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The Regulatory Effect of Risk-Based Capital in Property-Liability Insurance

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Abstract: This study investigates how U.S. property-liability insurers changed their behavior in response to the risk-based capital (RBC) requirements implemented in 1994. We posit that insurers may have acted to manage their operations and/or exploit anomalies in the RBC formula so as to improve the RBC result. The sample consists of pooled, cross-sectional data of U.S. property-liability insurers included in the NAIC's database for the period 1991 to 2007. Simultaneous equations with partial adjustment models are estimated with change in a firm's operating risk characteristic (change in leverage ratio, change in proportion of premiums written in high-risk lines and change in proportion of stock and real estate investment) as the dependent variable. First, regressions are estimated by year for 1991-1996. Then, pooled regressions are estimated with dummy variables reflecting insurers' financial strength added in the estimation. Two time dummy variables (1994 dummy and 1991-1993 dummy) are also added to study whether or how insurers adjust their behaviors over time. We find that insurers adjust to their target ratio of leverage, proportion of premiums written in high-risk lines and proportion of stock and real estate investment simultaneously. We find that insurers in weaker financial positions may have a larger response to the imposition of RBC requirements. Results indicate that insurers in different financial conditions responded to RBC differently. Further, insurers have adjusted their behaviors over time, and a new regulatory rule plays a role in affecting these adjustments.

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Keywords:

Introduction

Maintaining insurer solvency has always been a focal point of insurance regulation. U.S. regulators use various methods to promote insurers' financial strength and protect policyholders from losses due to insolvency. One important tool is embodied in Risk-Based Capital (RBC) Standards, which went into effect in the U.S. property-liability insurance industry in 1994. RBC incorporates six main types of risks: off balance sheet risks, investments in insurance company affiliates, investment in bonds, investment in stocks, credit risk, and pricing risk.[1] Capital adequacy is assessed with the RBC ratio, defined as the ratio of total adjusted capital to RBC. That is, insurers are divided into five different regulatory action levels, ranging from no action to supervisory takeover, based on their RBC result.

Ideally, well-designed RBC requirements can help regulators to identify weak insurers so that the regulator can legally intervene when an insurer's capital falls below specified levels. But considerable research criticizes the existing RBC system due to its low accuracy in predicting property-liability insurer insolvencies (Cummins, Grace, and Phillips, 1999; Cummins, Harrington and Klein, 1995). Further, previous research hypothesizes that imperfections in the existing RBC system will likely distort some financially sound insurers' decisions in undesirable and unintended ways so as to avoid being incorrectly identified as needing regulatory attention (e.g., Cummins, Harrington, and Niehaus, 1994). Another possibility that exists is that weak insurers will exploit

[1] Pricing risk is estimated via underwriting loss and expense reserves and net premiums written by line.

anomalies in the RBC formula so as to make their financial position appear to be more favorable than it really is.[2,3]

In spite of these possibilities associated with the use of the RBC formula in practice, little research is aimed at addressing how insurers may have changed their capital decisions and risk-taking behavior before and after RBC requirements were implemented. One paper, Petroni and Shackelford (1995), studies changes in stock life insurer's investment portfolios occurring after the implementation of RBC to determine if RBC had an effect. More specifically, they compare changes in investment portfolio allocations (e.g., investment proportions in stocks, bonds, etc.) from the pre-RBC period to the post-RBC period.[4] They conclude that there was little change in stock life insurer's investment portfolios during their sample period (1989-1993), suggesting that perhaps insurers may have chosen a mechanism to manage RBC reported results other than investment restructuring. However, they did not study the insurers' behavior change in capital position and underwriting portfolio in response to the RBC regulatory reform.

The purpose of this study is to determine how property-liability insurers may have changed their behavior in response to the new RBC requirements implemented in 1994. We posit that insurers (especially financially weak insurers) may have acted to manage

[2] That is, it is possible that some factors in the RBC formula are understated (given the level of risk involved), so that insurers can take advantage of this by re-orienting their behavior to exploit this.

[3] The banking literature suggests that banks might increase portfolio risks while managing to avoid violating banking regulatory RBC requirements. For example, Furlong (1988) finds that asset risk actually doubled in 1981-1986, the part of his sample in which banks faced explicit capital requirements, compared with the earlier period. Sheldon (1996) finds that bank asset volatility in U.S. banks rose over the period 1987 to 1994 (i.e., the period when Basel regulations came into force). Insurers might resort to the same tactics, in theory.

[4] The risk factors associated with stocks and different grades of bonds vary.

their operations so as to improve the RBC result. The sample consists of pooled, cross-sectional data of U.S. property-liability insurers included in the NAIC's database for the period 1990 to 2008. Simultaneous regressions are estimated with change in a firm's operating characteristic (change in capital, change in premiums written in high-risk lines, and change in stock investment) as the dependent variable. We posit that insurers in weaker financial positions may have had a larger response to the imposition of RBC requirements; hence we conduct analysis adding dummy variables reflecting insurers' financial strength. We also expect that insurers might have different behaviors over time and thus add two time dummy variables, RBCBEFORE and YEAR1994, to proxy for time period before and the first year the institution of the new RBC rule, respectively.

We study the insurers' behavior change in capital and risky portfolios simultaneously because we expect that insurers will balance the cost and benefit of all strategic decisions. Our simultaneous partial adjustment model assumes partial rather than complete contemporaneous adjustment, reflecting costly or infeasible immediate adjustment to the target levels of capital and risk portfolios (including leverage, underwriting and investment choices, among others).

By way of preview, we find that insurers in different financial conditions respond to RBC differently. Financially weak insurers have a higher rate of capital accumulation than financially strong insurers. The results suggest that the property-liability insurance industry is considerably better capitalized than before RBC requirements, perhaps explaining the recent decline in the insolvency trend in this industry. We also find that

financially distressed insurers attempt to increase their premiums dramatically, perhaps to gain enough cash flow to continue to pay claims.[5] Thus regulators should focus their resources on financially weaker insurers with increases in premiums in solvency regulation.

This research is important since, in June 2008, the NAIC launched a Solvency Modernization Initiative (SMI) in which the current solvency system, including RBC requirements, is being assessed. Under this initiative, recalibration of RBC requirements is being considered, among other measures. Thus, this research is very timely and can be helpful in evaluating the RBC system. In addition to regulators, this paper should be of interest to scholars and others interested in the efficiency and cost of regulation.

Hypotheses Development

There are many papers studying the firm behavior change in reaction to the adoption of the RBC standard in banking industry.[6] Surprisingly, similar studies are rare in insurance industry, which is also highly regulated and adopted the RBC standard only a few years after banking. We aim to fill this gap by studying the change of insurers' behavior before and after the imposition of the new RBC standard.

From a regulator's point of view, insurers with a relatively risky portfolio should

[5] Some financially distressed insurers cannot increase premiums written, partly due to their inability rather than unwillingness. In other words, they cannot attract more customers due to their weak financial strength, although they badly want to gain extra cash inflows.

[6] The literature on banking risk reduction to enhance RBC regulatory capital ratios focuses on banks reducing the size of their asset portfolios, especially their lending portfolios (e.g., Shrieves and Dahl, 1995). Demsetz and Strahan (1997) find that regulatory changes (in particular, implementation of risk-based capital adequacy standards and passage of the FDIC Improvement Act) affected the risk-taking propensity of large bank holding companies (BHCs) more than that of small BHCs.

hold a larger capital buffer to decrease the probability of failure and the likelihood of facing costs associated with bankruptcy. We assume that insurers will manage their capital and risky portfolio in such a way as to avoid, or minimize, costs associated with a breach of regulatory requirements. At the same time, insurers are expected to adjust their behavior to maximize shareholders' benefit, following the market discipline. Insurers may increase their capital while at the same time increasing their portfolio risk. Whether the increase in risk will more than offset the improvement in capital and increase insurers' insolvency propensity is unclear and requires empirical evidence. In this study, we investigate how insurers balance the cost and benefit of holding capital and increasing business portfolio risk for a higher return of capital.

We are especially interested in the adjustment in insurers' investment and underwriting portfolio risk in this paper. They constitute a significant part of insurer's overall portfolio risk.[7] Even though the proportion of certain risky business lines and investment in an insurer's portfolio may not exactly reflect the overall risk of an insurer, it may reflect risk attitude and project choice by firm managers and, thus, to some extent the overall firm risk.

If insurers consider the overall balance of risk and capital, one would expect the change in leverage ratio has a negative relationship with the change in the proportion of risky business and investment portfolio. However, if insurer managers face pressure to

[7] The premium charges and asset charges cover about 17 and 20 percent of total property-liability insurer RBC (Cummins et al., 1995).

increase the performance (e.g. rate of return) in a short time period, they might simultaneously increase the leverage ratio and the riskiness of the business and investment portfolio if the resulting RBC ratio is still beyond the regulatory threshold. A positive relationship might be observed in this case. Thus, the relationship between change in leverage ratio, risky business and investment portfolio is an empirical issue. This leads to our first hypothesis:

H_1: There is a significant relationship between the change in leverage ratio, the risky business portfolio and the risky investment portfolio.

The synchronization of capital and risk adjustments depends on the amount of insurers' capital holding in excess of the regulatory requirement. Insurers with low capital buffers might try to rebuild an appropriate buffer by raising capital while simultaneously lowering risk. In contrast, well capitalized insurers with larger buffers might maintain their capital safety margin above the regulatory threshold by increasing risk when capital increases.

More specifically, an insurer's response to RBC requirements may depend in part on its initial RBC ratio. An insurer might effectively increase its capital cushion if this is the best choice even without regulatory pressure or when regulators give the insurer no choice. The former case might happen more often for insurers with RBC ratios slightly above the RBC threshold. The latter case is more likely true for financially distressed insurers.

Market forces also play a role in insurers' decisions, although it is not easy to

disentangle the market and regulatory requirements. Market competitions might also incentivize insurers to maintain higher capital ratios than the regulatory threshold requires. However, there are costs of holding excess capital. To purse the interests of shareholders, well capitalized insurers might eventually increase their risk exposure if they have a safety margin above the required market capital level to reduce their cost of capital holdings. Insurers with capital levels that barely meet the regulatory threshold might reduce their risk exposure in case unexpected losses might cause them to be undercapitalized. Slightly undercapitalized insurers are expected to significantly adjust their behavior to boost their RBC ratios by all means to meet the requirement of the new RBC rule. Severely undercapitalized insurers might take more risk in an attempt to return to above the regulatory threshold (and market-adequate capital levels).

This leads to our second hypothesis:

H_2: The target ratio of the leverage ratio, the risky business portfolio and the risky investment portfolio are different for insurers in varying financial conditions.

The time insurers take to respond to the regulatory change is not clear. Insurers might respond to the new RBC standard quickly. Haubrich and Wachtel (1993) argue that the impact of risk-based standards on the composition of bank portfolios are quick and appeared mainly after the December 1990 implementation date, partly because banks spend quite a while to learn the new regulatory rules and can easily adjust their portfolios. Learning by insurers might be more significant because the lasting time of finalizing the insurance RBC standards and the previous RBC effect in banking industries. Thus, there

are three possibilities with regard to the insurers' reaction to the new regulatory rule. First, if insurers are somehow concerned about the new RBC rule and learn ahead of the implementation of the RBC standards and adapt to the new rule to avoid any possible regulatory intervention, we expect that insurers adjusted their capital and business portfolio risk ahead of 1994. Second, if insurers believe that they can adjust to the new regulatory rule quickly with a low or minimum cost, they might wait till the full disclosure of the requirement of RBC law to avoid unnecessary adjustment costs. Therefore, most adjustments might happen at exactly 1994. Third, if insurers are slow in learning or the adjustment costs are pretty high, the adjustment toward target might take a long period of time. Finally, insurers might do nothing specifically and continue to stick with their "old" capital and risk targets if they consider their risk and capital balance is well above the expected RBC requirement, so that the new rule is irrelevant to them. This leads to our third and fourth hypotheses:

H_3: The adjustment speed of leverage ratio, the risky business portfolio and the risky investment portfolio are different for insurers in varying financial conditions.

H_4: The target ratio of leverage ratio, the risky business portfolio and the risky investment portfolio are different for insurers in varying financial conditions in different time periods.

Data

The sample data consists of pooled, cross-sectional data of U.S. property-liability insurers included in the NAIC's database for the period 1990-2008. The samples include

all stock and mutual insurers with positive net admitted assets, surplus and net premiums written (NPW). Certain specialty insurers and insurers that did not file a statement with the NAIC are excluded from the RBC database and from this study.

Based on their RBC ratios, insurers are classified into one of five ranked categories based on the degree of any capital deficiency starting with C1 (no action needed) and proceeding to C5 (rehabilitation or liquidation of insurer required). Table 1 summarizes this information. As shown in Table 2, the vast majority of insurers were classified into category C1 (no action needed). This result is not surprising, as the RBC standards were designed to set minimum thresholds for capital in this industry (Cummins, Grace, and Phillips, 1999). However, the capital levels for insurers in categories C2 to C5 are deemed deficient enough that some action by the company or regulator is considered necessary. Thus it is likely that insurers in these categories are under some pressure to increase capital, reduce risk, or both in order to improve their RBC ratios.

Since the RBC requirements are designed to provide a minimum threshold, the categorization of insurers into classes C1 to C5 are used to distinguish among well capitalized insurers (category 1) and less well capitalized/financially distressed insurers (categories C2-C4) in this study. Insurers in categories C2 to C4 should face increased regulatory costs varying with the degree of their capital deficiency under the design of the RBC system. However, it is difficult to know in practice what these costs are and whether they are severe.

Insurers in category C1 are broken down into two groups: insurers marginally

meeting the RBC requirements, and insurers with capital well above the capital requirements. That is, insurers with RBC ratios marginally higher than the regulatory threshold of 200 percent may wish to improve capitalization so that there is a safe cushion between their RBC ratios and the threshold. RBC ratios between 200 and 300 percent are considered marginally above the threshold amount and defined adequately capitalized insurers for purposes of this study. Insurers with RBC ratios well above the C1 threshold (i.e., more than 300 percent) are not likely to consider the RBC requirements binding and are defined as well capitalized insurers. To the extent that the RBC ratio provides some sort of reasonable index of adequate capitalization, insurers with the highest RBC ratios may face pressure to reduce their ratios.

We do not have access to RBC ratios in 1991 and 1993. Thus, we classify insurers in 1991 and 1993 into five RBC categories based on their RBC ratios in 1992 and 1994, respectively.

Methodology

Several options might be used by insurers desiring to influence their RBC ratio. This section describes these actions and suggests models designed to capture these changes.

Insurers can directly strengthen their financial strength by boosting their surplus. We adapt the leverage ratio (equal to the liability divided by surplus) to capture the insurers' balance of capital and risk portfolios. If insurers choose to directly increase their surplus,

the leverage ratio will decrease, all else equal.[8]

Insurers' actual risk profile would change by: restructuring their investment portfolio through reallocation of relatively more of their investments to relatively safe vehicles (e.g., cash and Treasury securities); underwriting less risky lines of business (e.g., personal auto lines); and avoiding overly aggressive company operating strategies in general. Changes such as these, when conducted by relatively weak insurers, at least partially meet the design purposes of RBC.[9]

In order to improve their regulatory RBC ratios, insurers must reduce their volume of risky financial activities, including investments in stocks and mortgages, and premiums written in commercial long tail business. Both are associated with relatively high RBC risk charges more so than other investments or business lines. Investments in stocks and mortgages are generally considered riskier than the other categories of investment (e.g., bonds and cash). The performance of commercial long tail business is subject to higher variability than other lines of business (e.g., business in personal auto line). We thus choose the proportion of investments in stocks to proxy for investment risk

[8] Although RBC ratios might be a better proxy for capital, we choose leverage ratio to proxy for insurers' capital level in this study for three reasons. First, insurers are only required to maintain an RBC ratio above 200 percent to avoid regulatory intervention. Generally, insurers will maintain a safety margin above the regulatory threshold as shown in table 2. Since most insurers have an RBC ratio well above the regulatory threshold, RBC ratios might no longer be a focus in these insurers' capital decision. Second, we classify insurers into well capitalized, adequately capitalized and under-capitalized firms, according to the RBC ratio. If we further use the RBC ratio as the dependent variable, some econometric concerns will be raised. Third, previous insurance literature uses leverage more often to proxy for capital level. Using leverage allows us to compare our results with those of general finance literature.

[9] Changes made by insurers may be real or illusory. Troubled insurers have been found to be more likely to underestimate loss reserves relative to other insurers (e.g., Petroni, 1992; Petroni and Beasley, 1996; Beaver, McNichols, and Nelson, 2003; and Gaver and Patterson, 2004), and insurers can reduce RBC charges by underreserving. Manipulation of loss reserve is considered illusory change made by insurers solely to meet the requirement of regulators and does not change the firm's actual financial condition.

and premiums written in commercial long tail business to proxy for underwriting risk.[10]

The joint dependency between insurers' leverage, investment and underwriting decisions mean that OLS yields inconsistent coefficient estimates. Thus, we apply a model of simultaneous equations and incorporate dummy variables reflecting insurer financial strength in our models. Both change in leverage, investment and underwriting decisions are endogenous variables that are determined in the system of equations. Three-stage least squares estimation, which accommodates the correlation of the errors across equation, is used to estimate the parameters of these equations.

Insurers are likely to have relatively more flexibility in arranging their lines of business mix and investment portfolio allocations than the other RBC risk categories.[11] We modify the simultaneous equation model developed by Shrieves and Dahl (1992) to incorporate the risk-based capital standards in insurance.

$$\Delta CAP_{i,t} = \alpha_0 + \alpha_1 \Delta RISKINV_{i,t} + \alpha_2 \Delta RISKNPW_{i,t} - \alpha_3 CAP_{i,t-1} + \alpha_4 WRBC + \alpha_5 ARBC + \Theta H_{i,t} + \varepsilon_{i,t}$$

$$\Delta RISKINV_{i,t} = \beta_0 + \beta_1 \Delta CAP_{i,t} + \beta_2 \Delta RISKNPW_{i,t} - \beta_3 RISKINV_{i,t-1} + \beta_4 WRBC + \beta_5 ARBC + \Lambda V_{i,t} + \varpi_{i,t}$$

$$\Delta RISKNPW_{i,t} = \gamma_0 + \gamma_1 \Delta RISKINV_{i,t} + \gamma_2 \Delta CAP_{i,t} - \gamma_3 RISKNPW_{i,t-1} + \gamma_4 WRBC + \gamma_5 ARBC + \Gamma U_{i,t} + \zeta_{i,t}$$

where Δ indicates change (X_t-X_{t-1}), CAP represents the leverage ratio equals to liability divided by surplus, RISKINV indicates the proportion of investment in stocks and real estate relative to total invested assets, RISKNPW indicates the proportion of net

[10] Alternatively, we construct a composite measure of asset risk based on the weighted sum of insurer asset portfolio amounts divided by total invested assets. Following the existing literature, our measure of investment risk is calculated as the Risk-Based Capital (RBC) factor-weighted investment proportions of bonds, stocks, mortgage, real estate, and loans, scaled by total admitted assets (Baranoff and Sager, 2002; Baranoff and Sager, 2003; Baranoff, Papadopouls and Sager, 2007). Specifically, investment risk variable for PC insurers is calculated as 0.072*Class1-2bond+0.1483*Class3 -6bond +0.15* common stocks+0.075*mortgage divided by total invested assets. The similar construction is also used in study the relationship between capital and risk in banking (Shrieves and Dahl, 1992; Jacques and Nigro, 1997).

[11] Changing investment in affiliates is likely to be rather sticky, for example.

premiums written in commercial long tail business lines (workers' compensation, other liability and commercial auto liability), and WRBC and ARBC are dummy variables if a firm's RBC ratio is above 3 and between 2 (well capitalized insurers) and 3 (adequately capitalized insurers) respectively. i is insurer i, and t indicates time. The terms ε_{it}, ω_{it} and $\zeta_{i,t}$ are random error terms. H_{it}, V_{it} and U_{it} are control variables, α, β and γ are regression parameters, and Θ, Λ and Γ are vectors of coefficients of control variables. Hypothesis 1 will be supported if the coefficients α_1, α_2, β_1, β_2, γ_1, γ_2 are found significant different from 0.

Simultaneity exists among the equations above; hence the system will be estimated with a simultaneous equations approach that is robust to heteroscedasticity. The control variables for both equations include organizational form (mutual) dummy, size, group dummy, Herfindahl index of lines of business written, and geographical Herfindahl index of business written.[12] The identifying variables for the leverage (RBC ratio) change equations are reinsurance utilization and financing deficit. The identifying variables for the investment change equations are durations of assets. The identifying variables for the underwriting portfolio change equation are percentage changes of NPW. Further, the lag of dependent variables also can serve as the identifying variables in three equations.

These simultaneous partial adjustment equations highlight the fact that observed changes in the leverage ratio, underwriting and investment portfolio in period t are a

[12] Risk reduction through greater business diversification cannot effectively improve the RBC ratios because it is not explicitly incorporated into the insurance RBC standards.

function of the differences between the target level in period t and previous period's actual level, and any exogenous shock. Thus, α_3, β_3, and γ_3 are expected to be negative and between 0 and 1. The absolute size of these coefficients reflects the adjustment speed toward the target level.

First, the above simultaneous equations are estimated by year. In other words, we estimated the model using data of 1991-1996, separately, following Aggarwal and Jacques (2001). Then, we pooled the data of 1991-2007 together and add two time dummies in all equations: year 1994 dummy and RBCBEFORE (year 1991-1993) dummy, following Shrieves and Dahl (1992).[13]

$$\Delta CAP_{i,t} = \alpha_0 + \alpha_1 \Delta RISKINV_{i,t} + \alpha_2 \Delta RISKNPW_{i,t} - \alpha_3 CAP_{i,t-1} + \alpha_4 WRBC + \alpha_5 ARBC + \alpha_6 RBCBEFORE_{i,t} + \alpha_7 YEAR94DUMMY_{i,t} + \Theta H_{i,t} + \varepsilon_{i,t}$$

$$\Delta RISKINV_{i,t} = \beta_0 + \beta_1 \Delta CAP_{i,t} + \beta_2 \Delta RISKNPW_{i,t} - \beta_3 RISKINV_{i,t-1} + \beta_4 WRBC + \beta_5 ARBC + \beta_6 RBCBEFORE_{i,t} + \beta_7 YEAR94DUMMY_{i,t} + \Lambda V_{i,t} + \varpi_{i,t}$$

$$\Delta RISKNPW_{i,t} = \gamma_0 + \gamma_1 \Delta RISKINV_{i,t} + \gamma_2 \Delta CAP_{i,t} - \gamma_3 RISKNPW\Gamma_{i,t-1} + \gamma_4 WRBC + \gamma_5 ARBC + \gamma_6 RBCBEFORE_{i,t} + \gamma_7 YEAR94DUMMY_{i,t} + + \Gamma U_{i,t} + \zeta_{i,t}$$

Interaction between two time dummies and two insurer financial strength dummies (WRBC and ARBC) are added also in the final model. We expect insurers in varying states of financial strength might have different behavior in different time periods. Thus, if Hypothesis 2 is true, in which insurers in varying financial conditions have different target ratios, the coefficients of WRBC and ARBC are expected to be significantly different from zero. Further, if Hypothesis 4 is true, the coefficients of two time dummy

[13] We also pooled data of 1994-2007 together and add 1994 dummy variable only. Results remain quantitatively similar.

variables should be significantly different from zero.

To test Hypothesis 3, we further interact WRBC and ARBC with the lag of dependent variables in all three equations. If we find these interaction terms have significant coefficients, Hypothesis 3 is supported. Finally, we add interaction terms of two time dummy variables and WRBC and ARBC with the lag of dependent variable in all three equations.

We also conduct several robustness tests. Following Shrieves and Dahl (1992), we also stratify the sample relative to the RBC regulatory threshold and estimate the model separately for each subset of insurers. More specifically, insurers are categorized as well capitalized insurers (i.e., insurers in RBC categories C1 with RBC ratio larger than 3), adequately capitalized insurers (i.e., insurers in RBC categories C1 with RBC ratio larger than 2 but less than 3), undercapitalized insurers (i.e., insurers in RBC categories C2 with RBC ratio larger than 1.5 but less than 2), and critically undercapitalized capitalized insurers (i.e., insurers in RBC categories C3-C5 with RBC ratio less than 1.5). Due to the limitation of sample, we combine insurers falling into C2-C5 RBC category as financially troubled insurers in our regression analysis. Use of separate regressions on each capital group allows all slope coefficients to vary across the groups. Although the results show less significance due to the limited sample size for adequately capitalized and undercapitalized insures, results generally are consistent with the main model. [14]

[14] Test results where we arbitrarily defined as low capital those insurers below the 10^{th}, 15^{th}, 20^{th}, 25^{th} and 30^{th} percentiles each year, or over all years, were very similar.

Empirical Evidence

We report insurer leverage changes and other variables interested over time in Table 3. Much of the 1990s was a particular good time for insurance companies, which may have made the capital structure adjustment process quite easy. This might contribute to the significant capital improvement found in Harrington and Niehaus (2002).[15] Our extended time period enables us to cover more than one "macro" underwriting cycle. In Table 3, we also provide evidence about how the underwriting and investment portfolio of the P-C insurance industry adjusted over the last two decades. Table 4 presents descriptive statistics by RBC category over our sample period.

Table 5 provides results of simultaneous equations estimated by year. We report results of 1992 and 1994-1995 although we will also discuss results of 1991, 1993 and 1996 if applicable. α_3, β_3 and γ_3 are always significantly negative and between 0 and 1, suggesting the validity of using the partial adjustment model. The adjustment of leverage ratio ranges between 21 percent in 1993 to 80 percent in 1991. The adjustments in the proportion of risky investment and business mix are much slower, generally below 3 percent. This indicates that the costs of adjust investment portfolio and business mixture are higher than adjusting capital directly. The highest adjustment speed appears in 1994 for business mix, probably due to the effect of institution of the RBC rule.

The coefficients α_1, α_2, β_1, β_2, γ_1, γ_2 in model 1 are generally found

[15] Harrington and Niehaus (2002) provide evidence with insurers' capital structure over time from 1991-1998. We extend their data period to 2008. Also, our values are based on the mean/median of our sample from the NAIC data base while the industry aggregate value is used in Harrington and Niehaus (2002). Further, we complement their analysis by studying the change in asset portfolio and underwriting structure over time.

significantly different from 0. More specifically, change in risky investment is positively related to the change in leverage ratio except for 1996. Change in risky underwriting is negatively related to the change in leverage ratio except for 1993. Thus, Hypothesis 1 is at least partially supported.

Two insurer financial strength dummies (WRBC and ARBC) are negative and significant in 1991-1992 and 1995-1996, except that the ARBC dummy is not significant in 1992 but still carries the negative sign. This indicates that, compared to undercapitalized insurers, well capitalized insurers and adequately capitalized insurers decrease leverage ratios more significantly, probably due to their better ability to raise capital. Further, the coefficient of WEBC is significantly lower than that of the ARBC dummy, further confirming the importance of ability to raise capital. In contrast, the coefficients of WRBC and ARBC dummies are negative and significant in 1993, indicating that undercapitalized insurers face significant pressure to increase capital so that they can possibly avoid regulatory intervention in the first year of the institution of the new RBC rule (1994). Thus, undercapitalized insurers decrease leverage ratio more significantly than well capitalized and adequately capitalized insures by either raising capital or decreasing liability in 1993. Further, significant coefficients of WRBC and ARBC indicate that insurers in varying financial conditions have different target ratios, which supports Hypothesis 2.

In Table 6, we pool the data for the whole sample period, 1991 to 2006. Two time dummy variables are added to study if there is a time effect on insurers' portfolio

decisions. Interaction between two time dummies and two insurer financial strength dummies (WRBC and ARBC) are added also in the final model. The coefficients of WRBC and ARBC are significantly negative in leverage ratio equation for all models, indicating that financially strong insurers have better ability to decrease leverage ratios. The coefficients of WRBC and ARBC are significantly positive in risky business equations for all models, indicating that financially strong insurers increase the proportion of their business in long tail commercial lines. We also find weak evidence that well capitalized insurers increase their investment in stocks, which is evidenced by positive coefficients of WRBC in risky investment equation for some models. Thus, the pooled model further supports Hypothesis 2.

The coefficient of time dummy (1991-1993) is positively significant in all three equations indicating that insurers have higher leverage ratio and higher proportion of risky investments and business before the institution of the RBC rule than those since 1995. However, the coefficient of time dummy 1994 is negatively significant in both leverage and risky business equations, indicating insurers tend to lower their overall risk by all means to meet the new RBC regulatory rule in the first year of its becoming effective. The positive coefficient of the time dummy 1994 in the risky investment equation might be due to the stickiness of investment portfolio adjustments. Overall, it seems that insurers do not understand the new RBC rule fully until the release year 1994. Thus, insurers, especially relative financially weak insurers, tend to be conservative in 1994 to avoid any possible regulatory intervention. After 1995, however, insurers readjust

their targets, as long as they do not need to worry about the RBC rule.

The interaction term of WRBC and RBCBEFORE dummies is significantly negative, while the interaction term of WRBC and YEAR1994 dummies is significantly positive in the leverage equation. This further indicates that well capitalized insurers might not fully understand the new RBC rules until 1994. Thus, they tried to reduce their leverage ratios until they found that they really do not need to worry about the new RBC rule, and thus increase the leverage ratio at 1994. This is consistent with the argument that some financially sound insurers might pay unnecessary costs to meet the requirement of the new RBC rule (Cummins, Harrington, and Niehaus, 1994). Overall, insurers in varying financial strength seem to have different behavior in different time periods, supporting Hypothesis 3 and 4.

In unreported results, we further interact WRBC and ARBC with the lag of dependent variable in all three equations and find these interaction terms have significant coefficients, as expected. Thus, we find evidence consistent with Hypothesis 3. When we add interaction terms of two time dummy variables and WRBC and ARBC, with the lag of dependent variable in all three equations, we also find most interaction terms are significant in unreported results.

Conclusion

Insurers in different financial conditions responded to changing regulatory requirements differently; we find a higher rate of capital accumulation for financially weak insurers than for financially strong insurers. Insurers subject to RBC regulatory

action appear to increase their RBC ratios to avoid regulatory intervention, and financially distressed insurers take positive steps to improve their capital adequacy.

Our comparison between the results based on 1992 regulator RBC ratios and those based on 1994 formal RBC ratios yield separate market and regulatory effects. However, the successfulness of this separation largely depends on the degree to which the regulatory ratios contain private information that is not available to or expected by the market. Our empirical evidence suggests that RBC capital standards might induce insurers take higher risk portfolios. However, the high risk-taking incentives might be at most partially offset the increase in capital levels and do not necessarily increase the probability of insurer insolvency.

One remaining question unexplored is what determines insurers' choices from the menu of alternatives. In other words, research studying what is the option with the lowest costs for insurer would be desirable.

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Table 1. "Risk" Categories Based on the NAIC RBC Ratios (TAC/ACL RBC)

Insurer "Risk" Category	RBC Ratio	NAIC Regulatory Action Level	Classifications in this Study
C1	RBC ratio >= 2	No action needed	N/A
C11	NAIC RBC ratio>=3	No action needed	Financially strong/Well-capitalized insurers
C12	2<=NAIC RBC ratio<3	No action needed	Less financially strong insurers
C2	1.5 <= RBC ratio < 2	Company action level	Moderately financially distressed/Under-capitalized insurers
C3	1 <= RBC ratio < 1.5	Regulatory action level	Moderately financially distressed/Under-capitalized insurers
C4	0.7 <= RBC ratio < 1	Authorized control level	Moderately financially distressed/Under-capitalized insurers
C5	RBC ratio < 0.7	Mandatory control level	Highly financially distressed/Under-capitalized insurers

Note: TAC is the Total Adjusted Capital, and ACL RBC is the Authorized Control Level RBC.

Table 2. Observation Counts for RBC Risk Categories by Year

	Insurer RBC Risk Classification							
Year	C1	C11	C12	C2	C3	C4	C5	Total for year
1991*	2109	1995	114	50	22	10	27	2218
1992	2129	2017	112	46	17	9	27	2228
1993*	2027	1933	94	17	13	3	29	2089
1994	2051	1956	95	16	14	3	23	2107
1995	2299	2184	115	31	12	6	15	2363
1996	2324	2168	156	33	17	6	20	2400
1997	2368	2234	134	30	16	5	21	2440
1998	2385	2272	113	21	15	7	18	2446
1999	2349	2224	125	21	15	7	16	2408
2000	2318	2169	149	28	20	4	16	2386
2001	2367	2200	167	19	22	6	26	2440
2002	2344	2160	184	38	26	5	26	2439
2003	2373	2221	152	31	13	8	35	2460
2004	2404	2260	144	28	28	8	35	2503
2005	2447	2315	132	28	19	6	36	2536
2006	2497	2395	102	25	14	5	31	2572
2007	2550	2448	102	22	16	8	29	2625
Total	39341	37151	2190	484	299	106	430	40660

Note: C1: No action needed, NAIC RBC ratio>=2; C11: NAIC RBC ratio>=3; C12: 2<=NAIC RBC ratio<3; C2: Company action level, 1.5<=NAIC RBC ratio<2; C3: Regulatory action level, 1<=NAIC RBC ratio<1.5; C4: Authorized control level, 0.7<=NAIC RBC ratio<1; C5: Mandatory control level, NAIC RBC ratio<0.7. *We do not have access to RBC ratio in 1991 and 1993. Thus, we classify insurers in 1991 and 1993 based on their RBC ratios in 1992 and 1994, respectively.

Table 3. Descriptive Statistics by Year (Median)

Year	Leverage	RBC Ratio	Risky Business	Risky Investment	Δ%Leverage	Δ%RBC Ratio	Δ%Risky Business	Δ%Risky In
1991	1.538	-	0.408	0.051	-0.000	-	0.000	0.000
1992	1.521	8.357	0.420	0.055	-0.007	-	0.000	0.000
1993	1.557	-	0.443	0.055	0.002	-	0.000	-0.005
1994	1.557	8.756	0.452	0.049	-0.033	-0.423	-0.003	0.000
1995	1.421	8.125	0.444	0.050	-0.014	-0.643	0.000	0.000
1996	1.324	7.395	0.437	0.052	-0.058	0.290	0.000	0.000
1997	1.234	7.852	0.436	0.054	-0.019	0.061	0.000	0.000
1998	1.139	8.411	0.439	0.054	-0.002	0.097	0.000	0.000
1999	1.100	8.623	0.417	0.057	0.006	-0.075	0.000	0.000
2000	1.106	9.140	0.414	0.049	0.073	-0.250	0.000	0.000
2001	1.247	8.876	0.429	0.044	0.044	-0.364	0.000	0.000
2002	1.358	8.170	0.410	0.038	-0.009	0.023	0.000	0.000
2003	1.343	8.064	0.414	0.033	-0.006	0.253	0.000	0.000
2004	1.337	8.277	0.407	0.027	-0.014	0.464	0.000	0.000
2005	1.321	8.676	0.422	0.021	-0.056	0.516	0.000	0.000
2006	1.248	9.405	0.418	0.022	-0.036	0.125	0.000	0.000
2007	1.164	9.804	0.397	0.026	0.013	0.080	0.000	0.000
Total	1.304	8.527	0.424	0.043	-0.004	0.033	0.000	0.000

Note: Data for all categories are Winsorized at the 5% and 95% levels. RBC ratio=Total Adjusted Capital/Authorized Control Level RBC; Leverage=Liabilities/Surplus; Risky Investment is proxied by investment in stocks and real estates; Risky business is proxied by the net premiums written in commercial long tail lines (workers' compensation, other liability and commercial auto liability); The symbol Δ% indicates the change from year t to t+1 as a proportion of the value in year t. Δ%RBC ratio=Annual change of NAIC RBC ratio; Δ%Surplus=the annual percentage change in insurer Surplus; Δ%Net Premiums Written=the annual percentage change in Net Premiums Written. Δ%Risky Business=the annual percentage change in the ratio of net premiums written in commercial long tail lines. Δ%Risky Investment=the annual percentage change in the ratio of investments in stock and real estate to total invested assets.

Table 4. Descriptive Statistics by Categories, Year 1994-2007

Categories		RBC Ratio	Leverage	Risky Business	Risky Investment	Log(assets)	Mutual	Group	Δ%RBC Ratio
C1	mean	61.301	1.398	0.229	0.120	17.694	0.162	0.714	0.053***
NAIC RBC ratio>=2	std dev	134.965	1.134	0.329	0.173	1.938	0.368	0.452	0.435
N=33076	median	8.851	1.233	0.025	0.041	17.495	0.000	1.000	0.002
C11	mean	64.823	1.295	0.225	0.120	17.668	0.166	0.721	0.040***
NAIC RBC ratio>=3	std dev	138.158	1.025	0.326	0.174	1.927	0.372	0.448	0.425
N=31206	median	9.436	1.156	0.024	0.039	17.479	0.000	1.000	-0.003
C12	mean	2.524	3.104	0.294	0.124	18.128	0.087	0.589	0.268***
2<=NAIC RBC ratio<3	std dev	0.287	1.465	0.366	0.070	2.067	0.281	0.492	0.522
N=1870	median	2.543	2.981	0.077	0.154	17.785	0.000	1.000	0.116
C11 vs. C12		***	***	***		***	***	***	***
C2	mean	1.751	4.125	0.228	0.129	17.443	0.124	0.464	0.424***
1.5<=NAIC RBC ratio<2	std dev	0.144	2.235	0.364	0.178	1.757	0.330	0.499	0.730
N=371	median	1.752	3.747	0.005	0.053	17.324	0.000	0.000	0.227
C3	mean	1.223	5.771	0.267	0.102	17.285	0.198	0.441	0.894***
1<=NAIC RBC ratio<1.5	std dev	0.146	4.604	0.405	0.165	1.804	0.400	0.498	2.242
N=247	median	1.226	4.744	0.002	0.012	17.280	0.000	0.000	0.158
C4	mean	0.836	6.770	0.165	0.090	17.181	0.274	0.357	1.381***
0.7<=NAIC RBC ratio<1	std dev	0.083	5.225	0.310	0.172	1.967	0.449	0.482	2.835
N=84	median	0.834	5.844	0.000	0.000	16.789	0.000	0.000	0.268
C5	mean	-0.891	9.282	0.265	0.068	17.704	0.176	0.398	1.405***
NAIC RBC ratio<0.7	std dev	2.458	14.646	0.403	0.132	1.973	0.381	0.490	4.297
N=347	median	0.177	6.277	0.001	0.000	17.786	0.000	0.000	0.097

Table 4. continued

Categories		RBC Ratio	Leverage	Risky Business	Risky Investment	Log(assets)	Mutual	Group	Δ%RBC Ratio
C2-C5	mean	0.680	6.430	0.244	0.100	17.471	0.171	0.428	0.941***
NAIC RBC Ratio<2	std dev	1.817	9.187	0.384	0.162	1.865	0.376	0.495	2.894
N=1049	median	1.165	4.500	0.002	0.015	17.374	0.000	0.000	0.169
C1 vs. C2-5		***	***		***	***		***	***
	mean	25.337	1.644	0.189	0.208	17.672	-	0.484	0.066***
MUTUAL	std dev	75.764	2.488	0.311	0.188	2.051	-	0.500	0.646
N=5529	median	8.360	1.298	0.032	0.167	17.597	-	0.000	0.008
	mean	64.388	1.506	0.228	0.103	17.811	-	0.794	0.083***
STOCK	std dev	137.758	1.871	0.320	0.164	1.867	-	0.405	0.692
N=25276	median	8.557	1.278	0.025	0.022	17.606	-	1.000	0.005
STOCK vs. MUTUAL		***	***	***	***	***		***	*
	mean	59.437	1.552	0.229	0.120	17.687	0.162	0.705	0.080***
ALL	std dev	133.286	2.143	0.331	0.172	1.936	0.368	0.456	0.679
N=34125	median	8.535	1.266	0.024	0.040	17.493	0.000	1.000	0.005

Note: Data for all categories are Winsorized at the 5% and 95% levels. RBC ratio=Total Adjusted Capital/Authorized Control Level RBC; Leverage=Liabilities/Surplus; Risky Investment is proxied by investment in stocks and real estates; Risky business is proxied by the net premiums written in commercial long tail lines (workers' compensation, other liability and commercial auto liability); Log(assets)=log of total admitted assets; Mutual=dummy variable equal to one if insurer is mutual, and zero otherwise; Group=dummy variable equal to one if insurer belongs to a group, and zero otherwise; The symbol Δ% indicates the change from year t to t+1 as a proportion of the value in year t. Δ%RBC ratio=Annual change of NAIC RBC ratio; We run t-tests of mean=0 for "change" variables "Δ%RBC Ratio," "Δ%Surplus," "Δ%Net Premiums Written," "Δ%Risky business," and "Δ%Risky Investment." We run parametric t-tests of differences for all variables between following pairs: insurers in "C11" and "C12,", and mutuals and stocks. ***, **, and * represent significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table 5. Three-stage least square estimates of RBC on insurer leverage, risky investment and risky business by year

	1992			1994		
Variables	ΔLeverage	ΔRisky Business	ΔRisky Investment	ΔLeverage	ΔRisky Business	ΔRisky Investment
Intercept	-0.135	-0.008	0.023	1.491	0.112	-0.024*
	(-0.12)	(-0.42)	(1.51)	(1.23)	(1.55)	(-1.71)
$(Leverage)_t$	-0.356***			-0.585***		
	(-10.92)			(-11.5)		
$(Risky\ Business)_t$		-0.016***			-0.279***	
		(-4.31)			(-15.89)	
$(Risky\ Investment)_t$			-0.030***			-0.009
			(-4.27)			(-1.44)
$(Adequate\ Capitalization\ Dummy)_t$	-0.424	0.021**	-0.016**	2.179	-0.087	-0.033***
	(-0.82)	(2.44)	(-2.23)	(1.56)	(-1.52)	(-4.36)
$(Well\ Capitalization\ Dummy)_t$	-0.966**	0.024***	-0.007	0.105	-0.014	-0.018***
	(-2.41)	(3.89)	(-1.15)	(0.11)	(-0.34)	(-2.91)
$Log(Assets)_t$	0.118**	0.000	-0.000	-0.036	-0.001	0.002***
	(2.46)	(0.40)	(-0.51)	(-0.39)	(-0.17)	(3.67)
$(Mutual\ (=1)\ dummy)_t$	-0.047	-0.002	0.000	-0.802**	-0.014	0.008***
	(-0.26)	(-0.86)	(1.00)	(-2.39)	(-0.83)	(3.01)
$(Group\ (=1)\ dummy)_t$	-0.230	-0.003	-0.005*	-0.672**	-0.104***	0.005*
	(-1.17)	(-0.89)	(-1.74)	(-2.27)	(-8.35)	(1.67)

$(\text{Line Herfindahl Index})_t$	-0.831**	-0.022***	-0.000	0.008	0.012***	-0.000
	(-2.54)	(-6.18)	(-0.71)	(0.32)	(7.26)	(-0.71)
$(\text{State Herfindahl Index})_t$	0.324	0.004	0.009***	-0.762**	-0.091***	0.009***
	(1.44)	(1.12)	(2.78)	(-1.97)	(-4.91)	(2.78)
$(\Delta\text{Leverage})_t$		0.003*	0.002		-0.000	0.002***
		(1.83)	(1.15)		(-0.06)	(2.71)
$(\Delta\text{Risky Business})_t$	-26.493***		-0.084	-2.674**		0.018
	(-3.25)		(-0.69)	(-2.41)		(1.56)
$(\Delta\text{Risky Investment})_t$	32.155**	0.261		93.004***	-0.955	
	(2.28)	(1.04)		(2.68)	(-0.63)	
$(\text{Reinsurance Utilization})_t$	-0.125			0.272		
	(-0.59)			(0.82)		
$(\text{Financing Deficit})_{t+1}$	2.767E-9			-3.5E-10		
	(1.41)			(-0.21)		
$(\text{Change in NPW})_t$		-0.0287*			-0.0287*	
		(1.96)			(1.96)	
$(\text{Duration})_t$			0.000			-7.2E-05
			(1.54)			(-0.45)
N	1805			1669		
System weighted R-Square	0.087			0.226		

	1995			1996		
Variables	ΔLeverage	ΔRisky Business	ΔRisky Investment	ΔLeverage	ΔRisky Business	ΔRisky Investment
Intercept	3.628	0.034**	-0.049***	-1.138	0.108***	-0.027**
	(3.24)	(2.34)	(-3.22)	(-1.21)	(2.70)	(-2.57)
$(Leverage)_t$	-0.335***			-0.610***		
	(-7.79)			(-33.66)		
$(Risky\ Business)_t$		-0.020***			-0.007	
		(-6.50)			(-1.43)	
$(Risky\ Investment)_t$			-0.034***			-0.009
			(-5.42)			(-1.44)
$(Adequate\ Capitalization\ Dummy)_t$	-2.372***	-0.032**	0.011	-1.319***	0.059***	-0.013**
	(-3.60)	(-4.23)	(1.27)	(-2.60)	(3.05)	(-1.98)
$(Well\ Capitalization\ Dummy)_t$	-2.772***	-0.028***	0.018**	-1.544***	0.034**	-0.007
	(-4.86)	(-4.10)	(2.52)	(-4.16)	(2.29)	(-1.06)
$Log(Assets)_t$	-0.033	-0.001	0.003***	0.253***	-0.012***	0.003***
	(-0.65)	(-0.79)	(3.57)	(2.98)	(-3.93)	(4.84)
$(Mutual\ (=1)\ dummy)_t$	-0.140	(0.00)	0.005*	-0.024	-0.013*	(0.00)
	(-0.72)	(0.56)	(1.70)	(-0.15)	(-1.70)	(1.33)
$(Group\ (=1)\ dummy)_t$	0.296	-0.001	-0.004	-0.316	0.026***	-0.007***
	(1.64)	(-0.57)	(-1.53)	(-1.44)	(2.78)	(-3.02)
$(Line\ Herfindahl\ Index)_t$	-0.096	0.005***	0.001	-0.001	-0.000	-0.000
	(-0.75)	(2.79)	(0.74)	(-0.05)	(-0.50)	(-0.06)
$(State\ Herfindahl\ Index)_t$	0.111	-0.003	-0.001	-0.008	-0.000	0.000

	(0.49)	(-1.09)	(-0.24)	(-0.28)	(-0.24)	(0.12)
$(\Delta\text{Leverage})_t$		-0.000	0.001		0.000	-0.000
		(-0.07)	(0.72)		(0.17)	(-0.05)
$(\Delta\text{Risky Business})_t$	-7.931		-0.055	0.889		0.185*
	(-0.65)		(-0.36)	(0.13)		(1.91)
$(\Delta\text{Risky Investment})_t$	16.526**	0.404**		-53.414*	4.033***	
	(2.25)	(2.67)		(-1.84)	(3.76)	
$(\text{Reinsurance Utilization})_t$	-0.325			-0.317**		
	(-1..05)			(-2.04)		
$(\text{Financing Deficit})_{t+1}$	1.778E-9			1.323E-9		
	(0.53)			(1.04)		
$(\text{Change in NPW})_t$		0.006			0.006*	
		(1.46)			(1.65)	
$(\text{Duration})_t$			-0.000			0.000
			(-0.30)			(0.15)
N	1868			1906		
System weighted R-Square	0.036			0.082		

Note: Leverage=Liabilities/Surplus; Risky Investment is proxied by investment in stocks and real estates; Risky business is proxied by the net premiums written in commercial long tail lines (workers' compensation, other liability and commercial auto liability); The RBC Ratio is defined as the ratio of Total Adjusted Capital to Authorized Control Level RBC; Well Capitalization Dummy is a dummy variable equal to one if the insurer's RBC ratio is larger than 3, and zero otherwise; Adequate Capitalization Dummy is a dummy variable equal to one if the insurer's RBC ratio is larger than 2 but smaller than 3, and zero otherwise; Log(Assets) is the natural logarithm of total assets; Mutual is a dummy variable equal to one if the insurer is a member of a group, and zero otherwise; Group is a dummy variable equal to one if the insurer is a member of a group, and zero otherwise; Line and state Herfindahl indexes are Herfindahl indexes of premiums written by

product line and by state, respectively; Reinsurance utilization is the ratio of ceded loss reserves to direct plus assumed loss reserves; Financing deficit is (change in working capital minus lagged cash flow from operations) divided by assets; Change in NPW is the growth in net premiums written; Duration is an insurer's bond portfolio duration using the midpoint of the maturities provided for the time to maturity. The symbol Δ indicates the change from year t to t+1 as a proportion of the value in year t. t statistics appear below each coefficient. ***significant at 1 percent level, **significant at 5 percent level, *significant at 10 percent level.

Table 6. Three-stage least square estimates of RBC on insurer leverage, risky investment and risky business (sample period 1991-2007)

	Panel A			Panel B		
Variables	ΔLeverage	ΔRisky Business	ΔRisky Investment	ΔLeverage	ΔRisky Business	ΔRisky Investment
Intercept	0.283**	-0.016***	-0.005**	0.088	-0.015***	-0.009***
	(2.49)	(-5.00)	(-2.21)	(0.74)	(-4.70)	(-3.70)
$(Leverage)_t$	-0.454***			-0.456***		
	(-88.86)			(-89.07)		
$(Risky\ Business)_t$		-0.020***			-0.020***	
		(-26.61)			(-27.03)	
$(Risky\ Investment)_t$			-0.035***			-0.035***
			(-7.60)			(-27.55)
$(Adequate\ Capitalization\ Dummy)_t$	-0.731***	0.007***	-0.002	-0.662***	0.010***	0.001
	(-10.57)	(3.81)	(-1.43)	(-8.24)	(4.54)	(0.66)
$(Well\ Capitalization\ Dummy)_t$	-1.219***	0.018***	0.001	-1.070***	0.020***	0.004**
	(-19.16)	(10.94)	(0.72)	(-14.34)	(10.84)	(2.41)
(1991-93 dummy)t				0.881***	0.011***	0.012***
				(6.69)	(3.14)	(4.37)
(1994 dummy)t				-1.196***	-0.054***	0.012**
				(-4.46)	(-7.60)	(2.18)
$(1991\text{-}93\ dummy)*(Adequate\ Capitalization\ Dummy)_t$				-0.131	0.003	'-0.012***
				(-0.77)	(0.70)	(-3.30)
$(1991\text{-}93\ dummy)*(Well\ Capitalization\ Dummy)_t$				-0.722***	-0.006*	'-0.011***
				(-5.347)	(-1.71)	(-3.79)

(1994 dummy)*(Adequate Capitalization Dummy)$_t$				0.345	-0.042***	'-0.010
				(1.06)	(-4.77)	(-1.50)
(1994 dummy)*(Well Capitalization Dummy)$_t$				0.685***	0.002	'-0.007
				(2.61)	(0.25)	(-1.21)
Log(Assets)$_t$	0.093***	0.000	0.001***	0.095***	1.60E-4	0.001***
	(16.06)	(1.49)	(4.46)	(16.28)	(1.02)	(4.87)
(Mutual (=1) dummy)$_t$	-0.067***	-0.001	0.004***	-0.057**	-4.6E-4	0.004***
	(-2.63)	(-1.38)	(7.80)	(-2.21)	(-0.64)	(7.83)
(Group (=1) dummy)$_t$	-0.086***	-0.004***	-0.001**	-0.086***	-0.004***	-0.001**
	(-3.51)	(-6.46)	(-2.04)	(-3.52)	(-6.34)	(-2.03)
(Line Herfindahl Index)$_t$	-0.000	3.20E-06	4.56E-06	-1.2E-4	2.45E-6	4.52E-06
	(-0.71)	(0.76)	(1.47)	(-0.79)	(0.60)	(1.45)
(State Herfindahl Index)$_t$	-0.001	0.000	2.10E-05	-0.001	1.2E-05	2.2E-04
	(-0.92)	(0.43)	(0.72)	(-0.90)	(0.33)	(0.78)
(ΔLeverage)$_t$		0.002***	3.94E-04*		0.001***	4.66E-04*
		(5.04)	(1.64)		(4.50)	(1.96)
(ΔRisky Business)$_t$	-8.447***		0.015	-9.015***		0.018
	(-6.41)		(0.53)	(-6.63)		(0.62)
(ΔRisky Investment)$_t$	18.513***	0.062		18.947***	0.087*	
	(11.06)	(1.31)		(11.28)	(1.88)	
(Reinsurance Utilization)$_t$	0.022			0.037		
	(0.75)			(1.26)		
(Financing Deficit)$_{t+1}$	1.73E-10**			1.75E-10**		

	(2.36)			(2.41)		
$(\text{Change in NPW})_t$		0.000			1.3E-05	
		(0.52)			(0.39)	
$(\text{Duration})_t$			-3.38E-06			-5E-05
			(-0.05)			(-0.79)
N	30701			30701		
System weighted R-Square	0.118			0.140		

Note: Leverage=Liabilities/Surplus; Risky Investment is proxied by investment in stocks and real estates; Risky business is proxied by the net premiums written in commercial long tail lines (workers' compensation, other liability and commercial auto liability); RBC Ratio is defined as the ratio of Total Adjusted Capital to Authorized Control Level RBC; Well Capitalization Dummy is a dummy variable equal to one if the insurer's RBC ratio is larger than 3, and zero otherwise; Adequate Capitalization Dummy is a dummy variable equal to one if the insurer's RBC ratio is larger than 2 but smaller than 3, and zero otherwise; Log(Assets) is the natural logarithm of total assets; Mutual is a dummy variable equal to one if the insurer is a member of a group, and zero otherwise; Group is a dummy variable equal to one if the insurer is a member of a group, and zero otherwise; Line and state Herfindahl indexes are Herfindahl indexes of premiums written by product line and by state, respectively; Reinsurance utilization is the ratio of ceded loss reserves to direct plus assumed loss reserves; Financing deficit is (change in working capital minus lagged cash flow from operations) divided by assets; Change in NPW is the growth in net premiums written; Duration is an insurer's bond portfolio duration using the midpoint of the maturities provided for the time to maturity. The symbol Δ indicates the change from year t to t+1 as a proportion of the value in year t. t statistics appear below each coefficient. ***significant at 1 percent level, **significant at 5 percent level, *significant at 10 percent level.