Capital Structure in the Property-Liability Insurance Industry: Tests of the Tradeoff and Pecking Order Theories

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Abstract: This study examines whether property-liability insurers have an optimum capital structure by testing the tradeoff and pecking order theories for this industry. Capital structure is measured with the net premiums written to surplus ratio, and alternatively, with the liability to asset ratio. The results indicate that the tradeoff theory dominates the pecking order theory in explaining property-liability insurer capital structure. Further, mutual and stock insurers appear to have different target capital structures, as agency theory suggests. Finally, mutual and stock insurers do not adjust at different speeds to their optimal capital structure. [Key words: Risk-based capital, tradeoff theory, pecking order theory]

INTRODUCTION

Studies of firm capital structure are the subject of mainstream research in the finance field (e.g., Shyam-Sunder and Myers, 1999; Baker and Wurgler, 2002; Fama and French, 2002; Welch, 2004; and Leary and Roberts, 2005; Huang and Ritter, 2009; Leary and Roberts, 2010; Ovtchinnikov, 2010; among others). Two common theories to explain capital structure are the tradeoff theory and the pecking order theory.[3] According to the tradeoff theory, firms "trade off" the benefits of holding capital (e.g., reduced

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chance of insolvency) with the costs of holding capital, including agency costs, in arriving at an optimal or target capital level. Under the (modified) pecking order theory (Donaldson, 1961), firms finance their investments with the cheapest forms of capital, starting with internal capital and ending up with equity capital (as a last resort). Under this theory, a firm's actual capital structure depends on past profitability and prior investments.

In contrast to the finance literature on capital structure, there has been relatively little recent research on determinants of insurer capital structure. Some underwriting cycle theories focus on the relative "stickiness" of capital in the property-liability insurance industry due to asymmetric information about such factors as the adequacy of loss reserves between capital providers and insurer managers (e.g., Winter, 1994; Cummins and Danzon, 1997; and Harrington and Niehaus, 2002). Other underwriting cycle theories posit that insurers have an optimal capital structure (e.g., Cagle and Harrington, 1995; and Cummins and Danzon, 1997). Cummins and Nini (2002) investigate whether insurers were overcapitalized in the 1990s. But there has been no systematic test of mainstream finance theories about capital structure such as the tradeoff and pecking order theories.

To better understand property-liability insurer capital structure in general, this research tests the tradeoff and pecking order theories in this industry. Tests of the tradeoff theory will indicate whether insurers have an optimal capital structure. On the other hand, the pecking order theory posits no optimal capital structure. Instead, well-financed insurers would have an incentive to stockpile capital (as financial slack), and capitalization would not stabilize at some optimal levels as under the tradeoff theory. Thus, the pecking order and tradeoff theories can be tested by studying the response of well-capitalized insurers to changes in relative capital levels.

Under the tradeoff theory, firms take actions to return to optimum capital levels when deviations occur. However, adjusting capital structure is costly, and this may affect the speed at which firms return to optimum capitalization. Therefore, in this research, a partial adjustment regression model is estimated. This model allows us to determine whether an optimal capital structure exists and thus whether the tradeoff or pecking order theory is supported. The partial adjustment model also allows us to estimate the speed at which firms move toward their optimum or target, if an optimum exists. Further, previous literature indicates that the speed with

[3]Other theories exist that are based on the market value of the firm (e.g., market timing hypothesis (Baker and Wurgler, 2002) and the inertia theory (Welch, 2004)). These theories likely have more limited applicability in the property-liability insurance industry where many firms are not publicly traded (e.g., mutual insurers). Further, many publicly held insurers are part of a holding company, rather than traded individually.

which firms return to their optimal capital structure varies by the degree of undercapitalization, and tests for this are conducted in this research as well (Lemmon and Zender, 2004; and Flannery and Rangan, 2006).

The sample period of this study is 1994 to 2003. Capital structure is measured using the net premiums written to surplus ratio, and, alternately, with the liability to asset ratio. Previous insurance literature employs leverage ratios such as these as a proxy for an insurer's capitalization (e.g., Cummins and Doherty, 2002; Cummins and Nini, 2002; and Harrington and Niehaus, 2002); the finance literature also uses broad book leverage ratios. Insurers are segmented into different categories based on their Risk-based capital ratios to determine whether the financial strength of the insurer affects adjustment speed. As a robustness measure, capital structure is measured also with the RBC ratio. The RBC ratio considers an insurer's surplus relative to the insurer's risk, including underwriting risk. The advantage of this measure is that, unlike simple book measures of leverage, it considers an insurer's surplus level relative to the insurer's risk, including underwriting, investment, and credit risk.[4]

This research is important for a number of reasons. This is the first study to directly test the tradeoff and pecking order theories in the property-liability insurance industry. Previously, these theories have been tested mainly in studies of non-financial, unregulated industries. Also, this research sheds light on the applicability of different underwriting cycle theories, such as the capacity constraint theory and other underwriting cycle theories that posit insurers have an optimal capital structure. That is, if insurers have an optimal capital structure, this would be consistent with the tradeoff theory.

By way of preview, our results indicate that insurers do appear to have an optimal or target capital structure, and that some less well-capitalized insurers move toward their target leverage ratios at different adjustment speeds. Well-capitalized insurers with RBC ratios comfortably above the minimum requirement close about 20–30 percent of the gap between their target and actual leverage ratio in one year. While the tradeoff theory dominates the pecking order theory, evidence exists that insurers' capital structures are sensitive to financing deficits. The latter suggests that past financing deficits affect the benefit-cost tradeoff of holding capital. Finally, the results overall indicate that mutual and stock insurers have different

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[4]Although the RBC ratio has been criticized in some previous studies as a measure of required capital for an insurer (Cummins, Harrington, and Klein, 1995), it is the only ratio available that specifically incorporates the risk of an insurer. Further, an insurer may incur regulatory and other costs (such as loss of business) if it fails to meet RBC requirements, making the RBC ratio an important metric for insurers.

target capital structures but differences in the speed of adjustment to the optimal capital structure are mostly insignificant and not large in size.

The remainder of this paper is organized as follows. The next section briefly summarizes the main capital structure theories tested, the tradeoff and pecking order theories, as they relate to the property-liability insurance industry specifically. The hypotheses are presented in the succeeding section. The next section describes the capital structure measures used in the study, the partial adjustment model, and factors expected to be associated with capital structure. This is followed by discussion of the data. The succeeding sections contain the results and the conclusion, respectively.

CAPITAL STRUCTURE THEORIES

The primary capital structure theories tested in this research are the tradeoff and pecking order theories. In this subsection, both of these theories are described. The discussion of these theories provides the background for the development of the hypotheses in the next section.

Tradeoff Theory

Under the tradeoff theory, market or regulatory forces are assumed to drive insurers to hold capital so as to maintain an acceptable insolvency risk. Then firms must balance the benefits against the costs of holding capital to achieve the optimal insolvency risk.[5] Three main benefits are associated with holding capital. First, insurance customers are sensitive to the insolvency risk of an insurer, so an insurer may lose business if its insolvency risk becomes too high. Second, insurers with lower insolvency risk ("safer insurers") can charge higher prices than insurers with higher insolvency risk (Cummins and Danzon, 1997). Finally, insurers avoid financial distress costs by maintaining adequate capital levels. Financial distress costs consist of costs such as direct and indirect bankruptcy costs, reputation losses, loss of valuable employees, and loss of investment in relationship-specific assets (e.g., investments in distribution systems or private information gained about customers).

But holding capital is costly. Insurers are subject to the costs of moral hazard and adverse selection in their claims settlement and underwriting activities. Capital invested in an insurer is subject to double taxation, and other market imperfections can make holding capital costly (Cummins and

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[5]Insurer capital is subject to fluctuation no matter how perfect contract design, underwriting, and the claims settlement processes of an insurer are, hence an insolvency risk is assumed to exist.

Grace, 1994). Several different types of agency costs may affect capital holding costs for insurers because of market frictions among policyholders, owners, and managers. The arguments concerning the balancing of benefits and costs of holding capital have led some researchers to conclude that insurers have an optimal capital structure (e.g., Cagle and Harrington, 1995 and Cummins and Danzon, 1997). The benefits and costs of holding capital particularly for property-liability insurers are discussed below.

According to the general agency theory literature, managers are assumed to be risk-averse, and as a result may be reluctant to take on positive net present value (NPV) projects with high risk/variation that are expected to increase firm value. Further, if managers do not have a full ownership stake, they may not exert their full effort because they do not reap the full rewards of their effort. And managers may behave in other ways that do not add value to the firm (e.g., excessive consumption of perquisites, empire building). The possibility for opportunistic behavior would be enhanced for insurers that write long-tail lines of insurance, because there is a longer time lag between receipt of cash premiums and payout of losses. These agency costs may make capital more costly to hold for these insurers.

Further, agency costs, and therefore capital structure, may also vary by organizational form. An inherent owner–policyholder conflict exists for insurers whereby owners have an incentive to increase the risk of the firm to the detriment of policyholders. When policyholders are aware of this conflict, the effect, in theory, is incorporated in price (i.e., a lower price must be charged). To mitigate the effect on price, owners can commit higher levels of capital to the firm, and thus capital is less costly to hold as a result. The owner–policyholder conflict should not be a factor for mutual firms, because the owners and policyholders are the same.

Also, the manager–owner conflict may affect stock versus mutual insurers differently because the owners of a mutual (the policyholders) do not exert much effective control over managers (Mayers and Smith, 1992 and 2005; and Mayers, Shivdasani, and Smith, 1997). This would make capital more costly to hold for mutual insurers, everything else held equal.

On the other hand, mutuals have less access to capital markets, making raising capital more difficult and costly for them (e.g., Harrington and Niehaus, 2002). Hence for a mutual, holding capital may be less costly than the alternative of raising capital when capital is needed. Mutuals might find it less costly to hold capital than stocks, according to this argument.

In summary, inherent differences in the owner–policyholder conflict and owner–manager conflict in mutual versus stock insurers and the fact that mutuals may find it more difficult to raise capital may result in different optimal capital structures for stock versus mutual insurers. On the other hand, mutual and stock insurers should experience similar capital holding costs with respect to adverse selection and moral hazard, double taxation and costs associated with other market imperfections.[6]

According to the tradeoff theory, not only is holding capital costly but so is adjusting capital structure.[7] One primary reason capital adjustment is costly is the existence of information asymmetries between managers and investors (Myers and Majluf, 1984). In the property-liability insurance industry, this problem is particularly applicable due to informational asymmetries about the adequacy of loss reserve levels. Loss reserves are the single largest liability for property-liability insurers, accounting for 56 percent of total industry liabilities in 2005 (*Best's Aggregates & Averages Property/Casualty, 2006*). Managers are much more knowledgeable about loss reserve levels and might manipulate loss reserves (Weiss, 1985; Petroni, 1992; and Gaver and Paterson, 2004). Thus the adequacy of prices, loss reserves, and the risk of the firm are more difficult for investors to determine in this industry compared to some others. As a result, raising equity capital for insurers is likely to be more costly compared to firms in most other industries, and an insurer may not always be at its optimal capital level if increasing capital is costly in the short term.

Pecking Order Theory

The pecking order theory also is based on informational asymmetries between equity providers and firm managers. According to this theory, informational asymmetries between firms and investors imply that external capital is likely to be more costly than internal capital (Myers, 1984; Froot, Scharfstein, and Stein, 1993). Therefore, firms prefer to use internal capital first in financing investments. If external financing is required, firms' next choice will be safe debt. Equity issuance is a last resort for investment financing because it is the most costly (Myers and Majluf, 1984). An optimal capital level does not exist under this theory, as firms prefer to accumulate financial slack for future investment purposes. According to this theory, current capital levels will be directly related to the net changes in the firm's external and internal cash flows (i.e., the financing deficit).[8] Support for this theory can be found in underwriting cycle theory. Under

[6]Some arguments explaining the mutual form of organization stress the shared nature of losses associated with the mutual form of organization (e.g., Thistle and Ligon, 2005). Under these theories, mutuals may be less subject to adverse selection and moral hazard as a result.

[7]The static tradeoff theory of capital structure assumes that the cost of adjusting an insurer's capital structure is zero. In dynamic versions of the model, the optimum is characterized as an optimal interval, and active revisions in the firm's capital structure occur when the endpoints of the interval are violated (Fisher, Heinkel, and Zechner, 1989).

the capacity constraint theory, capital does not flow freely into and out of the property-liability insurance industry (Winter, 1994). Insurers anticipate that correlation among losses will lead to loss shocks that deplete capital. Thus in periods of excess capacity (when the industry is flush with capital), insurers will hold on to capital. Also, because internal capital is cheaper than external capital, firms prefer to raise capital through retained earnings.

Because the property-liability insurance industry consists of mutual versus stock insurers, and stock insurers have easier access to equity markets, the implication of the pecking order theory may be different for stock and mutual insurers. More specifically, stock insurers may be less reliant on financial slack than are mutuals.

Hypotheses

The pecking order theory predicts that a typical insurer does not have a target capital ratio, while the tradeoff theory indicates that an optimal target capital level based on a benefit-cost tradeoff exists. Thus the first hypothesis is concerned with whether the tradeoff theory is supported:

Hypothesis 1: The tradeoff theory dominates the pecking order theory in explaining insurer behavior over the sample period.

The sample period of 1994 to 2003 is especially interesting to study, since the imposition of new RBC requirements in 1994 may have changed the regulatory costs associated with holding capital (and thus, the optimal capital level).

Lemmon and Zender (2004) argue that undercapitalized firms have no choice but to improve capitalization, because they cannot borrow further in the market. With respect to property-liability insurers, undercapitalized insurers would have an incentive to improve their capital position regardless of whether the pecking order theory or tradeoff theory is more important. Thus, the pecking order theory and tradeoff theory have the same prediction for undercapitalized insurers. Therefore, Hypothesis 1 is tested for well-capitalized property-liability insurers. Intuitively, Hypothesis 1 is tested with a regression model that determines the extent to which changes in capital at t+1 are related to capital at time t and the financing deficit.[9] The pecking order theory would be supported if the economic significance

[8]The financing deficit is defined by Frank and Goyal (2003) as external cash outflow (i.e., the sum of dividend payments, investments, and change in working capital) net of internal cash flow divided by total assets.

[9]Of course, other firm characteristics are controlled for in the regression model.

of the financing deficit variable outweighed the importance of capital in the model.

The discussion in the previous section indicates that the higher cost of raising capital should lead mutuals to hold more capital, while agency costs associated with the owner–policyholder conflict and manager–owner conflict should reduce the costs of holding capital for stock insurers. Therefore, under the tradeoff theory, if the benefits and costs of holding capital vary by organizational form, then the target capital level would be different for stocks and mutuals. Thus Hypothesis 1a states,

Hypothesis 1a: Mutual and stock insurers do not have the same target capital level.

Harrington and Niehaus (2002) find evidence that capital-to-liability ratios are relatively higher for mutuals than for stock insurers.

Further, since mutuals have less access to capital markets, mutuals would be expected to adjust more slowly to their target capital level, leading to Hypothesis 1b,

Hypothesis 1b: Mutual insurers adjust more slowly to their target capital level than stock insurers.

This hypothesis was supported by Harrington and Niehaus (2002).

Agency costs associated with the manager–owner conflict should affect the cost of holding capital for firms writing predominantly long-tail lines, per the discussion in the previous section. This leads to Hypothesis 1c:

Hypothesis 1c: Insurers writing relatively more long-tail lines have lower target capital levels.

Under the pecking order theory, the financing deficit is the *most important* determinant of a firm's capital structure. However, it is possible that the financing deficit is a consideration in determining optimal capital structure under the tradeoff theory.[10] That is, the relative costs of using internal cash flows for funding versus external sources may be one of the factors that insurers "trade off" in determining capital structure (Frank and Goyal, 2003, p. 219). For example, more-profitable insurers in the industry might rely more on internal capital to finance investments because it is cheaper (pecking order theory), while still maintaining a target capital level

[10]Froot (2007) argues that insurers can invest more aggressively with a high level of capital although the deadweight costs of holding capital must be considered. He also indicates that the insurer might hold more capital if there were product-market imperfections besides capital-market imperfections.

(tradeoff theory). The discussion in the preceding section indicates that mutual firms should find it relatively more difficult to raise capital when financing deficits (e.g., underwriting losses) occur, leading to Hypothesis 1d:

Hypothesis 1d: Mutual firms' capital levels are more sensitive to financing deficits than stock insurers.

In their study of unregulated, non-financial firms, Flannery and Rangan (2006) found evidence that firms with relatively low capital levels move toward their targets more quickly than those with a high capital level. This suggests that deviations from target levels are more costly for undercapitalized firms. If this were also true in the property-liability insurance industry, then less well-capitalized insurers would be expected to improve their capital position at a greater speed than well-capitalized insurers. Thus the second hypothesis states,

Hypothesis 2: Insurers in varying financial condition adjust toward their target capital level at different speeds, with less well-capitalized insurers adjusting more quickly to their target capital level than well-capitalized insurers.

METHODOLOGY

In this section, the selection of the capital structure variables and categorization of insurers into well-capitalized versus less well-capitalized are discussed, followed by a description of the partial adjustment model used to test the pecking order and tradeoff theories. Finally, factors expected to be associated with capital structure that are used in the partial adjustment model are explained.

Capital Level Measure

Ideally the measure of capitalization used to test the capital structure theories should reflect important characteristics and the risk of the insurer. The best readily available candidates for measuring capital levels are the net premiums written to surplus ratio and the liability to assets ratio (Cummins and Doherty, 2002; Cummins and Nini, 2002; and Harrington and Niehaus, 2002).

To test hypotheses regarding adjustment speed for firms in varying financial condition, insurers must be classified as well-capitalized versus less well-capitalized. This is achieved by means of the RBC ratio. The RBC ratio is defined as the ratio of an insurer's total adjusted capital to risk-based capital. More specifically, an insurer is categorized into one of five

Table 1. Definition of NAIC RBC Risk Categories

Insurer RBC category	RBC ratio	NAIC regulatory action level
C1	NAIC RBC ratio ≥ 2	No action need
C2	1.5 ≤ RBC ratio < 2	Company action level
C3	1 ≤ RBC ratio < 1.5	Regulatory action level
C4	0.7 ≤ RBC ratio < 1	Authorized control level
C5	RBC ratio < 0.7	Mandatory control level

Note: RBC ratio = Total adjusted capital/Authorized control level RBC

ranked categories on the basis of its RBC ratio, starting with C1 (no action needed) and proceeding to C5 (rehabilitation or liquidation of insurer required). Table 1 summarizes this information.

Since the RBC requirements are designed to provide a minimum threshold, the categorization of insurers into classes C1 to C5 is 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. Because insurers in category C5 are required to be taken over by the regulator, it is not clear how much control over capital structure managers of these insurers can exert. Therefore, it is not clear that any conclusions concerning the pecking order and tradeoff theories with respect to these insurers can be determined, and these insurers are omitted from analysis.

Finally, 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 capital levels and the minimum regulatory required capital. RBC ratios between 200 and 300 percent are considered marginally above the minimum regulatory required capital level for purposes of this study.[11] In contrast, insurers with RBC ratios well above the C1 threshold (i.e., more than 300 percent) are not likely to consider the RBC requirements binding. Thus these insurers are considered to be very well capitalized. In fact, to the extent that the RBC ratio provides some sort of reasonable index of adequate capitalization, insurers with the highest RBC ratios could face pressure to reduce their ratios.[12]

Partial Adjustment Model Specification and Estimation

A partial adjustment model is used to determine whether firms behave as if they have a target capital structure and the speed at which firms adjust to their target capital structure (assuming they have a target capital structure). The partial adjustment model allows for the existence of adjustment costs that may prevent an insurer from returning immediately to the target capital structure. Instead, return to the target capital structure may require several periods.

The optimal capital structure is not directly observable, and it is likely to differ across individual insurers and/or over time. To allow for this, the following general target capital structure equation is estimated:

$$(\text{Capital ratio})^*_{i,t+1} = \beta X_{it}, \tag{1}$$

where $(\text{Capital ratio})^*_{i,t+1}$ is the measure of target capital structure (i.e., leverage ratio) for insurer i in year t+1, X_{it} is a vector of insurer characteristics related to costs and benefits of operating at that capital structure, and β represents a vector of coefficients.[13] A standard partial adjustment model is given by

$$(\text{Capital ratio})_{i,t+1} - (\text{Capital ratio})_{i,t} = \delta[(\text{Capital ratio})^*_{i,t+1} - (\text{Capital ratio})_{i,t}] + \varepsilon_{i,t+1}. \tag{2}$$

[11]Initially, insurers in the bottom 10 percent of the C1 sample were considered to be marginally above the threshold; however, the RBC ratio at this observation (3.46909) was shared by many other insurers both above and below the 10 percent cutoff level (i.e., a total of 788 insurers had this RBC ratio). The next smallest RBC ratio after 3.46909 was 2.96125. Therefore, this RBC ratio (rounded to three) was used to find insurers marginally above the threshold. As a robustness test, the sample of insurers with RBC ratios lower than 3.46909 (or 11.5 percent of the C1 sample) were considered to be marginally above the threshold, and analysis was conducted with this sample. However, the results were not significantly changed when this subsample was used.

[12]Although the RBC ratio has been criticized in some previous studies as a measure of required capital for an insurer (Cummins, Harrington, and Klein, 1995), it is the only ratio available that specifically incorporates the risk of an insurer. Further, an insurer may incur regulatory and other costs (such as loss of business) if it fails to meet RBC requirements, making the RBC ratio an important metric for insurers.

[13]There is no stochastic disturbance term ε_{it} in equation (1). If $(\text{Capital ratio})^*_{i,t+1}$ is truly an equilibrium relation, an error term is not required. On the other hand, the adjustment mechanism can be imperfect, in which case an error term should be added.

Equation (2) indicates that the actual change in the capital ratio in any given time period t+1 is some fraction δ of the desired change for that period. If δ = 1, then the insurer adjusts to the desired capital ratio instantaneously in the same period. However, if δ = 0, then the actual capital ratio at time t+1 is the same as that observed in the previous time period t so that nothing has changed. Typically, δ is expected to lie between these two extremes since the individual insurer is likely to close a proportion δ of the gap between its actual and its desired capital ratio, if the tradeoff theory applies.

After substituting equation (1) into equation (2) and doing some rearranging, the model becomes:

$$(\text{Capital ratio})_{i,t+1} = (\delta\beta)X_{it} + (1-\delta)\,(\text{Capital ratio})_{i,t} + \varepsilon_{i,t+1}. \qquad (3)$$

Equation (3) implies that (1) insurers have target capital ratios, which are equal to βX_{it} (from equation (1)); (2) insurers take steps to close the gap between the target and existing capital ratio within each time period; and (3) the short-run adjustment speed δ is the same for all insurers and given by 1 minus the estimated coefficient of $(\text{Capital ratio})_{i,t}$.[14] Hypothesis 1 would be partly supported if the coefficient for $(\text{Capital ratio})_{i,t}$ is significant and less than one.[15]

Testing Speed of Adjustment. To test some hypotheses, a distinction between mutual and stock insurers is required or a distinction between insurers in different financial condition (i.e., different RBC categories) must be made. The discussion illustrating how these hypotheses will be tested is framed in terms of the hypotheses concerning stock versus mutual insurers. However, the methodology used to distinguish between insurers in varying financial condition is analogous to that used for distinguishing stock versus mutual insurers.

The partial adjustment models for stock and mutual insurers are assumed to be:

$$(\text{Capital ratio})_{Si,t+1} = (\delta_S\beta_S)X_{Sit} + (1-\delta_S)\,(\text{Capital ratio})_{Sit} + \varepsilon_{Si,t+1} \qquad (4a)$$

[14]The equation also implies that the long-run impact of firm characteristics on the leverage ratio is given by the estimated coefficients of X_{it} divided by δ.

[15]The way the problem of mechanical mean reversion in the leverage ratio is dealt with is similar to Flannery and Rangan (2006). That is, the sample is sorted into several categories by RBC ratio as well as by organizational form. This approach at least partly deals with any mechanical mean reversion problem that may exist (Chen and Zhao, 2007).

$$(\text{Capital ratio})_{Mi,t+1} = (\delta_M\beta_M)X_{Mit} + (1 - \delta_M)\ (\text{Capital ratio})_{Mit} + \varepsilon_{Mi,t+1}, \quad (4b)$$

where S and M represent stock and mutual insurers, respectively. To allow for the possibility that mutual and stock insurers have different adjustment speeds as well as different capital structure, the following pooled model can be estimated:

$$(\text{Capital ratio})_{Ai,t+1} = D_S[\ (\delta_S\beta_S)X_{Sit} + (1 - \delta_S)\ (\text{Capital ratio})_{Sit}] + D_M\ [\ (\delta_M\beta_M)X_{Mit} + (1 - \delta_M)\ (\text{Capital ratio})_{Mit}] + \varepsilon_{Ai,t+1,} \quad (5)$$

where A represents a stock or mutual insurer and D_M (D_S) is a dummy variable equal to one if the insurer is a mutual (stock) insurer.

If $\beta_S \neq \beta_M$, this would indicate that mutuals' target capital ratios are different from stock insurers, supporting Hypothesis 1a. Further, the individual coefficients for each X_i can be compared across stock and mutual insurers to determine what causes any difference in capital structure, assuming a difference is found. Finally, if δ_S is significantly different from δ_M , then this would signify that mutuals adjust toward their capital structure at a different speed than stock insurers. In particular, if $\delta_S > \delta_M$, then mutuals adjust more slowly toward their optimal capital structure than stock insurers, supporting Hypothesis 1b.

To test Hypothesis 2, Equation (5) is modified as follows:

$$(\text{Capital ratio})_{Bi,t+1} = D_{Cn}[\ (\delta_{Cn}\beta_{Cn})X_{Cnit} + (1 - \delta_{Cn})\ (\text{Capital ratio})_{Cnit}] + D_{Cp}\ [\ (\delta_{Cp}\beta_{Cp})X_{Cpit} + (1 - \delta_{Cp})\ (\text{Capital ratio})_{Cpit}] + \varepsilon_{Bi,t+1,} \quad (6)$$

where C_n and C_p refer to insurers with specific RBC ratio ranges defined in terms of categories n and p, respectively. The subscript B applies to insurers in categories C_n and C_p (i.e., a pooled sample of insurers in categories C_n and C_p). Also, C_p refers to a category of insurers with RBC ratios less than that for insurers in C_n (i.e., insurers in C_p have lower relative capitalization). Note that equation (6), like equation (5), allows all coefficients for the C_n variables to vary from those for C_p.

If insurers in varying financial condition adjust toward their target capital level at different speeds, then the coefficient for $(\text{Capital Ratio})_{Cnit}$ would be significantly different from for $(\text{Capital Ratio})_{Cpit}$, and Hypothesis 2 is supported. In particular, if insurers that are less well-capitalized adjust toward their target capital structure more quickly, then $\delta_{Cp} > \delta_{Cn}$, and Hypothesis 2 would be supported. Equation (6) is estimated for the following samples of insurers: (a) insurers with RBC ratio > 3 versus insurers with 2 ≤ RBC ratio ≤ 3; (b) insurers with 2 ≤ RBC ratio ≤ 3 versus insurers in RBC category C2; and (c) insurers in category C2 versus insurers in categories C3–C4.

Testing Dominance of Tradeoff Theory. As indicated previously, under the pecking order theory, the financing deficit is the primary factor in explaining contemporaneous changes in a firm's capital structure. Thus to test this theory, the relationship between *changes* in an insurer's capital structure (i.e., leverage ratio) and the financing deficit must be determined in relation to other factors associated with the tradeoff theory:

$$\Delta(\text{Capital ratio})_{i,t+1} = (\delta\beta)X_{it} - \delta(\text{Capital ratio})_{i,t} + \lambda(\text{Financing deficit})_{i,t+1} + \varepsilon_{i,t+1}, \quad (7)$$

where $\Delta(\text{Capital ratio})_{i,t+1} = (\text{Capital ratio})_{i,t+1} - (\text{Capital ratio})_{i,t}$ and the other variables are defined as before (Flannery and Rangan, 2006). The coefficient λ is expected to be positive and significant under the pecking order theory, if a leverage ratio is used as the dependent variable. Furthermore, the economic impact of this variable should far outweigh the effect of the lagged capital ratio on $\Delta(\text{Capital ratio})_{i,t+1}$. That is, the effect of the other explanatory variables in the equation should decrease significantly in importance so that the change in the capital ratio (or leverage ratio) is explained primarily by the financing deficit (Frank and Goyal, 2002). If the latter occurs, then the pecking order theory would dominate the tradeoff theory. Otherwise, Hypothesis 1 would be supported. For reasons explained earlier, equation (7) is estimated for relatively well capitalized insurers (i.e., insurers in category C1).

To determine whether the tradeoff or pecking order theory is relatively more important for stock versus mutual insurers, the change in the capital ratio from equation (5) is estimated:

$$\begin{aligned}\Delta(\text{Capital ratio})_{Ai,t+1} &= [(\text{Capital ratio})_{Ai,t+1} - (\text{Capital ratio})_{Ait}] = \\ &D_S[(\delta_S\beta_S)X_{Sit} - \delta_S(\text{Capital ratio})_{Sit} + \lambda_S(\text{Financing deficit})_{Si,t+1}] + \\ &D_M[(\delta_M\beta_M)X_{Mit} - \delta_M(\text{Capital ratio})_{Mit} + \\ &\lambda_M(\text{Financing deficit})_{Mi,t+1}] + \varepsilon_{Ai,t+1}. \quad (8)\end{aligned}$$

A positive coefficient for the financing deficit variable would mean that an insurer's level of capitalization (leverage) increases directly with financing deficits.[16] Thus, if the coefficients λ_S and λ_M are positive and

[16]Recall that the financing deficit is scaled net cash outflow. Thus, if the financing deficit is greater than zero, then the firm's cash position has deteriorated.

significant and also outweigh the importance of the other variables in the change in leverage ratio equations, the pecking order theory would be supported. If ??? the absolute value of ? λ_M exceeds that of $\lambda_{S,}$ this would indicate that changes in mutual insurers' leverage ratios are more sensitive to mutuals' financing deficits, supporting Hypothesis 1d. Finally, if the coefficient $\lambda_S(\lambda_M)$ only is significant, and its economic impact outweighs the other regression variables, this would signify that the pecking order theory is dominant for stock (mutual) insurers only, contradicting (supporting) Hypothesis 1d.

Estimation Techniques

We first estimate pooled regression models based on equations (3), (5), (6), (7), and (8) using OLS, a firm fixed effects model, and a firm random effects model for all regressions.[17] Time dummy variables are included in the regressions to control for any time-varying influences on capital structure (e.g., regulatory environment change, catastrophe risk shocks, and macroeconomic environment changes). Finally, because inclusion of a lagged dependent variable can result in correlation between this variable and the error term, models using two-stage-least-squares are estimated as well.[18] Consistent with prior research, the data are winsorized (at the 5th and 95th percentile), to eliminate extreme observations (see, e.g., Flannery and Rangan, 2006). Nonlinear wald tests are performed to determine whether the individual coefficients comprising β_S are different from β_M.[19]

Determinants of Target Capital Structure

Before equation (3) can be estimated, the determinants of capital structure (X_{it}), must be specified. The hypotheses provide some guidance on the variables that should be included in X_{it}. Hypothesis 1c indicates that insurers writing relatively more long-tail lines of business should have lower target capital levels. Therefore, a long-tail lines variable defined as (total loss reserves)/(total losses incurred) is included in the regression

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[17]The partial adjustment model satisfies the assumptions of the classical linear regression model, and OLS estimation will yield consistent estimates (Gujarati, 2003: 677). Flannery and Rangan (2006) suggest that a panel regression with unobserved (fixed) effects is more appropriate if firms have relatively stable, unobserved variables affecting their leverage targets.

[18] STATA's software for two-stage-least squares is used in the estimation, and the standard error of the coefficient for the endogenous regression variable is adjusted as part of the two-stage least squares routine. See Davidson and MacKinnon (1993: 209–224).

[19] That is, the coefficients estimated are $\delta_S\beta_S$ and $\delta_M\beta_M$. Thus a wald test is conducted to determine whether $\delta_S\beta_S/\delta_S = \delta_M\beta_M/\delta_M$.

(Cummins and Nini, 2002). Hypothesis 1c is supported if the coefficient for this variable is negative.

Prior literature indicates that additional factors are associated with insurer capital structure. Insurers that are more diversified are expected to require less relative capital to operate. Size is sometimes associated with diversification because larger insurers, in theory, should be able to achieve a better spread of risk than smaller insurers. Therefore size, defined as the logarithm of assets, is included in the regression model, and its expected sign is positive. Insurers might also diversify risk by writing across many different product lines and/or across different geographic areas. Therefore, herfindahl indices for product mix and geographic spread are included in the model. The expected signs for the herfindahl index variables are negative. That is, decreases in product mix and geographic spreads are associated with increases in the herfindahl index and less diversification. Less diversification would be associated with higher capital requirements (i.e., lower leverage). Reinsurance usage is associated with increased diversification, since through reinsurance insurers can obtain a better spread of risks (Cummins and Nini, 2002). Reinsurance usage is measured as the ratio of ceded loss reserves to the sum of direct loss reserves and assumed loss reserves. Reinsurance usage is expected to be positively related to leverage.

Growth opportunities are expected to be related to capital structure. Firms with growth opportunities should prefer to finance these with the cheapest form of capital, internal capital. Further, asymmetries between managers and investors are also likely to make financing new investments through internal capital to be preferred (Myers and Majluf, 1984). Thus, firms with more growth opportunities are expected to hold relatively more capital, everything else equal. Growth opportunities are measured as the change in direct net premiums written. However, insurers experience an equity penalty when writing new business. That is, prepaid acquisition expenses (an asset under GAAP accounting) are not recognized as an asset in statutory accounting. Instead, prepaid acquisition expenses effectively act to reduce underwriting income and, hence, surplus or equity. Therefore, the sign of the growth variable is difficult to predict.

As mentioned earlier, the financing deficit can be a factor considered under the tradeoff theory. That is, it is possible that a significant and positive coefficient might be found for the leverage ratios, but that the net external and internal cash flows still play a role in determining capital structure. (That is, the financing deficit could be just one of several factors considered by a firm in setting target capital structure.) Therefore, the financing deficit variable is included when estimating equation (5), and its expected sign is positive for the reasons discussed earlier.[20] Commercial business is sometimes considered to be more volatile than personal lines of business (such as personal auto); thus the percent of business written in commercial lines is included in the model. The expected sign for this variable is negative.

A dummy variable representing group affiliation is included in the models. Group insurers might have an advantage by being able to diversify risks within the group (through intra-group reinsurance) and operate with relatively lower capital levels. On the other hand, insurers within a group might be more likely to obtain capital infusions from their parent company when capital levels are deficient. Therefore, the sign for this variable is difficult to predict a priori. Finally, a dummy variable equal to one for insurers that are neither mutuals nor stocks (and zero otherwise) is included in the model. We have no priors on the sign of this variable.

DATA

Individual insurer data are used in this study because RBC standards apply to individual insurers and state regulators focus more on individual insurers' insolvency propensities than that of groups (Cummins, Harrington, and Klein, 1995). Data were obtained primarily from individual insurers' Annual Statements filed with the NAIC. The sample insurers consist of insurers included in the NAIC's RBC database; this database excludes certain specialty insurers and insurers that did not file a statement with the NAIC.[21] All insurers with negative assets, surplus, and net premiums written are excluded.[22] Further, data for two consecutive years were

[20]Prior studies have also considered whether firms' capital adequacy is related to past profitability and to cash flow (e.g., Harrington and Niehaus, 2002; Rajan and Zingales, 1995; and Baker and Wurgler, 2001).

[21]Insurers excluded from the NAIC filing requirements are typically reinsurers, small single-state companies, or small companies with exotic organizational forms such as Texas Lloyds or reciprocals (Cummins, Grace, and Phillips, 1999). Professional reinsurers are excluded. Following Weiss and Chung (2004), an insurer is classified as a professional reinsurer if the proportion of its property-liability nonproportional reinsurance premiums assumed from nonaffiliates exceeds 70 percent of its total reinsurance assumed. This is based on the criterion that professional reinsurers will not rely extensively on intra-group transactions. Any insurers classified by the NAIC as "U.S. branch of alien insurer" are excluded from the sample.

[22]Insolvent insurers are not included in the study since these insurers are already under the control of the regulator through the liquidation or rehabilitation process and consequently do not make independent business decisions. Their data also are typically unavailable in the NAIC Annual Statement database.

required for each sample insurer; hence observations that did not meet this criterion were eliminated from the sample.[23] The final sample has 17,393 firm-year observations.[24]

RESULTS

Summary statistics for the samples analyzed in this research are presented in Table 2. Means for the entire sample and by NAIC categorization are provided as well as means for stock and mutual insurers in category C1. Insurers in categories C3 and C4 are combined into one sample because there were too few observations to analyze categories C3 and C4 separately.

As expected, insurers in category C1 have much lower leverage ratios than insurers in the other NAIC categories. Asset size (expressed in logarithms), percent of business in commercial lines, and the long-tail lines variables do not appear to vary substantially among the different samples, however (except for category C5). Mutuals have significantly lower ratios of liabilities to assets than stocks do and this is consistent with Harrington and Niehaus (2002).[25] Change in net premiums written varies substantially among the samples, and it is highest for insurers in categories C1 and C3–C4. The herfindahl indices for lines of business and state geographic spread also vary among the categories, with higher indices observed for insurers in the lower-rated NAIC categories. Membership in an insurance group is lower for insurers in lower-rated RBC categories.

In the remainder of this section, tests of the specific hypotheses are discussed. The hypotheses tests are based on the results of partial adjustment model regressions on various (sub)samples of the data. The regression results are presented in Tables 3 through 8, with Tables 3 through 5 providing results for regressions in which NPW/Surplus is used as the leverage ratio and Tables 6 through 8 providing results for regressions in which Liabilities/Assets is used as the dependent variable.

Panel data methods are used in estimation for all cases where adequate numbers of observations for the same insurer over time are included in the

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[23]For example, the leverage ratios for two consecutive years are used in equation (3), and to compute the change in net premiums written, two consecutive years of data are needed.

[24]The numbers of observations in the final sample for 1994 through 2003, by year, are 1590, 1799, 1800, 1798, 1798, 1723, 1698, 1730, 1727, and 1730, respectively.

[25]Harrington and Niehaus (2002) argue that mutuals have higher ex ante target capital ratios than stock insurers. Mutuals also have a higher ratio of NPW to Surplus, but the difference is not significant at conventional significance levels. The latter is not consistent with Harrington and Niehaus (2002).

Table 2. Summary Statistics, Sample Period 1994–2002

Variable	All	NAIC RBC Category C1	C2	C3–C4	C5	RBC ratio > 3	2 ≤ RBC ratio ≤ 3	NAIC RBC Cat. Mutual C1	Stock C1
$(\text{NPW/Surplus})_t$	1.1532	1.0967	2.6555	3.5926	3.4643	1.0353	1.9264	1.1325	1.1070
$(\text{NPW/Surplus})_{t+1}$	1.1378	1.1026	2.3624	3.1110	1.5610	1.0593	1.6876	1.1291	1.1157
$\Delta(\text{NPW/Surplus})_{t+1}$	–0.0233	0.0031	1.7464	–0.7565	–2.3020	0.0204	–0.2299	–0.0010	0.0045
$(\text{Liabilities/Assets})_t$	0.5661	0.5588	0.7574	0.7997	0.9634	0.5462	0.7292	0.5433	0.5638
$(\text{Liabilities/Assets})_{t+1}$	0.5735	0.5665	0.7410	0.7770	1.0080	0.5554	0.7166	0.5461	0.5726
$\Delta(\text{Liabilities/Assets})_{t+1}$	0.0063	0.0067	0.0831	–0.0253	0.0184	0.0081	–0.0113	0.0024	0.0078
Log(Assets)_t	17.9272	17.9396	17.1731	17.5410	17.9360	17.9240	18.1504	17.7853	18.0458
$(\text{Change in NPW})_t$	0.1399	0.1429	–0.0039	0.1690	–0.0652	0.1509	0.0344	0.0922	0.1568
$(\text{Reinsurance utilization})_t$	0.3913	0.3915	0.3190	0.4522	0.4166	0.3908	0.4010	0.3350	0.4100
$(\text{Line herfindahl index})_t$	0.5173	0.5109	0.6968	0.7639	0.8037	0.5055	0.5828	0.4554	0.5064
$(\text{State herfindahl index})_t$	0.5760	0.5706	0.7493	0.7927	0.7630	0.5696	0.5844	0.7238	0.5243
$(\text{Financing deficit})_{t+1}$	0.0079	0.0078	0.0025	0.0418	–0.0132	0.0076	0.0111	0.0036	0.0090
$(\text{Commercial business \%})_t$	0.5987	0.5958	0.6085	0.6924	0.8669	0.5922	0.6444	0.5307	0.5962
$(\text{Long-tail bus. exposure})_t$	0.5722	0.5690	0.6314	0.6842	0.7814	0.5635	0.6435	0.4632	0.5842
$(\text{Group (=1) dummy})_t$	0.6719	0.6810	0.4167	0.3557	0.2258	0.6876	0.5926	0.4670	0.7754
$(\text{RBC ratio})_t$	10.9641	11.2450	1.7683	1.1109	–0.3864	11.8899	2.5342	10.8115	11.4226
$(\text{RBC ratio})_{t+1}$	10.0062	10.2451	2.3488	1.8099	–0.1437	10.7775	3.0541	10.1600	10.3238
$\Delta(\text{RBC ratio})_{t+1}$	–0.6085	–0.6416	1.1094	0.7084	0.3620	–0.7276	0.5207	–0.4343	–0.6895
$(\text{Mutual (=1) dummy})_t$	0.2063	0.2068	0.1324	0.2685	0.1774	0.2144	0.1046		
$(\text{Other org. form (=1) dummy})_t$	0.0792	0.0759	0.1520	0.1409	0.3387	0.0724	0.1235		
No. obs.	17393	16916	204	149	124	15750	1166	3499	12133

Note: The RBC ratio is defined as the ratio of total adjusted capital to authorized control level RBC; NPW signifies net premiums written; Log(Assets) is the natural logarithm of total assets; change in NPW is the growth in net premiums written; line and state herfindahl indexes are herfindahl indexes of premiums written by product line and by state, respectively; financing deficit is (change in working capital minus lagged cash flow from operations) divided by assets; commercial business % is the proportion of net premiums written in commercial lines; long-tail business exposure is the ratio of insurance reserves to losses incurred in the current year; group (mutual) is a dummy variable equal to one if the insurer is a member of a group (is a mutual), and zero otherwise; and other org. form is a dummy variable equal to one if the insurer is neither a stock nor a mutual insurer. The symbol Δ indicates the change from year t to t+1 as a proportion of the value in year t.

Table 3. Partial Adjustment Regression Results, 1994–2002

	NAIC RBC category C1				RBC ratio > 3			
Dependent variable	Change in NPW/Surplus		$(NPW/Surplus)_{t+1}$		Change in NPW/Surplus		$(NPW/Surplus)_{t+1}$	
Independent variables	(1) Coeff.	(2) Coeff.	(3) Coeff.	(4) Coeff.	(5) Coeff.	(6) Coeff.	(7) Coeff.	(8) Coeff.
$(NPW/Surplus)_t$	–0.2549***	–0.2170***	0.6504***	0.7168***	–0.1883***	–0.1728***	0.7010***	0.7525***
	0.0055	0.0092	0.0067	0.0112	0.0055	0.0091	0.0072	0.0117
$Log(Assets)_t$	0.0737***	0.0660***	0.0797***	0.0662***	0.0525***	0.0492***	0.0687***	0.0580***
	0.0072	0.0073	0.0087	0.0090	0.0066	0.0067	0.0085	0.0087
$(Change in NPW)_t$	0.5169***	0.5308***	0.6376***	0.6619***	0.4835***	0.4881***	0.6080***	0.6235***
	0.0068	0.0073	0.0083	0.0089	0.0060	0.0064	0.0078	0.0083
$(Reinsurance utilization)_t$	–0.1153***	–0.0968***	–0.1247***	–0.0923***	–0.0944***	–0.0872***	–0.1093***	–0.0854***
	0.0165	0.0169	0.0202	0.0207	0.0147	0.0151	0.0190	0.0195
$(Line herfindahl index)_t$	–0.1190***	–0.1051***	–0.1611***	–0.1368***	–0.1081***	–0.1025***	–0.1577***	–0.1393***
	0.0220	0.0222	0.0268	0.0271	0.0196	0.0198	0.0254	0.0257
$(State herfindahl index)_t$	–0.0893***	–0.0789***	–0.1420***	–0.1238***	–0.0554***	–0.0510***	–0.1138***	–0.0995***
	0.0196	0.0198	0.0239	0.0242	0.0174	0.0175	0.0224	0.0226
$(Financing deficit)_{t+1}$	0.1497***	0.1390***	0.1882***	0.1694***	0.1482***	0.1441***	0.1948***	0.1812***
	0.0463	0.0464	0.0565	0.0568	0.0428	0.0429	0.0554	0.0555
$(Commercial business %)_t$	–0.0751***	–0.0647***	–0.1063***	–0.0882***	–0.0473**	–0.0438**	–0.0855***	–0.0739***
	0.0225	0.0226	0.0275	0.0277	0.0199	0.0199	0.0257	0.0258
$(Long-tail business exposure)_t$	–0.1985***	–0.1871***	–0.2173***	–0.1928***	–0.1542***	–0.1496***	–0.1863***	–0.1711***
	0.0236	0.0238	0.0288	0.0291	0.0209	0.0210	0.0270	0.0272
$(Mutual (=1) dummy)_t$	0.0719**	0.0665**	0.0774*	0.0680*	0.0873***	0.0854***	0.0817**	0.0756**
	0.0330	0.0331	0.0403	0.0404	0.0290	0.0291	0.0375	0.0377
$(Other org. form (=1) dummy)_t$	–0.0010	0.0035	–0.0291	–0.0212	0.0437	0.0463	–0.0361	–0.0275
	0.0374	0.0375	0.0457	0.0458	0.0331	0.0331	0.0427	0.0428

(Group (=1) dummy)$_t$	−0.0271**	−0.0222*	−0.0479***	−0.0394***	−0.0255**	−0.0240**	−0.0415***	−0.0366***
	0.0122	0.0122	0.0148	0.0149	0.0109	0.0109	0.0141	0.0142
N	16916	16916	16916	16916	15750	15750	15750	15750
Two-stage-least-squares	No	Yes	No	Yes	No	Yes	No	Yes
C-D wald F statistic		4008.12		4008.12		3960.15		3690.15
C-D wald F statistic df		2.14439		2.14439		2.13313		2.13313
Sargan statistic		1.6860		0.0010		2.3590		0.1520
Sargan statistic P value		0.1941		0.9706		0.1246		0.6966
R-squared	0.2758	0.3002	0.7431	0.7704	0.3157	0.3285	0.7924	0.7924

Note: Standard Error appears below each coefficient. C-D wald F statistic is the Cragg-Donald wald F statistic. All models include fixed company and year effects.
Note: *** significant at 1 percent level, ** significant at 5% level, and * significant at 1% level.
Note: The RBC ratio is defined as the ratio of total adjusted capital to authorized control level RBC; Log(Assets) is the natural logarithm of total assets; change in NPW is the growth in net premiums written; line and state herfindahl indexes are herfindahl indexes of premiums written by product line and by state, respectively; financing deficit is (change in working capital minus lagged cash flow from operations) divided by assets; commercial business % is the proportion of net premiums written in commercial lines; long-tail business exposure is the ratio of insurance reserves to losses incurred in the current year; group (mutual) is a dummy variable equal to one if the insurer is a member of a group (is a mutual), and zero otherwise; and other org. form is a dummy variable equal to one if the insurer is neither a stock nor a mutual insurer.

Table 4. Partial Adjustment Model Regression Results, 1994–2002; Stock and Mutual Insurers in Category C1, 1994–2002

Dependent variable	(NPW/Surplus)$_{t+1}$						Change in NPW/Surplus					
	1			2			3			4		
	Coeff for			Coeff for			Coeff for			Coeff for		
Independent variable	Stock dummy*	Mutual dummy*	Wald test	Stock dummy*	Mutual dummy*	Wald test	Stock dummy*	Mutual dummy*	Wald test	Stock dummy*	Mutual dummy*	Wald test
(NPW/Surplus)$_t$	0.6482***	0.7017***	***	0.4209***	0.3969***		–0.2532***	–0.2245***	**	–0.4935***	–0.5546***	
	0.008	0.016		0.084	0.116		0.006	0.013		0.071	0.098	
Log(Assets)$_t$	0.0843***	0.0806***		0.1308***	0.1382***		0.0733***	0.0744***		0.1223***	0.1362***	
	0.009	0.010		0.020	0.021		0.007	0.009		0.017	0.018	
(Change in NPW)$_t$	0.6370***	0.6728***	**	0.5564***	0.5240***		0.5138***	0.5748***	***	0.4285***	0.4136***	
	0.009	0.026		0.031	0.062		0.007	0.022		0.026	0.053	
(Reinsurance utilization)$_t$	–0.1509***	–0.0089	**	–0.2729***	–0.0915	***	–0.1292***	–0.0459	*	–0.2582***	–0.1355***	***
	0.022	0.051		0.050	0.062		0.018	0.042		0.042	0.052	
(Line herfindahl index)$_t$	–0.1585***	–0.1112		–0.2431***	–0.2164**		–0.1105***	–0.1669**		–0.1999***	–0.2808***	
	0.028	0.080		0.043	0.092		0.023	0.065		0.036	0.078	
(State herfindahl index)$_t$	–0.1477***	–0.0908		–0.2126***	–0.2016**		–0.0943***	–0.0215		–0.1632***	–0.1408**	
	0.025	0.072		0.034	0.084		0.021	0.059		0.029	0.070	
(Financing deficit)$_{t+1}$	0.1773***	0.3430**		0.2571***	0.3817**		0.1195**	0.3322**	*	0.2040***	0.3739***	
	0.064	0.142		0.072	0.148		0.052	0.116		0.061	0.125	
(Commercial business %)$_t$	–0.1143***	–0.1242**		–0.1807***	–0.2311***		–0.0833***	–0.0972*		–0.1534***	–0.2134***	
	0.064	0.063		0.042	0.079		0.025	0.052		0.035	0.067	
(Long-tail business exposure)$_t$	–0.1143***	–0.3078***		–0.2782***	–0.3976***		–0.1912***	–0.2616***		–0.2670***	–0.3587***	
	0.031	0.081		0.041	0.091		0.026	0.067		0.035	0.077	
(Group (=1) dummy)$_t$	–0.0633***	–0.0396		–0.0965***	–0.0933**		–0.0373**	–0.0228		–0.0724***	–0.0811***	
	0.019	0.028		0.023	0.036		0.015	0.023		0.019	0.031	

N	15632	15458	15632	15458
Two-stage-least-squares	No	Yes	No	Yes
C-D wald F statistic		36.78		36.62
C-D wald F statistic df		3,13356		3,13356
Sargan statistic		0.6770		3.1660
Sargan statistic P value		0.4107		0.0752
R-squared	0.7452	0.4604	0.2795	0.3874

Note: Standard Error appears below each coefficient. C-D Wwald F statistic is the Cragg-Donald Wwald F statistic.
Note: ***significant at 1 percent level, **significant at 5 percent level, *significant at 10 percent level.
Note: All models include fixed company and year effects. Wald test is nonlinear test that β_S=β_M.
Note: Log(Assets) is the natural logarithm of total assets; change in NPW is the growth in net premiums written; line and state herfindahl indexes are herfindahl indexes of premiums written by product line and by state, respectively; financing deficit is (change in working capital minus lagged cash flow from operations) divided by assets; commercial business % is the proportion of net premiums written in commercial lines; long-tail business exposure is the ratio of insurance reserves to losses incurred in the current year; and group is a dummy variable equal to one if the insurer is a member of a group, and zero otherwise.

Table 5. Partial Adjustment Model Regression Results, 1994–2002, Dependent Variable: (NPW/Surplus)t+1

	1 OLS coeff for			2 2SLS coeff for			3 OLS coeff for			4 2SLS coeff for			5 OLS coeff for			6 2SLS coeff for		
Variable	RBC ratio>3 dummy	2≤RBC≤ ratio≤3 dummy*	Wald test	RBC ratio>3 dummy	2≤RBC≤ ratio≤3 dummy*	Wald test	2≤RBC≤ ratio≤3 dummy	RBC category 2 dummy*	Wald test	2≤RBC≤ ratio≤3 dummy	RBC category 2 dummy*	Wald test	RBC category 2 dummy*	RBC categories 3&4 dummy*	Wald test	RBC category 2 dummy	RBC categories 3&4 dummy*	Wald test
$(NPW/Surplus)_t$	0.6885***	0.5704***	***	0.4447***	0.1615	**	0.4872***	0.6103***		0.1276	0.0253		0.7417***	0.6821***		0.7392**	0.5398***	
	0.0076	0.0134		0.0770	0.1225		0.0637	0.0761		0.1699	0.2104		0.1683	0.0810		0.3742	0.1718	
$Log(Assets)_t$	0.0739***	0.0845***	***	0.1208***	0.1771***		0.3678***	0.3293***		0.3852***	0.4147***		0.0051	0.1042		–0.0081	0.1379	
	0.0087	0.0094		0.0176	0.0269		0.0820	0.0868		0.0842	0.0988		0.1340	0.1298		0.1438	0.1308	
$(Change\ in\ NPW)_t$	0.6067***	1.0943***	***	0.5274***	0.9293***		1.0941***	1.5242***	*	0.9158***	1.1312***		1.5632***	0.4991*	*	1.5475***	0.3469	
	0.0084	0.0291		0.0253	0.0577		0.0917	0.1945		0.1178	0.2404		0.5130	0.2946		0.5231	0.3256	
$(Reinsurance\ utilization)_t$	–0.1072***	–0.0965**		–0.2255***	–0.4270***		0.1395	0.8472**	*	0.0015	0.1922		0.2613	1.8900***	*	0.2404	1.6238**	
	0.0201	0.0472		0.0419	0.1033		0.2484	0.3613		0.2666	0.4529		0.7927	0.6689		0.9593	0.7016	
$(Line\ herfindahl\ index)_t$	–0.1608***	–0.0295	***	–0.2678***	0.0139	***	–0.3743	–0.4954		–0.5364*	–0.3833		0.3358	0.0350		0.3534	0.6807	
	0.0267	0.0491		0.0406	0.0686		0.2763	0.3988		0.2919	0.4240		0.8539	1.2079		0.8278	1.3479	
$(State\ herfindahl\ index)_t$	–0.1268***	–0.0398	***	–0.2084***	0.0137	***	–0.0709	0.0293		–0.1644	0.1499		–0.0848	–0.6263		–0.1111	–0.4458	
	0.0237	0.0408		0.0336	0.0645		0.2831	0.3658		0.2910	0.3898		0.6486	0.7952		0.6563	0.7850	
$(Financing\ deficit)_{t+1}$	0.2061***	0.0073	*	0.2729***	0.2295		–0.2224	4.6036***	***	0.0377	4.4476***	***	5.2585*	–2.7636	***	5.4639**	–2.4827	
	0.0600	0.1428		0.0664	0.1628		0.4232	0.9745		0.4433	0.9966		2.7939	1.7215		2.6787	1.6720	
$(Commercial\ business\ \%)_t$	–0.0924***	–0.0865*		–0.1597***	–0.2286***		–0.3606	–0.4449		–0.6515	–1.0685**		–0.1080	–1.5887**		–0.1324	–1.8876***	
	0.0271	0.0453		0.0348	0.0708		0.4298	0.4762		0.4491	0.5428		0.5789	0.6473		0.5944	0.6984	
$(Long\text{-}tail\ business\ exposure)_t$	–0.1673***	–0.4001***	**	–0.2200***	–1.0275***	***	–0.2243	–0.1791		–0.3631	–0.8192		–0.5005	–0.7092		–0.4768	–1.5976	
	0.0287	0.0716		0.0388	0.2246		0.3518	0.4440		0.3812	0.5667		1.0309	1.1946		1.3184	1.4886	
$(Mutual\ (=1)\ dummy)_t$	0.0823**	0.1106**		0.1142***	0.1517***		–0.2517	–0.3126		–0.2735	–0.1488		–0.2644	0.9938*		–0.2601	1.0849**	
	0.0397	0.0532		0.0428	0.0573		0.5104	0.5849		0.5213	0.6010		0.6162	0.5618		0.5894	0.5455	

(Other org. form (=1) dummy)$_t$	–0.0138	–0.0846		–0.0542	–0.1037 *		0.6021	1.1146	*	0.7519	1.0397		–0.1133	–0.9525	*	–0.1003	–1.0483	
	0.0451	0.0581		0.0493	0.0628		0.8012	0.8266		0.8214	0.8457		0.6104	0.7217		0.5834	0.6973	
(Group (=1) dummy)$_t$	–0.0439***	–0.1155***	*	–0.0692***	–0.2001***	***	0.0405	–0.0211		0.0466	–0.1316		0.1165	–1.2876**		0.1189	–1.3774**	
	0.0148	0.0296		0.0175	0.0424		0.1530	0.2280		0.1585	0.2408		0.4763	0.6134		0.4684	0.5938	
N		16916			16714			1370			1120			353			353	
Fixed company effects		Yes			Yes			Yes			Yes			No			No	
Two-stage-least squares		No			Yes			No			Yes			No			Yes	
C-D wald F statistic					46.9						38.31						23.41	
C-D wald F statistic df					3,14427						3,734						4,317	
Sargan statistic					1.983						0.089						0.001	
R-squared		0.7601			0.4603			0.1662			0.2518			0.4252			0.4196	

Note: Standard Error appears below each coefficient. C-D wald F statistic is the Cragg-Donald wald F statistic. All models include fixed year effects. Wald test is nonlinear test that $\beta_S=\beta_M$.
Note: *** significant at 1 percent level, ** significant at 5% level, and * significant at 1% level.
Note: Log(Assets) is the natural logarithm of total assets; change in NPW is the growth in net premiums written; line and state herfindahl indexes are herfindahl indexes of premiums written by product line and by state, respectively; financing deficit is (change in working capital minus lagged cash flow from operations) divided by assets; commercial business % is the proportion of net premiums written in commercial lines; long-tail business exposure is the ratio of insurance reserves to losses incurred in the current year; group (mutual) is a dummy variable equal to one if the insurer is a member of a group (is a mutual), and zero otherwise; and other org. form is a dummy variable equal to one if the insurer is neither a stock nor a mutual insurer.

Table 6. Partial Adjustment Regression Results, 1994–2002

	NAIC RBC category C1				RBC Ratio > 3			
Dependent variable	Change in (Liabilities/Assets)		$(\text{Liabilities/Assets})_{t+1}$		Change in (Liabilities/Assets)		$(\text{Liabilities/Assets})_{t+1}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent variables	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
$(\text{Liabilities/Assets})_t$	–0.2029***	–0.1439***	0.6667***	0.7882***	–0.1969***	–0.1151***	0.6659***	0.7571***
	0.0049	0.0083	0.0067	0.0113	0.0052	0.0100	0.0071	0.0136
Log(Assets)_t	0.0069***	0.0011	0.0092***	–0.0027	0.0072***	–0.0013	0.0100***	0.0005
	0.0014	0.0016	0.0019	0.0021	0.0015	0.0018	0.0021	0.0024
$(\text{Change in NPW})_t$	0.0525***	0.0557***	0.0669***	0.0735***	0.0547***	0.0586***	0.0708***	0.0753***
	0.0013	0.0013	0.0017	0.0018	0.0013	0.0014	0.0018	0.0019
$(\text{Reinsurance utilization})_t$	–0.0112***	–0.0091***	–0.0106**	–0.0062	–0.0133***	–0.0107***	–0.0136***	–0.0106**
	0.0031	0.0031	0.0042	0.0042	0.0032	0.0032	0.0044	0.0044
$(\text{Line herfindahl index})_t$	–0.0263***	–0.0213***	–0.0270***	–0.0167***	–0.0282***	–0.0208***	–0.0297***	–0.0214***
	0.0042	0.0042	0.0056	0.0057	0.0043	0.0044	0.0059	0.0060
$(\text{State herfindahl index})_t$	–0.0241***	–0.0207***	–0.0358***	–0.0289***	–0.0229***	–0.0183***	–0.0359***	–0.0307***
	0.0037	0.0037	0.0050	0.0051	0.0038	0.0039	0.0052	0.0053
$(\text{Financing deficit})_{t+1}$	0.0894***	0.0899***	0.1178***	0.1188***	0.0977***	0.0982***	0.1264***	0.1270***
	0.0087	0.0088	0.0118	0.0120	0.0094	0.0095	0.0129	0.0129
$(\text{Commercial business \%})_t$	–0.0147***	–0.0137***	–0.0251***	–0.0229***	–0.0158***	–0.0144***	–0.0270***	–0.0255***
	0.0042	0.0043	0.0057	0.0058	0.0043	0.0044	0.0060	0.0060
$(\text{Long-tail business exposure})_t$	–0.0063	–0.0074*	0.0007	–0.0015	–0.0088*	–0.0105**	–0.0057	–0.0076
	0.0045	0.0045	0.0060	0.0061	0.0046	0.0046	0.0062	0.0063
$(\text{Mutual (=1) dummy})_t$	0.0165***	0.0155**	0.0222***	0.0203**	0.0173***	0.0159**	0.0224***	0.0209**
	0.0062	0.0063	0.0084	0.0085	0.0064	0.0064	0.0087	0.0088

(Other org. form (=1) dummy)$_t$	–0.0035	–0.0029	–0.0094	–0.0083	–0.0029	–0.0020	–0.0111	–0.0101
	0.0071	0.0071	0.0096	0.0097	0.0072	0.0073	0.0099	0.0100
(Group (=1) dummy)$_t$	–0.0003	0.0007	–0.0007	0.0014	–0.0006	0.0007	–0.0008	0.0006
	0.0023	0.0023	0.0031	0.0031	0.0024	0.0024	0.0033	0.0033
N	16916	16916	16916	16916	15750	15750	15750	15750
Two-stage-Least-squares	No	Yes	No	Yes	No	Yes	No	Yes
C-D wald F statistic		4008.75		4008.75		2509.99		2509.99
C-D wald F statistic df		2,14439		2,14439		2,133313		2,13313
Sargan statistic		0.6370		0.2220		0.4230		0.0440
Sargan statistic P value		0.4248		0.6372		0.5155		0.8342
R-squared	0.1527	0.1947	0.8214	0.8471	0.1563	0.2153	0.8173	0.8414

Note: Standard Error appears below each coefficient. C-D wald F Sstatistic is the Cragg-Donald wald F statistic. All models include fixed company and year effects.
Note: *** significant at 1 percent level, ** significant at 5% level, and * significant at 1% level.
Note: The RBC ratio is defined as the ratio of total adjusted capital to authorized control level RBC; Log(Assets) is the natural logarithm of total assets; change in NPW is the growth in net premiums written; line and state Herfindahl indexes are herfindahl indexes of premiums written by product line and by state, respectively; financing deficit is (change in working capital minus lagged cash flow from operations) divided by assets; commercial business % is the proportion of net premiums written in commercial lines; long-tail business exposure is the ratio of insurance reserves to losses incurred in the current year; group (mutual) is a dummy variable equal to one if the insurer is a member of a group (is a mutual), and zero otherwise; and other org. form is a dummy variable equal to one if the insurer is neither a stock nor a mutual insurer.

Table 7. Partial Adjustment Model Regression Results, 1994–2002; Stock and Mutual Insurers in Category C1, 1994–2002

Dependent variable	(Liabilities/Assets)$_{t+1}$						Change in Liabilities/Assets					
	1			2			3			4		
	Coeff for			Coeff for			Coeff for			Coeff for		
Variable	Stock dummy*	Mutual dummy*	Wald test	Stock dummy*	Mutual dummy*	Wald test	Stock dummy*	Mutual dummy*	Wald test	Stock dummy*	Mutual dummy*	Wald test
(Liabilities/Assets)$_t$	0.6610***	0.7272***	***	0.6583***	0.6174***		–0.2051***	–0.1806***	*	–0.2463***	–0.2998***	
	0.007	0.018		0.046	0.087		0.005	0.013		0.034	0.066	
Log(Assets$_)$t	0.0110***	0.0089***		0.0111**	0.0131**		0.0075***	0.0077***		0.0115***	0.0145***	
	0.002	0.002		0.005	0.005		0.001	0.002		0.004	0.004	
(Change in NPW)$_t$	0.0674***	0.0630***	**	0.0672***	0.0562***		0.0521***	0.0576***		0.0498***	0.0504***	
	0.002	0.005		0.003	0.007		0.001	0.004		0.002	0.006	
(Reinsurance utilization)$_t$	–0.0120***	–0.0042		–0.0121**	–0.0038		–0.0133***	0.0017	*	–0.0151***	0.0024	**
	0.005	0.011		0.005	0.011		0.003	0.008		0.004	0.008	
(Line herfindahl index)$_t$	–0.0246***	–0.0190		–0.0250***	–0.0264		–0.0244***	–0.0302**		–0.0281***	–0.0374***	
	0.006	0.017		0.007	0.018		0.004	0.012		0.005	0.013	
(State herfindahl index)$_t$	–0.0381***	–0.0128		–0.0385***	–0.0198		–0.0244***	–0.0170		–0.0270***	–0.0243**	
	0.005	0.015		0.006	0.016		0.004	0.011		0.004	0.012	
(Financing deficit)$_{t+1}$	0.1246***	0.0958***		0.1254***	0.0890***		0.0975***	0.0622***		0.0983***	0.0556**	*
	0.013	0.030		0.013	0.030		0.010	0.022		0.010	0.022	
(Commercial business %)$_t$	–0.0288***	–0.0439***		–0.0288***	–0.0468***		–0.0137***	–0.0405***	***	–0.0145***	–0.0435***	***
	0.007	0.013		0.007	0.013		0.005	0.010		0.005	0.010	
(Long-tail business exposure)$_t$	0.0024	0.0021		0.0014	0.0107		–0.0059	–0.0014		–0.0059	0.0069	
	0.007	0.017		0.007	0.018		0.005	0.013		0.005	0.014	

(Group (=1) dummy)$_t$	–0.0069*	0.0020	–0.0069*	–0.0006	–0.0034	0.0008	–0.0041	0.0021
	0.004	0.006	0.004	0.006	0.003	0.004	0.003	0.005
N	15632		15458		15632		15458	
Two-stage-least-squares	No		Yes		No		Yes	
C-D wald F statistic			114.79				114.33	
C-D wald F statistic df			3,13356				3,13356	
Sargan statistic			0.6020				2.6060	
Sargan statistic P value			0.4376				0.1064	
R-squared	0.8280		0.5055		0.1574		0.2978	

Note: Standard Error appears below each coefficient. C-D wald F statistic is the Cragg-Donald wald F statistic.
Note: ***significant at 1 percent level, **significant at 5 percent level, *significant at 10 percent level.
Note: All models include fixed company and year effects. Wald test is nonlinear test that $\beta_S = \beta_M$.
Note: Log(Assets) is the natural logarithm of total assets; change in NPW is the growth in net premiums written; line and state Herfindahl indexes are herfindahl indexes of premiums written by product line and by state, respectively; financing deficit is (change in working capital minus lagged cash flow from operations) divided by assets; commercial business % is the proportion of net premiums written in commercial lines; long-tail business exposure is the ratio of insurance reserves to losses incurred in the current year; and group is a dummy variable equal to one if the insurer is a member of a group, and zero otherwise.

Table 8. Partial Adjustment Model Regression Results, 1994–2002; Dependent Variable (Liabilities/Assets)t+1

	1			2			3			4			5			6		
	OLS			2SLS			OLS			2SLS			OLS			2SLS		
	coeff for			coeff for			coeff for			coeff for			coeff for			coeff for		
Variable	RBC ratio >3 dummy	2≤RBC≤ ratio ≤3 dummy*	Wald test	RBC ratio >3 dummy	2≤RBC ≤ratio ≤3 dummy*	Wald test	2≤RBC ≤ ratio ≤3 dummy	RBC category 2 dummy*	Wald test	2≤RBC ≤ ratio ≤3 dummy	RBC category 2 dummy*	Wald test	RBC category 2 dummy*	RBC categories 3&4 dummy*	Wald test	RBC category 2 dummy	RBC categories 3&4 dummy*	Wald test
$(\text{Liabilities/Assets})_t$	0.6656***	0.6037***	**	0.7702***	0.6759***	*	0.4528***	0.3494***		0.6350***	0.3239		0.8392***	0.6814***		0.9692***	0.6880***	
	0.0069	0.0277		0.0143	0.0587		0.0514	0.0897		0.2462	0.4095		0.0785	0.0719		0.1718	0.1462	
Log(Assets)_t	0.0096***	0.0113***		–0.0005	0.0023		0.0280***	0.0314***		0.0208	0.0330		–0.0023	0.0098**		–0.0070	0.0102	
	0.0019	0.0023		0.0023	0.0032		0.0072	0.0082		0.0129	0.0203		0.0051	0.0049		0.0075	0.0067	
$(\text{Change in NPW})_t$	0.0707***	0.0200***	***	0.0760***	0.0205***	***	0.0198***	0.0253		0.0216***	0.0231		0.0199	–0.0076		0.0238	–0.0076**	
	0.0018	0.0061		0.0019	0.0063		0.0072	0.0156		0.0076	0.0181		0.0163	0.0090		0.0162	0.0086	
$(\text{Reinsurance utilization})_t$	–0.0114***	–0.0054		–0.0075*	–0.0021		0.0399*	0.0621**		0.0413**	0.0581**		0.0222	–0.0044		0.0218	–0.0038**	
	0.0042	0.0098		0.0043	0.0099		0.0204	0.0286		0.0202	0.0289		0.0235	0.0208		0.0225	0.0201	
$(\text{Line herfindahl index})_t$	–0.0292***	–0.0013	***	–0.0198***	0.0003	***	0.0030	–0.0229		0.0094	–0.0228		0.0031	–0.0297		0.0089	–0.0313	
	0.0057	0.0104		0.0058	0.0104		0.0228	0.0328		0.0238	0.0337		0.0274	0.0367		0.0270	0.0352	
$(\text{State herfindahl index})_t$	–0.0363***	–0.0360***		–0.0303***	–0.0316***		–0.0351	0.0113	**	–0.0405*	0.0179		–0.0012	0.0030		–0.0105	0.0049	
	0.0050	0.0087		0.0051	0.0092		0.0234	0.0305		0.0242	0.0391		0.0212	0.0253		0.0232	0.0248	
$(\text{Financing deficit})_{t+1}$	0.1258***	0.0725**	**	0.1271***	0.0688**	***	0.0164	0.1246		0.0187	0.1325		0.2062**	–0.0304		0.2076**	–0.0317	
	0.0127	0.0303		0.0128	0.0307		0.0349	0.0812		0.0357	0.0916		0.0890	0.0547		0.0850	0.0523	
$(\text{Commercial business \%})_t$	–0.0259***	–0.0239**		–0.0242***	–0.0253***		0.0519	0.0727*		0.0652*	0.0764*		0.0057	–0.0328		0.0081	–0.0320*	
	0.0057	0.0096		0.0058	0.0098		0.0356	0.0387		0.0388	0.0410		0.0182	0.0199		0.0176	0.0191	

(Long-tail business exposure)$_t$	–0.0015	0.0040		–0.0036	0.0115		0.0130	0.0189		0.0008	0.0070		0.0207	–0.0185		0.0179	–0.0193
	0.0031	0.0144		0.0061	0.0147		0.0291	0.0351		0.0352	0.0382		0.0298	0.0351		0.0287	0.0355
(Mutual (=1) dummy)$_t$	0.0212**	0.0333***		0.0196**	0.0329***	***	0.0140	–0.0225		0.0115	–0.0172		–0.0105	0.0227		–0.0167	0.0224
	0.0084	0.0113		0.0085	0.0115		0.0422	0.0485		0.0419	0.0507		0.0200	0.0181		0.0205	0.0181
(Other org. form (=1) dummy)$_t$	–0.0084	–0.0217*		–0.0069	–0.0199		0.0474	0.0295		0.0497	0.0383		–0.0193	–0.0316		–0.0228	–0.0301
	0.0096	0.0123		0.0096	0.0124		0.0663	0.0684		0.0658	0.0684		0.0196	0.0230		0.0192	0.0220
(Group (=1) dummy)$_t$	–0.0005	–0.0018		0.0013	–0.0028		0.0084	–0.2490	**	0.0119	–0.0250		–0.0169	–0.0372**		–0.0168	–0.0370**
	0.0031	0.0063		0.0032	0.0064		0.0127	0.0188		0.0132	0.0186		0.0151	0.0195		0.0144	0.0186
N	16916			16714			1370			1120			353			353	
Fixed company effects	Yes			Yes			Yes			Yes			No			No	
Two-stage-least squares	No			Yes			No			Yes			No			Yes	
C-D wald F statistic				788.09						10.06						18.59	
C-D wald F statistic df				3,14427						3,734						4,317	
Sargan statistic				1.403						0.471						4.153	
R-squared	0.8213			0.4986			0.2497			0.2385			0.558			0.5542	

Note: Standard Error appears below each coefficient. C-D wald F statistic is the Cragg-Donald wald F statistic. All models include fixed year effects. Wald test is nonlinear test that β_S=β_M.
Note: *** significant at 1 percent level, ** significant at 5% level, and * significant at 1% level.
Note: Log(Assets) is the natural logarithm of total assets; change in NPW is the growth in net premiums written; line and state herfindahl indexes are herfindahl indexes of premiums written by product line and by state, respectively; financing deficit is (change in working capital minus lagged cash flow from operations) divided by assets; commercial business % is the proportion of net premiums written in commercial lines; long-tail business exposure is the ratio of insurance reserves to losses incurred in the current year; group (mutual) is a dummy variable equal to one if the insurer is a member of a group (is a mutual), and zero otherwise; and other org. form is a dummy variable equal to one if the insurer is neither a stock nor a mutual insurer.

sample.[26] Hausman tests indicated that fixed company effects were favored over random effects in the panel data models. Fixed time effects are included in each model. OLS and instrumental variables (2SLS) models are provided in each table for comparison purposes. In the instrumental variables models, the Cragg-Donald partial F statistics (weak instruments test) are provided as well as the Sargan statistics (test of the validity of the instruments). The results of these two tests indicate that the instruments used are valid (i.e., the Sargan statistics are insignificant at the 5 percent level or better), and that they pass the weak instruments test, with limited exceptions.[27]

Relative Importance of Tradeoff and Pecking Order Theory

Hypothesis 1 states that the tradeoff theory dominates the pecking order theory in explaining insurer capital structure. For reasons explained earlier, this hypothesis is tested using well-capitalized insurers, defined in this study as insurers in category C1. Regressions using the change in (NPW/Surplus) and change in (Liabilities/Assets) (eq. (7)) and $(\text{NPW/Surplus})_{t+1}$ and $(\text{Liabilities/Assets})_{t+1}$ (eq. (3)) are used to test this hypothesis, and the regression results are presented in Tables 3 and 6. Results are included also for insurers that have RBC ratios significantly above the C1 threshold level (i.e., RBC ratios > 3).

The results for the models in Table 3 using $(\text{NPW/Surplus})_{t+1}$ as the dependent variable (columns 3–4 and 7–8) support the tradeoff theory in that the coefficients for the lagged (NPW/Surplus) are positive and significant for all models. The adjustment speed associated with the 2SLS coefficients for categories C1 and for insurers with an RBC ratio > 3 imply that insurers adjust toward their optimal target ratio at a rate of approximately 25 to 35 percent per year (i.e., δ ranges from 1–0.7525 to 1–0.6504). However, the coefficients for the financing deficit variables are positive and significant, suggesting that financial slack is related to capital structure also.

To determine whether the tradeoff theory is dominant, regression results with the change in (NPW/Surplus) as the dependent variable and the lagged (NPW/Surplus) and financing deficit variables as independent variables are evaluated. (See columns 1–2 and 5–6 in Table 3.) Note that the

[26]Panel methods are used for insurers with RBC ratios > 3 and for insurers with 2 ≤ RBC ratio ≤ 3. In the other samples, insurers had a tendency to move into a different category from one year to the next, so that panel data methods could not be used.

[27]The exceptions are in Tables 5 and 8 when comparisons of insurers in categories C2 and C3–C4 are made. Therefore, separate regressions are run for insurers in categories C2 and C3–C4, and a comparison of the coefficients of the leverage ratios is made. The results do not change.

sign and significance of the coefficient for $(NPW/Surplus)_t$ is still negative and significant at better than the 1 percent level in the change in (NPW/ Surplus) equations in Table 3,[28] but the implied adjustment speed is smaller, varying from 17.28 to 25.49 percent across the different categories shown. However, the positive and significant coefficients for the financing deficit variable in Table 3 are consistent with the pecking order theory.

The economic impact of the (NPW/Surplus) and financing deficit variables in the change in (NPW/Surplus) regressions are used to determine the relative importance of the pecking order and tradeoff theories.[29] The economic impact of a one-standard-deviation change in the (NPW/ Surplus) and financing deficit variables in the 2SLS results for insurers in category C1 (with RBC ratios > 3) are 38.9 (38.8) and 2.3 (3.8) percents, respectively. Results are similar when the OLS coefficients are used. Thus an increase of one standard deviation in (NPW/Surplus) would have a significantly larger effect on the change in (NPW/Surplus) than an increase of one standard deviation for the financing deficit variable. On balance, then, it appears that the tradeoff theory is more important than the pecking order theory, since the financing deficit variable does not wipe out the effect of the other variables in the $\Delta(\text{Capital ratio})_{i,t+1}$ equations. Thus Hypothesis 1 is supported in the (NPW/Surplus) regressions.

Table 6 has the same models as in Table 3 except that the leverage ratio is (Liabilities/Assets). Hypothesis 1 is supported by the results in Table 6 since the coefficients for lagged (Liabilities/Assets) are positive and significant in the $(\text{Liabilities/Assets})_{t+1}$ models and negative and significant in the change in (Liabilities/Assets) models. The speed of adjustment implied from the $(\text{Liabilities/Assets})_{t+1}$ models ranges from (1–.6667) to (1–.7882), according to Table 6. The speed of adjustment appears to be somewhat lower in the change in (Liabilities/Assets) equation, ranging from 11.59 to 20.29 percents.

The coefficients for both the financing deficit and lagged (Liabilities/ Assets) variables are significant in the change in (Liabilities/Assets) regres-

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[28]Recall that in the change in leverage ratio equation (eq. (7)), $(\text{leverage ratio})_t$ is subtracted.

[29]The economic significance of (NPW/Surplus) in the equations is determined by finding the effect of a one-standard-deviation change in the target (NPW/Surplus) ratio and the financial slack variable on the fitted value of the change in (NPW/Surplus) (i.e., predicted $\Delta(\text{NPW/Surplus}))_{t+1}$). The target (NPW/Surplus) is found using equation (1). The economic impact of a one-standard-deviation change in (NPW/Surplus) is computed as (coefficient for lagged (NPW/Surplus) * standard deviation of target (NPW/Surplus))/(standard deviation of the fitted value for change in (NPW/Surplus)); and the economic impact of the financing deficit variable is found by calculating (coefficient for financing deficit * standard deviation of financing deficit variable)/(standard deviation of fitted value for change in the target (NPW/Surplus)). This approach is used in Flannery and Rangan (2006) as well.

sions, and the economic impact of a one-standard-deviation change in the (Liabilities/Assets) and financing deficit variables are 47.8 (49.1) and 9.5 (12.1) percents, respectively, for insurers in category C1 (with RBC ratio > 3). Thus, like the results in Table 3, the dominance of the tradeoff theory over the pecking order theory is supported.

Mutual versus Stock Insurer Results

Hypothesis 1a indicates that mutual and stock insurers do not have the same target capital level. This hypothesis is tested by comparing the coefficients of the independent variables (β_M and β_S) interacted with the stock and mutual dummies by means of a nonlinear wald test. The overall regression results are presented in Table 4.[30] The coefficients for the interaction of the stock dummy and the independent variables are shown in one column for each equation (i.e., $D_S[(\delta_S\beta_S)X_{Sit} + (1 - \delta_S)(\text{Capital ratio})_{Sit}]$) and the coefficients for the interaction of the mutual dummy with the independent variables are shown in the adjacent column (i.e., $D_M[(\delta_M\beta_M)X_{Mit} + (1 - \delta_M)(\text{Capital ratio})_{Mit}]$). The sample of insurers in category C1 is used for this test, because the RBC ratio adjustment speed should be affected if the insurer is experiencing financial distress, and stocks are more likely to become insolvent (Cummins, Harrington, and Klein, 1995; Cummins, Grace, and Phillips, 1999).

Recall that if any of the coefficients for the mutual interaction dummy variables X_M are significantly different from the stock interaction terms (i.e., elements of β_S not equal to β_M), it would signify that the target RBC ratio varies between stock and mutual insurers with respect to that factor. The nonlinear wald test results in Table 4 indicate that the coefficients for $(\text{NPW/Surplus})_t$ are significantly different for stocks versus mutuals in all results except for 2SLS results for $(\text{NPW/Surplus})_{t+1}$. According to the wald tests in Table 4, the coefficients for $(\text{Reinsurance utilization})_t$ are significantly different between stock and mutual insurers in all models, while the coefficients $(\text{Change in NPW})_t$ are significantly different between stocks and mutuals in some models. Overall, these results support Hypothesis 1a, which states that mutual and stock insurers do not have the same target capital level. This is consistent with Harrington and Niehaus (2002), who find evidence that capital to liability ratios differ between stock and mutual insurers.[31]

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[30]Evidence to support this hypothesis can also be found in Tables 3 and 6. The coefficients for the mutual dummy variables are positive and significant in the $(\text{NPW/Surplus})_{t+1}$ and $(\text{Liabilities/Assets})_{t+1}$ regressions in Tables 3 and 6.

[31]However, Harrington and Niehaus (2002) find that mutual insurers hold more capital than stock insurers.

Two of the four models reported in Table 7 indicate that mutuals have significantly different (Liabilities/Assets) than stock insurers because wald tests indicate significant differences in some β_M compared to β_S in these models (i.e., models 1 and 3). Also, the coefficients for (Reinsurance Utilization)$_t$ and (Commercial business %)$_t$ are significantly different for stock versus mutuals in the results in Table 7 for change in (Liabilities/Assets). Thus, overall, the results in Table 7 mostly support the hypothesis of different target leverage ratios for stocks versus mutuals.

Hypothesis 1b indicates that mutuals adjust toward their target leverage ratio more slowly than stock insurers. Hypothesis 1b would be supported if the coefficient for (NPW/Surplus)$_t$ is larger and significantly different than for stock insurers in Table 4. The 2SLS results in models 2 and 4 in Table 4 indicate that the adjustment speed for mutual insurers and stock insurers are not significantly different, since the wald test result is not significant. Significant differences in the coefficients for (NPW/Surplus)$_t$ in the OLS results exist, however. The OLS results in columns 1 and 3 indicate that mutuals' adjustment speed is slower than for stocks, although the differences are not large. For example, in model 1, the adjustment speeds for mutual versus stock insurers are, respectively, (1–.7017) and (1–.6482), while the adjustment speed is 22.45 and 25.32 percents, respectively, in model 3 in Table 5. The OLS results are consistent with Harrington and Niehaus (2002). Thus, limited evidence exists that mutuals adjust their capital structure more slowly than stock insurers.

The OLS regressions in model 1 in Table 7 indicate that mutuals adjust significantly more slowly to the target (Liabilities/Assets) level than stock insurers, with adjustment speeds of (1–.7272) for mutuals versus (1–.6610) for stock insurers. As in Table 4, no significant differences exist in adjustment speeds in the 2SLS models in Table 7 in columns 2 and 4. Thus, once again, only limited evidence exists that mutuals adjust their capital structure more slowly than stock insurers.

Hypothesis 1d states that mutuals should be more sensitive to financing deficits than stock insurers. If mutuals are more sensitive to financing deficits, then the coefficient for the financing deficit variable interacted with the mutual dummy variable should be significantly larger in the change in (NPW/Surplus) equations in Table 4. The results in the change in (NPW/Surplus) regressions in Table 4 (models 3 and 4) indicate that the financing deficit is positively related to the change in (NPW/Surplus)$_{t+1}$, as expected. However, the wald test for differences in the coefficients for stock and mutual insurers indicates that the differences in the coefficients between stock and mutual insurers are not significant except in one case, where it is significant at the 10 percent level.[32] Thus, Hypothesis 1d is not supported.[33, 34]

The results in Table 7 do not support Hypothesis 1d, either, since the wald tests for differences in the coefficients of the stock and dummy interactions with the financing deficit variable are insignificant except in one case. The exception occurs in the 2SLS results for model 4, where the wald test statistic is significant at the 10 percent level. But the coefficient for the interaction of the mutual dummy variable with the financing deficit variable is smaller than the interaction for the stock dummy variable, contrary to Hypothesis 1d.

Long-Tail Business and Capital Structure

Hypothesis 1c indicates that insurers that write relatively more long-tail lines have lower target capital levels. The results in Tables 3 and 4 show that the coefficients for the long-tail business exposure variable, (Long-Tail Business Exposure), in the (NPW/Surplus) regressions are significant and negative in all models, as expected. Thus, insurers with more long-tail business exposure appear to operate with lower (NPW/Surplus). However, the same results do not hold for the (Liabilities/Assets) results. That is, in Tables 6 and 7, the coefficients for the (Long-Tail Business Exposure) variable are generally not significant. Therefore, mixed results exist for Hypothesis 1c.

Financial Condition and Speed of Adjustment

To determine whether insurers in relatively worse financial condition adjust towards their optimal capital RBC ratios at faster speeds, equation (6) is estimated for several samples of insurers. The results are presented in Table 5 for (NPW/Surplus) and in Table 8 for (Liabilities/Assets). If insurers in relatively worse financial condition adjust more quickly towards their target capital ratio, then the coefficients for the interaction of the C_p dummy with the lagged (NPW/Surplus) or lagged (Liabilities/Assets) should be significantly larger than the coefficients for the C_n dummy variable interacted with the lagged (NPW/Surplus) or lagged (Liabilities/Assets).

[32]In contrast, Harrington and Niehaus (2002) find that mutuals' capital ratios are more sensitive to *earnings* than those for stocks.

[33]Note that the coefficients for the lagged (NPW/Surplus) and financing deficit variables are significant in the change in (NPW/Surplus) ratios in Table 4. The economic impacts corresponding to these coefficients indicate that the tradeoff theory dominates over the pecking order theory, adding more support to the results in Table 3 and Hypothesis 1.

[34]We also estimate the partial adjustment models separately for stock insurers and mutual insurers rather than pooling all observations together by adding a mutual dummy. Results do not change materially.

The results in Table 5 support Hypothesis 2 for insurers with RBC ratios > 3 compared to insurers with 2 ≤ RBC ratio ≤ 3, since the wald test statistics are significant for NPW/Surplus. The implied adjustment speed for insurers with 2 ≤ RBC ratio ≤ 3 is one (because the coefficient for $(NPW/Surplus)_t$ is not significant) in the 2SLS results, which is larger than the implied adjustment speed for insurers with RBC ratios > 3 (i.e., 1–0.4447 in the 2SLS results). The same results hold for the OLS results in model 1. Thus, insurers with RBC ratios > 3 are found to have a slower adjustment speed than insurers with 2 ≤ RBC ratio ≤ 3, supporting Hypothesis 2.

The 2SLS results for insurers with 2 ≤ RBC ratio ≤ 3 compared to insurers in category 2 in model 4 indicate that there is no significant difference in adjustment speed for insurers in these categories and that these insurers adjust to the optimal RBC ratio within one period (since the coefficients for $(NPW/Surplus)_t$ are not significant in model 4). Further, the remaining results in Table 5 do not support Hypothesis 2, because there is no significant difference in adjustment speeds between insurers in categories 2 and categories 3–4 (according to wald tests) and because the adjustment speeds implied by these models are smaller than for insurers with RBC ratios greater than 3 (for the 2SLS results). Perhaps this is an indication that by the time an insurer reaches categories 3–4, it is so financially impaired that its ability to significantly improve their capital position is hampered.

The OLS and 2SLS results in models 1 and 2 in Table 8 support Hypothesis 2. That is, the adjustment speed for insurers with 2 ≤ RBC ratio ≤ 3 is approximately 0.32 (i.e., 1–.6759), compared to 0.23 (i.e., 1–.7702) in the 2SLS results for insurers with RBC ratios > 3, and the difference is significant at the 10 percent level, according to the wald test. No significant differences exist between the adjustment speeds among insurers in adjacent NAIC categories, as indicated by the wald test for the remaining models in Table 8.

Overall, then, Hypothesis 2 holds for insurers with RBC ratios > 3 compared to insurers with RBC ratios 2 ≤ RBC ratio ≤ 3. Insurers in categories indicating that they are impaired (C2–C4), do not, overall, adjust to their optimal capital ratio more quickly than the previous impairment category (e.g., C2 versus C3–C4), according to wald tests. Thus some support exists in favor of Hypothesis 2.

Other Results

The results with respect to the other regression coefficients are mostly as expected. For ease of reference, the results for the sample in Table 3 are discussed here, and differences from other regression results are just briefly noted.

The coefficients for the diversification variables, line herfindahl index and state geographic herfindahl index, are negative and significant in all models in Table 3, as expected. $(NPW/Surplus)_{t+1}$ is positively related to size (proxied by the logarithm of assets), also as expected. The percent of business written in commercial lines is negatively and significantly related to $(NPW/Surplus)_{t+1}$, as expected, while the coefficient for the group dummy variable is negative and significant as well. The coefficient for the growth opportunities variable is positive and significant in Table 3. Recall that there were no priors on the sign of the group and growth opportunities variable. The coefficient for reinsurance usage is unexpectedly negative and significant. The latter implies that insurers relying more on reinsurance have lower leverage ratios, and the reason for this is not clear. The coefficient for the dummy for non-stock, non-mutual organizational form is not significant.

The findings discussed above are also consistent with the results in Tables 4 through 8, except that fewer coefficients are significant in the Table 5 and 8 results for less well-capitalized insurers (in models 3 to 6). (But the latter models have a smaller number of observations as well.)

Robustness Tests

Partial adjustment regressions using the RBC ratio as the dependent variable were also performed as a robustness test. This section briefly summarizes the findings related to these regressions. For the sake of brevity, the RBC ratio results are not shown; however, they are available from the authors. Note that the dependent variables used in the robustness tests are defined as adjusted capital to authorized control level RBC; hence the expected sign for many of the regression coefficients (e.g., the financing deficit and long-tail business exposure variables) are the opposite of those for the leverage ratio analysis.

The results for the models using $(RBC\ ratio)_{t+1}$ as the dependent variable support the tradeoff theory in that the coefficients for the lagged RBC ratio are positive and significant for all models. Further, the sign and significance of the coefficient for $(RBC\ ratio)_t$ remains positive and significant at better than the 1 percent level in the change in RBC ratio equations. However, negative and significant coefficients for the financing deficit variable also exist and this is consistent with the pecking order theory. The economic impact of the coefficients for the RBC ratio and financing deficit variables are 50.5 (55.75) and 2.7 (3.2) percent in the 2SLS results for insurers in category C1 (with RBC ratio > 3), respectively. (The results are similar when the OLS coefficients are used.) Thus the tradeoff theory is supported, consistent with Hypothesis 1.

Nonlinear wald test results indicate the coefficients for $(\text{RBC ratio})_t$ are significantly different for stocks versus mutuals in both the OLS and 2SLS results, and so are the coefficients for Log(Assets)_t, $(\text{Reinsurance Utilization})_t$ and $(\text{Change in NPW})_t$ in the OLS results. These results support Hypothesis 1a, which states that mutual and stock insurers do not have the same target capital level.

Hypothesis 1b is supported if the coefficient for $(\text{RBC ratio})_t$ is larger for mutual insurers and significantly different from that for stock insurers. The 2SLS results indicate that the adjustment speed for mutual insurers (1–0.6707) is smaller than for stock insurers (1–0.3010), and the difference is significant at the 10% level. This is also consistent with Harrington and Niehaus (2002), who argue that mutuals adjust more slowly towards their long-run targets. Thus, these results provide some support for Hypothesis 1b, in contrast to the leverage ratio results. If mutuals are more sensitive to financing deficits, then the coefficient for the financing deficit variable interacted with the mutual dummy variable should be significantly more negative in the change in RBC ratio equations. The wald test for the differences in the coefficients for stock and mutual insurers indicates that the differences in the coefficients between stock and mutual insurers are not significant, hence Hypothesis 1d is not supported. Further, the coefficients for the long-tail business exposure variable in the $(\text{RBC ratio})_{t+1}$ regressions are not generally significant. Thus Hypothesis 1c is not supported.

Insurers with RBC ratios > 3 have a slower adjustment speed than insurers with 2 ≤ RBC ratio ≤ 3, but the wald statistic indicates there is no significant difference in adjustment speed for insurers in these categories, contradicting Hypothesis 2. Adjustment speeds for insurers with 2 ≤ RBC ratio ≤ 3 compared to insurers in category C2 indicate that the adjustment speed is 1 for insurers in both categories (because the coefficients for the lagged RBC ratio and the interaction of the C_p and C_n dummies with the lagged RBC ratio are not significantly different from zero). The remaining results indicate that the adjustment speed is 1 for insurers in category C_n. Overall, then, the results using the RBC ratio provide limited support for Hypothesis 2.

Robustness Tests Conclusion. In conclusion, the robustness test results are overall consistent with the leverage ratio analysis. More specifically, the RBC ratio results and the leverage ratio results support Hypotheses 1, 1a, and 1b. Hypothesis 2 is partly in the RBC ratio analysis, and in the leverage ratio analysis. In addition, the RBC ratio results and the leverage ratio results do not support Hypotheses 1c and 1d.

CONCLUSION

Capital structure in financial firms such as property-liability insurers is intrinsically linked to the financial health and solvency of these institutions. This research assesses whether insurers have target leverage ratios in mind when determining capital structure. The opposing view is that insurers do not have a target capital structure and that well-capitalized insurers act to stockpile capital for purposes of financing future investment opportunities.

The question of whether firms have an optimal capital structure versus whether they stockpile capital is well researched in non-financial, non-regulated industries but is much less well understood in financial institutions such as property-liability insurers. For example, the insurance underwriting cycle literature contains support for the existence of optimal insurer capital structure. However, other underwriting cycle theories also exist that suggest that insurer capital structure is "sticky" so that insurers hold on to seemingly excess capital at times (e.g., when market conditions are good), which would seem to belie the existence of an optimal capital structure.

The finance literature contains well-formulated hypotheses about determinants of firm capital structure that could encompass optimal capital structure explanations for insurer behavior as well as stockpiling capital behavior. More specifically, the tradeoff theory suggests that firms have an optimal capital structure that is determined by trading off the benefits and costs of holding capital (such as the agency costs so frequently mentioned in underwriting cycle literature). On the other hand, the pecking order theory indicates that firms do not have an optimal capital structure and that well-capitalized firms will stockpile capital.

In this research, the tradeoff and pecking order theories are tested in the property-liability insurance industry. The sample period for the study, 1994–2003, coincides with the institution of RBC requirements in this industry. The imposition of these new requirements could have changed the cost-benefit tradeoff of holding capital for insurers, making this time period an especially interesting one for examining industry capital structure. A partial adjustment model is estimated to determine whether firms have an optimal capital structure and how quickly firms adjust to the optimum when deviations from the optimum occur.

The results of this research indicate that the tradeoff theory dominates the pecking order theory for property-liability insurers. Further, the speed of adjustment towards the optimum tends to be faster for insurers that are marginally less well capitalized ($2 \leq$ RBC ratio ≤ 3) compared to very well capitalized insurers (RBC ratio > 3). The latter is consistent with the idea that capital holding costs might be higher for less well capitalized firms, providing them an incentive to adjust toward the optimum more quickly. The results also indicate that mutual and stock insurers do not have the same target capital structure, consistent with various agency theory arguments.

However, mutuals do not appear to rely relatively more on financial slack to replace depleted capital. The latter is somewhat surprising, given the often touted statement that mutuals have less access to capital markets than do stock insurers. Perhaps innovative financial products such as CAT bonds and other derivative products (in addition to surplus notes) may have lessened the importance of accessing capital markets by issuing stock. Also, research indicates that investor uncertainty about an insurer's financial health (e.g., the adequacy of loss reserves) may mean that stock insurers need to boost capital (through retained earnings) before going to the capital markets for funds after an adverse capital shock (Cummins and Danzon, 1997). This would mean that building up capital from past profitability is very important for stock *and* mutual insurers.

REFERENCES

Baker, M, and J Wurgler (2002) Market Timing and Capital Structure, *Journal of Finance* 57, 1–32.

Cagle, J, and S Harrington (1995) Insurance Supply with Capacity Constraints and Endogenous Insolvency Risk, *Journal of Risk and Uncertainty* 11, 219–232.

Chen, L, and X Zhao (2007) Mechanical Mean Reversion of Leverage Ratios, *Economics Letters* 95, 223–229.

Cummins, JD, and PM Danzon (1997) Price, Financial Quality and Capital Flows in Insurance Markets, *Journal of Financial Intermediation* 6, 3–38.

Cummins, JD, and NA Doherty (2002) Capitalization of the Property-Liability Insurance Industry: Overview, *Journal of Financial Services Research* 21, 5–14.

Cummins, JD, and MF Grace (1994) Tax Management and Investment Strategies of Property-Liability Insurers, *Journal of Banking and Finance* 18, 43–72.

Cummins, JD, MF Grace, and RD Phillips (1999) Regulatory Solvency Prediction in Property-Liability Insurance: Risk-Based Capital, Audit Ratios, and Cash Flow Simulation, *Journal of Risk and Insurance* 66, 417–458.

Cummins, JD, SE Harrington, and RW Klein (1995) Insolvency Experience, Risk-based Capital, and Prompt Corrective Action in Property-Liability Insurance, *Journal of Banking and Finance* 19, 511–527.

Cummins, JD, and GP Nini (2002) Optimal Capital Utilization by Financial Firms: Evidence from the Property-Liability Insurance Industry, *Journal of Financial Services Research* 21, 15–53.

Davidson, R, and JG MacKinnon (1993) *Estimation and Inference in Econometrics*. New York: Oxford University Press.

Donaldson, G (1961) Corporate Debt Capacity: A Study of Corporate Debt Policy and the Determination of Corporate Debt Capacity. Harvard Business School, Division of Research, Harvard University.

Fama, EF, and KR French (2002) Testing Tradeoff and Pecking Order Predictions about Dividends and Debt, *The Review of Financial Studies* 15, 1–33.

Fisher, E, R Heinkel, and J Zechner (1989) Dynamic Capital Structure Choice: Theory and Tests, *Journal of Finance* 44, 19–40.

Flannery, MJ, and KP Rangan (2006) Partial Adjustment toward Target Capital Structures, *Journal of Financial Economics* 79, 469–506.

Frank, M, and V Goyal (2003) Testing the Pecking Order Theory of Capital Structure, *Journal of Financial Economics* 67, 217–248.

Froot, KA (2007) Risk Management, Capital Budgeting, and Capital Structure Policy for Insurers and Reinsurers, *Journal of Risk and Insurance* 74, 273–299.

Froot, KA, DD Scharfstein, and JC Stein (1993) Risk Management: Coordinating Corporate Investment and Financing Policies, *Journal of Finance* 48, 1629–1658.

Gaver, JJ, and JS Paterson (2004) Do Insurers Manipulate Loss Reserves to Mask Solvency Problems? *Journals of Accounting and Economics* 37, 393–416.

Gujarati, DN (2003) Basic Econometrics, 4th edition, international edition, New York: McGraw-Hill Higher Education.

Harrington, SE, and G Niehaus (2002) Capital Structure Decisions in the Insurance Industry: Stocks versus Mutuals, *Journal of Financial Services Research* 21, 145–163.

Huang, R, and J Ritter (2009) Testing Theories of Capital Structure and Estimating the Speed of Adjustment, *Journal of Financial and Quantitative Analysis* 44, 237–271.

Leary, MT, and MR Roberts (2005) Do Firms Rebalance Their Capital Structures? *Journal of Finance* 60, 2575–2619.

Leary, MT, and MR Roberts (2010) The Pecking Order, Debt Capacity, and Information Asymmetry, *Journal of Financial Economics* 95, 332–355.

Lemmon, M, and J Zender (2004) Debt Capacity and Tests of Capital Structure Theories, University of Utah and University of Colorado Working Paper.

Mayers, D, and CW Smith, Jr. (1992) Executive Compensation in the Life Insurance Industry, *The Journal of Business* 65, 51–74.

Mayers, D, and CW Smith, Jr. (2005) Agency Problems and the Corporate Charter, *Journal of Law, Economics, and Organization* 21, 417–440.

Mayers, D, A Shivdasani, and CW Smith, Jr. (1997) Board Composition and Corporate Control: Evidence from the Insurance Industry, *The Journal of Business* 70, 33–62.

Myers, S (1984) The Capital Structure Puzzle, *Journal of Finance* 39, 575–592.

Myers, SC, and NS Majluf (1984) Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have, *Journal of Financial Economics* 13, 187–221.

Ovtchinnikov, AV (2010) Capital Structure Decisions: Evidence from Deregulated Industries, *Journal of Financial Economics* 95, 249–274.

Petroni, KR (1992) Optimistic Reporting in the Property-Casualty Insurance Industry, *Journal of Accounting and Economics* 15, 485–508.

Rajan, RG, and L Zingales (1995) What Do We Know about Capital Structure? Some Evidence from International Data, *Journal of Finance* 50, 1421–1460.

Shyam-Sunder, L, and SC Myers (1999) Testing Static Trade-off against Pecking-Order Models of Capital Structure, *Journal of Financial Economics* 51, 219–244.

Thistle, PD, and JA Ligon (2005) The Formation of Mutual Insurers in Markets with Adverse Selection, *Journal of Business* 78, 529–555.

Weiss, M (1985) A Multivariate Analysis of Loss Reserving Estimates in Property-Liability Insurers, *The Journal of Risk and Insurance* 52, No. 2, 199–221.

Weiss, MA, and JH Chung (2004) U.S. Reinsurance Prices, Financial Quality and Global Capacity, *Journal of Risk and Insurance* 71, 437–467.

Welch, I (2004) Capital Structure and Stock Returns, *Journal of Political Economy* 112, 106–131.

Winter, RA (1994) The Dynamics of Competitive Insurance Markets, *Journal of Financial Intermediation* 3, 379–415.