| | {.0105818} | {.0036463} | {.0032505} |
| *2005* | -.3856366** | -.1773363** | -.0863455** |
| | {.0103815} | {.0035773} | {.003189} |
| *2006* | -.489207** | -.2770424** | -.1261559** |
| | {.0103867} | {.0035791} | {.0031906} |
| *2007* | -.331273** | -.3164549** | -.1989485** |
| | {.0103625} | {.0035708} | {.0031831} |
| F-Statistic | 4192.98 | 11008.07 | 23900.45 |
| $R^2$ | 0.4947 | 0.7199 | 0.848 |
| Adj. $R^2$ | 0.4946 | 0.7199 | 0.848 |
| Observations | 81,386 | 81,386 | 81,386 |

* denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {

Table 6

Log-linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln $(P(I_1))$ | ln $(P(I_2))$ | ln (Inflation-Adj. Price Per $1000) |
| *INTERCEPT* | 1.046625** | .621066** | .2938355** |
| | {.0212063} | {.0168284} | {.0101297} |
| *SMOKE* | .8064207** | .7977101** | .7678407** |
| | {.0031801} | {.0025236} | {.0015191} |
| *HEALTH* | -.1823567** | -.1837224** | -.1845379** |
| | {.0012653} | {.0010041} | {.0006044} |
| *GENDER* | .1803032** | .1800581** | .1797108** |
| | {.0028092} | {.0022293} | {.0013419} |
| *PROJECTED* | -.1538379** | -.1320328** | .0329572** |
| | {.0048723} | {.0038664} | {.0023274} |
| *DOMTAX* | .0296727** | .0327478** | .0234992** |
| | {.0032442} | {.0025744} | {.0015497} |
| *RETALIATORY* | .0883819** | .1029983** | .0701176** |
| | {.0069501} | {.0055153} | {.0033199} |
| *GROUP* | .4615215** | .2788614** | .2934054** |
| | {.0095718} | {.0075957} | {.0045722} |
| *STOCK* | -.6887385** | -.5497623** | -.3452787** |
| | {.0056895} | {.0045149} | {.0027177} |
| *AGENCY* | -.3268328** | -.1860688** | -.0823297** |
| | {.0033324} | {.0026445} | {.0015918} |
| *REALASSETS* | -6.00e-14 | 3.67e-13** | 2.40e-13** |
| | {3.85e-14} | {3.06e-14} | {1.84e-14} |
| *NY* | -.2385145** | -.1299196** | -.0735825** |
| | {.0045574} | {.0036165} | {.0021769} |
| *LICENSES* | .0011341** | -.0055587** | -.0022147** |
| | {.0003559} | {.0002824} | {.00017} |
| *BEST* | -.1293283** | -.0995143** | -.0511267** |
| (Four Nominal Categories) | {.0027996} | {.0022217} | {.0013373} |
| *GROUPRATING* | -.270694** | -.0111534** | .0435239** |
| | {.0043311} | {.003437} | {.0020689} |
| *PERDOMESTIC* | .0402283 | .0553904** | .0025071 |
| | {.0238871} | {.0189558} | {.0114103} |
| *2004* | -.2772086** | -.2955732** | -.0294916** |
| | {.0045988} | {.0036494} | {.0021967} |
| *2005* | -.2058244** | -.1767555** | -.067666** |
| | {.0045117} | {.0035803} | {.0021551} |
| *2006* | -.2792747** | -.2819322** | -.1023896** |
| | {.004514} | {.0035821} | {.0021562} |
| *2007* | -.1965158** | -.3475397** | -.165211** |
| | {.0045035} | {.0035738} | {.0021512} |
| F-Statistic | 8611.19 | 12407.7 | 29467.51 |
| $R^2$ | 0.6679 | 0.7434 | 0.8731 |
| Adj. $R^2$ | 0.6678 | 0.7434 | 0.8731 |
| Observations | 81,386 | 81,386 | 81,386 |

** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {}

Table 7

Linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | $P(I_1)$ | $P(I_2)$ | Inflation-Adj. Price Per $1000 |
| *INTERCEPT* | 2.352059** | 1.590557** | 1.474402** |
| | {.0488745} | {.0169271} | {.0150382} |
| *SMOKE* | 1.306017** | .8127664** | 1.100216** |
| | {.0073398} | {.0025421} | {.0022584} |
| *HEALTH* | -.2378461** | -.1436899** | -.2040034** |
| | {.0029188} | {.0010109} | {.0008981} |
| *GENDER* | .3079498** | .1855414** | .2574643** |
| | {.0064827} | {.0022452} | {.0019947} |
| *PROJECTED* | -.2527118** | -.0523116** | .0497121** |
| | {.0064827} | {.0038306} | {.0034032} |
| *DOMTAX* | .0023715 | .0260637** | .0270792** |
| | {.0074905} | {.0025942} | {.0023048} |
| *RETALIATORY* | -.0242069 | .0776376** | .0777069** |
| | {.0160667} | {.0055645} | {.0049436} |
| *GROUP* | .9314984** | .2331302** | .389008** |
| | {.0223724} | {.0077484} | {.0068838} |
| *STOCK* | -1.067869** | -.464315** | -.4599874** |
| | {.0137741} | {.0047705} | {.0042382} |
| *AGENCY* | -.6598243** | -.1856948** | -.144578** |
| | {.0074872} | {.0025931} | {.0023037} |
| *REALASSETS* | 9.55e-14 | 1.06e-13** | -9.38e-14** |
| | {8.65e-14} | {3.00e-14} | {2.66e-14} |
| *NY* | -.595088** | -.1217745** | -.0867234** |
| | {.0105129} | {.003641} | {.0032347} |
| *LICENSES* | .0092804** | -.0069475** | -.0055346** |
| | {.0008113} | {.000281} | {.0002496} |
| *BEST* | -.0212396 | -.0354876** | -.0216032** |
| (A++ equals one) | {.011294} | {.0039115} | {.003475} |
| *GROUPRATING* | -.8558678** | -.0459205** | .0185033** |
| | {.0098232} | {.0034022} | {.0030225} |
| *PERDOMESTIC* | .0858622 | .0564928** | -.018292 |
| | {.0551149} | {.0190884} | {.0169583} |
| *2004* | -.4184996** | -.2863341** | -.0340557** |
| | {.0106816} | {.0036994} | {.0032866} |
| *2005* | -.378757** | -.1764912** | -.0854782** |
| | {.0105204} | {.0036436} | {.003237} |
| *2006* | -.4820704** | -.2763124** | -.1253406** |
| | {.0105449} | {.0036521} | {.0032446} |
| *2007* | -.3289973** | -.3190037** | -.2002897** |
| | {.0105634} | {.0036585} | {.0032503} |
| F-Statistic | 4143.89 | 10765.77 | 23643.89 |
| $R^2$ | 0.4918 | 0.7154 | 0.8467 |
| Adj. $R^2$ | 0.4917 | 0.7154 | 0.8466 |
| Observations | 81,386 | 81,386 | 81,386 |

** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {}

Table 8

Log-linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln ($P(I_1)$) | ln ($P(I_2)$) | ln (Inflation-Adj. Price Per $1000) |
| *INTERCEPT* | .9535905** | .5322752** | .259273** |
| | {.0214351} | {.0169268} | {.0102044} |
| *SMOKE* | .8032879** | .7967901** | .7664102** |
| | {.0032191} | {.002542} | {.0015325} |
| *HEALTH* | -.1839456** | -.1846987** | -.1851978** |
| | {.0012801} | {.0010109} | {.0006094} |
| *GENDER* | .1810211** | .1805521** | .1800021** |
| | {.0028432} | {.0022452} | {.0013535} |
| *PROJECTED* | -.1147507** | -.1060301** | .0489343** |
| | {.0048508} | {.0038305} | {.0023093} |
| *DOMTAX* | .0282384** | .0332956** | .0227194** |
| | {.0032851} | {.0025942} | {.0015639} |
| *RETALIATORY* | .0853393** | .1067275** | .0681327** |
| | {.0070465} | {.0055644} | {.0033545} |
| *GROUP* | .4424936** | .2881407** | .2828012** |
| | {.009812} | {.0077483} | {.0046711} |
| *STOCK* | -.7010237** | -.583694** | -.3469814** |
| | {.006041} | {.0047704} | {.0028759} |
| *AGENCY* | -.3607135** | -.2096466** | -.0960447** |
| | {.0032837} | {.0025931} | {.0015632} |
| *REALASSETS* | -4.62e-13** | 1.08e-13** | 7.51e-14** |
| | {3.79e-14} | {3.00e-14} | {1.81e-14} |
| *NY* | -.2447761** | -.135005** | -.0760234** |
| | {.0046107} | {.0036409} | {.002195} |
| *LICENSES* | -.0014096** | -.0071044** | -.0032734** |
| | {.0003558} | {.000281} | {.0001694} |
| *BEST* | -.0605249** | -.1124717** | -.0154363** |
| (A++ equals one) | {.0049532} | {.0039115} | {.002358} |
| *GROUPRATING* | -.306526** | -.0343645** | .0287968** |
| | {.0043082} | {.0034021} | {.002051} |
| *PERDOMESTIC* | .0137522 | .0428055* | -.008963 |
| | {.024172} | {.019088} | {.0115073} |
| *2004* | -.2703851** | -.2985446** | -.0257347** |
| | {.0046847} | {.0036994} | {.0022302} |
| *2005* | -.2052227** | -.1854808** | -.0662444** |
| | {.004614} | {.0036435} | {.0021965} |
| *2006* | -.2789121** | -.2916051** | -.1009641** |
| | {.0046247} | {.003652} | {.0022017} |
| *2007* | -.2013636** | -.3624185** | -.1656911** |
| | {.0046328} | {.0036584} | {.0022055} |
| F-Statistic | 8304.74 | 12171.57 | 28889.42 |
| $R^2$ | 0.6598 | 0.7397 | 0.8709 |
| Adj. $R^2$ | 0.6597 | 0.7397 | 0.8709 |
| Observations | 81,386 | 81,386 | 81,386 |
| ** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {} | | | |

## Table 9

## Linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | $P(I_1)$ | $P(I_2)$ | Inflation-Adj. Price Per $1000 |
| *INTERCEPT* | 1.725504** | 1.451861** | 1.365263** |
| | {.0514839} | {.0169523} | {.0161502} |
| *SMOKE* | 1.284694** | .8004964** | 1.099195** |
| | {.0070163} | {.0023103} | {.002201} |
| *HEALTH* | -.2356756** | -.1400362** | -.2013239** |
| | {.0027889} | {.0009183} | {.0008749} |
| *GENDER* | .3076765** | .1853527** | .2573271** |
| | {.0061852} | {.0020366} | {.0019403} |
| *PROJECTED* | .0528264** | -.0030305 | -.0156822** |
| | {.0120454} | {.0039662} | {.0037786} |
| *DOMTAX* | .0325034** | .0460184** | .0322911** |
| | {.0071681} | {.0023603} | {.0022486} |
| *RETALIATORY* | .0885653** | .1501572** | .0952107** |
| | {.0154652} | {.0050923} | {.0048513} |
| *GROUP* | 1.180426** | .2608013** | .4007716** |
| | {.022113} | {.0072812} | {.0069367} |
| *STOCK* | -1.233921** | -.5702976** | -.4965381** |
| | {.0134126} | {.0044164} | {.0042074} |
| *AGENCY* | -.752122** | -.2892672** | -.1687456** |
| | {.008274} | {.0027244} | {.0025955} |
| *REALASSETS* | 1.12e-13 | -1.66e-13** | -1.26e-13** |
| | {8.65e-14} | {2.85e-14} | {2.71e-14} |
| *NY* | -.6492438** | -.1443539** | -.0904952** |
| | {.0100616} | {.003313} | {.0031563} |
| *LICENSES* | .0166306** | -.0052502** | -.0044802** |
| | {0.0007939} | {.0002614} | {.000249} |
| *B rating=1* | .9429781** | .7032331** | .2669285** |
| | {.0376508} | {.0123974} | {.0118108} |
| *B+ rating = 1* | .6741985** | .8455802** | .7261868** |
| | {.0372472} | {.0122645} | {.0116842} |
| *B++ rating =1* | .0454461* | .2790673** | .1571532** |
| | {.021247} | {.0069961} | {.006665} |
| *A- rating = 1* | -.4400307** | -.1771635** | .0314538** |
| | {.013885} | {.0045719} | {.0043556} |
| *A rating = 1* | .4342324** | .1095749** | .0233221** |
| | {.0130545} | {.0042985} | {.0040951} |
| *A+ rating = 1* | .0214451 | .0689366** | .0288202** |
| | {.0111451} | {.0036698} | {.0034961} |
| *GROUPRATING* | -.7780305** | .0393668** | .0618638** |
| | {.0099374} | {.0032721} | {.0031173} |
| *PERDOMESTIC* | .1090592* | .0583529** | -.007438 |
| | {.0526111} | {.0173234} | {.0165038} |
| *2004* | -.3699863** | -.2613704** | -.0301348** |
| | {.0104006} | {.0034247} | {.0032626} |
| *2005* | -.3304128** | -.142482** | -.0768049** |
| | {.0102111} | {.0033622} | {.0032031} |
| *2006* | -.461787** | -.2490511** | -.1100241** |
| | {.010251} | {.0033754} | {.0032157} |
| *2007* | -.2987363** | -.2989656** | -.1900456** |
| | {.010259} | {.003378} | {.0032182} |
| F-Statistic | 3938.37 | 11089.22 | 19976.97 |
| $R^2$ | 0.5374 | 0.7659 | 0.8549 |
| Adj. $R^2$ | 0.5373 | 0.7658 | 0.8549 |
| Observations | 81,386 | 81,386 | 81,386 |

** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {}

Table 10

Linear Regression Results

| | Dependent Variables | | |
|---|---|---|---|
| Independent Variables | ln $(P(I_1))$ | ln $(P(I_2))$ | ln (Inflation-Adj. Price Per $1000) |
| *INTERCEPT* | .4900303** | .253995** | .1393117** |
| | {.0220649} | {.0170585} | {.010963} |
| *SMOKE* | .7940963** | .7853695** | .7670905** |
| | {.003007} | {.0023247} | {.0014941} |
| *HEALTH* | -.1817967** | -.1813984** | -.1834967** |
| | {.0011953} | {.0009241} | {.0005939} |
| *GENDER* | .1806184** | .1802838** | .1798556** |
| | {.0026508} | {.0020494} | {.0013171} |
| *PROJECTED* | .0030173 | -.0390012** | -.0035702 |
| | {.0051624} | {.0039911} | {.002565} |
| *DOMTAX* | .0443073** | .0523209** | .024829** |
| | {.0030721} | {.0023751} | {.0015264} |
| *RETALIATORY* | .1442027** | .1760431** | .0745074** |
| | {.0066281} | {.0051242} | {.0032932} |
| *GROUP* | .5752729** | .3364174** | .3008218** |
| | {.0094772} | {.0073269} | {.0047088} |
| *STOCK* | -.7865537** | -.6826338** | -.3646796** |
| | {.0057484} | {.0044441} | {.0028561} |
| *AGENCY* | -.3976834** | -.2964491** | -.0986957** |
| | {.0035461} | {.0027415} | {.0017619} |
| *REALASSETS* | -3.12e-13** | -6.27e-14* | 1.39e-13** |
| | {3.71e-14} | {2.87e-14} | {1.84e-14} |
| *NY* | -.2695885** | -.1573812** | -.0769939** |
| | {.0043122} | {.0033338} | {.0021425} |
| *LICENSES* | .0033257** | -.004799** | -.0021159** |
| | {.0003402} | {.000263} | {.0001691} |
| *B rating=1* | .7033573** | .724085** | .2218316** |
| | {.0161363} | {.0124751} | {.0080174} |
| *B+ rating = 1* | .6053051** | .8293041** | .4862482** |
| | {.0159634} | {.0123414} | {.0079315} |
| *B++ rating =1* | .1668906** | .3376755** | .0953012** |
| | {.009106} | {.0070399} | {.0045244} |
| *A- rating = 1* | -.1279789** | -.0930075** | .0485584** |
| | {.0059508} | {.0046006} | {.0029567} |
| *A rating = 1* | .2894804** | .2219888** | .0290114** |
| | {.0055949} | {.0043254} | {.0027798} |
| *A+ rating = 1* | .0460213** | .1348318** | .0103061** |
| | {.0047765} | {.0036928} | {.0023732} |
| *GROUPRATING* | -.24836** | .0456377** | .0542312** |
| | {.0042589} | {.0032926} | {.0021161} |
| *PERDOMESTIC* | .0374918 | .0493185** | .0032731 |
| | {.022548} | {.017432} | {.0112031} |
| *2004* | -.2476702** | -.2773052** | -.0229499** |
| | {.0044575} | {.0034461} | {.0022147} |
| *2005* | -.1797454** | -.1563094** | -.0608264** |
| | {.0043762} | {.0033833} | {.0021744} |
| *2006* | -.2652915** | -.2707639** | -.0902364** |
| | {.0043933} | {.0033965} | {.0021828} |
| *2007* | -.1821581** | -.345833** | -.156716** |
| | {.0043968} | {.0033992} | {.0021846} |
| F-Statistic | 8073.71 | 12244.66 | 24345.39 |
| $R^2$ | 0.7043 | 0.7832 | 0.8778 |
| Adj. $R^2$ | 0.7042 | 0.7831 | 0.8777 |
| Observations | 81,386 | 81,386 | 81,386 |
| ** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {} | | | |

Table 11

Full-sample Regression Results

| | Dependent Variables | |
|---|---|---|
| Independent Variables | Inflation-Adj. Price Per $1000 | ln (Inflation-Adj. Price Per $1000) |
| *INTERCEPT* | 1.593733** | .3138431** |
| | {.0133864} | {.0084388} |
| *SMOKE* | 1.080463** | .7602393** |
| | {.0022489} | {.0014177} |
| *HEALTH* | -.2041424** | -.1801019** |
| | {.0009141} | {.0005763} |
| *GENDER* | .259062** | .1753335** |
| | {.0020276} | {.0012782} |
| *PROJECTED* | .1663917** | .1328086** |
| | {.0040326} | {.0025421} |
| *DOMTAX* | .0233227** | .0166559** |
| | {.0023458} | {.0014788} |
| *RETALIATORY* | .0560433** | .0421535** |
| | {.0048749} | {.0030731} |
| *GROUP* | .2662476** | .1970681** |
| | {.0061988} | {.0039077} |
| *STOCK* | -.3109978** | -.2282193** |
| | {.0044558} | {.002809} |
| *AGENCY* | -.1205088** | -.0811412** |
| | {.0022489} | {.0014177} |
| *REALASSETS* | -3.22e-13** | -5.22e-14** |
| | {3.22e-14} | {2.03e-14} |
| *NY* | -.1078845** | -.0758871** |
| | {.0031851} | {.0020079} |
| *LICENSES* | -.0013011** | -.0008748** |
| | {.0002099} | {.0001324} |
| *BEST* | -.3325861** | -.1803603** |
| (any A rating equals 1) | {.0044608} | {.0028121} |
| *GROUPRATING* | .0206198** | .0020476 |
| | {.0028338} | {.0017864} |
| *PERDOMESTIC* | .0270999 | .0096638 |
| | {.0169824} | {.0107057} |
| *2004* | -.0308376** | -.0181126** |
| | {.0031428} | {.0019812} |
| *2005* | -.061279** | -.0427316** |
| | {.0031547} | {.0019888} |
| *2006* | -.13093** | -.0949825** |
| | {.003233} | {.0020381} |
| *2007* | -.1919981** | -.1464022** |
| | {.0032067} | {.0020215} |
| F-Statistic | 22675.32 | 31447.44 |
| $R^2$ | 0.719 | 0.7802 |
| Adj. $R^2$ | 0.719 | 0.7801 |
| Observations | 168,382 | 168,382 |

** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {}

Table 12

Full-sample Regression Results

| | Dependent Variables | |
|---|---|---|
| Independent Variables | Inflation-Adj. Price Per $1000 | ln (Inflation-Adj. Price Per $1000) |
| *INTERCEPT* | 1.419753** | .2472451** |
| | {.0133131} | {.0083379} |
| *SMOKE* | 1.083201** | .7617347** |
| | {.0022756} | {.0014252} |
| *HEALTH* | -.2080352** | -.1818312** |
| | {.000923} | {.0005781} |
| *GENDER* | .2591792** | .1753634** |
| | {.0020519} | {.0012851} |
| *PROJECTED* | .1854097** | .1338199** |
| | {.0041323} | {.002588} |
| *DOMTAX* | .0218666** | .0158328** |
| | {.0023739} | {.0014867} |
| *RETALIATORY* | .052807** | .0403608** |
| | {.0049331} | {.0030895} |
| *GROUP* | .2564612** | .1980111** |
| | {.0062915} | {.0039403} |
| *STOCK* | -.28892** | -.218214** |
| | {.0044955} | {.0028155} |
| *AGENCY* | -.1011005** | -.0676461** |
| | .{0022972} | {.0014387} |
| *REALASSETS* | -1.82e-13** | 8.25e-14** |
| | {3.32e-14} | {2.08e-14 } |
| *NY* | -.1099146** | -.0790472** |
| | {.0032299} | {.0020228} |
| *LICENSES* | -.0006548** | -.0004703** |
| | {.0002125} | {.0001331} |
| *BEST* | -.070169** | -.0547083** |
| (Four Nominal Categories) | {.0018319} | {.0011473} |
| *GROUPRATING* | -.0031669 | -.0049129** |
| | {.0028656} | {.0017947} |
| *PERDOMESTIC* | .0426151* | .0215268* |
| | {.01719} | {.0107659} |
| *2004* | -.0214983** | -.0124371** |
| | {.0031798} | {.0019915} |
| *2005* | -.0514603** | -.0364619** |
| | {.0031932} | {.0019999} |
| *2006* | -.1236945** | -.0906695** |
| | {.0032711} | {.0020487} |
| *2007* | -.1804984** | -.1392305** |
| | {.0032451} | {.0020324} |
| F-Statistic | 21933.38 | 31017.43 |
| $R^2$ | 0.7122 | 0.7778 |
| Adj. $R^2$ | 0.7122 | 0.7778 |
| Observations | 168,382 | 168,382 |
| ** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {} | | |

Table 13

Full-sample Regression Results

| | Dependent Variables | |
|---|---|---|
| Independent Variables | Inflation-Adj. Price Per $1000 | ln (Inflation-Adj. Price Per $1000) |
| *INTERCEPT* | 1.293317** | .1446984** |
| | {.013014} | {.00815} |
| *SMOKE* | 1.082455** | .7608601** |
| | {.0022837} | {.0014301} |
| *HEALTH* | -.2100076** | -.1835208** |
| | {.0009254} | {.0005795} |
| *GENDER* | .2593537** | .1755131** |
| | {.0020589} | {.0012894} |
| *PROJECTED* | .2300021** | .1708389** |
| | {.004029} | {.0025231} |
| *DOMTAX* | .0218502** | .0157545** |
| | {.002382} | {.0014917} |
| *RETALIATORY* | .0514871** | .0387155** |
| | {.0049507} | .0031003 |
| *GROUP* | .2219935** | .167747** |
| | {.0062921} | {.0039404} |
| *STOCK* | -.2679002** | -.19652** |
| | {.004563} | {.0028576} |
| *AGENCY* | -.1127496** | -.0763688** |
| | {.0022822} | {.0014292} |
| *REALASSETS* | -4.74e-13** | -1.63e-13** |
| | {3.28e-14} | {2.05e-14} |
| *NY* | -.1009711** | -.0719624** |
| | {.003233} | .0020246 |
| *LICENSES* | -.0008701** | -.0006329** |
| | {.0002131} | {.0001335} |
| *BEST* | .0596355** | .0713477** |
| (A++ equals one) | {.0033784} | {.0021157} |
| *GROUPRATING* | -.0351523** | -.0327535** |
| | {.0028274} | {.0017706} |
| *PERDOMESTIC* | .0281021 | .0102191 |
| | {.0172446} | {.0107993} |
| *2004* | -.0189723** | -.0083426** |
| | {.003203} | {.0020059} |
| *2005* | -.048993** | -.0318508** |
| | {.0032232} | {.0020185} |
| *2006* | -.1195432** | -.0850195** |
| | {.0032984} | {.0020656} |
| *2007* | -.178128** | -.1347521** |
| | {.0032741} | {.0020504} |
| F-Statistic | 21723.86 | 30751.83 |
| $R^2$ | 0.7103 | 0.7763 |
| Adj. $R^2$ | 0.7102 | 0.7763 |
| Observations | 168,382 | 168,382 |
| ** denotes statistically significant at the 1% level, * denotes statistically significant at the 5% level, standard errors are in {} | | |