Cost of Capital and Insurer Loss Reserve Manipulation

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Abstract

An insurer’s loss reserve estimate represents the single largest liability on its balance sheet and has a material effect on the insurer’s financial reports. While a significant body of literature exists that focuses on the motivations for specific insurers to engage in earnings management, very little research has addressed the issues surrounding a possible systemic influence on the broader insurance marketplace. This research examines insurers’ loss reserving behavior within the context of the cost of insurer capital. We hypothesize that, in their efforts to smooth their cost of capital, senior insurance management intentionally over/under-states its loss reserves to manipulate artificially its policyholder surplus. Management will do this in order to adjust its capital structure during periods of relatively low/high capital from other traditional sources. To test our hypotheses, we utilize data from 1996 to 2011 – a time period in which the market saw a significantly varying cost of capital in the traditional markets. These conditions allow us to examine the impact of varying costs on insurer reserving behavior. This is the first study that examines comprehensively the effect the cost of capital has on insurer loss reserving behavior. To capture the varying effects environmental factors have on insurers reserving behavior across differing forms of ownership, the analysis will be performed separately for publicly traded stock insurers, privately held stock insurers and mutual insurers, in addition to an aggregate analysis. We use system GMM estimators that control for dynamic responses as well as potential endogeneity. As a robustness check, we will also estimate alternative models using panel data fixed effects and random effects models. Additionally, we will cluster our standard errors by firm, as well as by time period, to adjust the standard errors for possible dependence across the residuals.
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Research Problem

An insurer’s loss reserve estimate represents the single largest liability on its balance sheet and has a material effect on the insurer’s financial reports. The motivations and rationale for senior management to engage in the subtle manipulation of loss reserves have been well documented (see, for example, Weiss, 1985; Petroni, 1992; Browne, Ma, and Wang, 2009, Eckles and Halek, 2010, and Grace and Leverty, 2012). While a significant body of literature exists that focuses on the motivations for earning management at the firm level, very little research has addressed the issues surrounding systemic influence on the broader insurance market. Figure 1 shows the historical trend of loss reserve errors at the industry level for U.S. property-casualty insurers. The pattern of reserve errors suggest that one or more environmental factors are affecting industry reserving practices as a whole - encouraging the industry to over/under-reserve in accordance with some external influence in the marketplace. However, very little research has addressed the issues surrounding systemic influence on the broader insurance market.

This research examines insurer’s loss reserving behavior within the context of the cost of insurer capital. Specifically, we analyze the relationship U.S. property-casualty insurance loss reserving behavior shares with the broader array of other sources of insurer capital in the marketplace. Whether insurers over-reserve (under-reserve) when alternative sources of capital are relatively cheaper (more expensive) is the question this research is trying to address. Given the financial crisis within the past decade and the impact loss reserve estimates have on an insurer’s balance sheet, the attributes to insurer loss reserve errors are of significant interest to not only regulators, but also numerous investors and general public.

Figure 1. U.S. Property-Casualty Insurance Industry: Historical Loss Reserve Errors
**Literature Review and Hypothesis Development**

Loss reserves are accounting entries denoting anticipated future payments associated with current and incurred but not yet reported claims. Insurers are required to post their estimates of these liabilities on a regular basis for reporting purposes. Typically, actuaries generate models designed to present senior management with a range of feasible values from which management chooses a “reasonable” point estimate for reporting purposes. Assuming comprehensive modeling on the part of the actuaries, the theoretical “reasonable” point estimate ultimately chosen by senior management should be subject to random error, i.e. sometimes higher - sometimes lower than the “true” ultimate value of the loss. What constitutes “reasonable” is an ill-defined term within the actuarial and accounting fields; some argue that any value within a range should be considered “reasonable.” Invoking the principles of accounting conservatism, Shapland (2003) suggests that lacking more specific evidence as to a “reasonable” choice, the prudent choice of a lower bound of a “reasonable” choice for loss reserves should be at least the expected value of the distribution, if not higher. Guidance that is even more specific exists within the Statements of Statutory Accounting Principles (SSAPs) that states, “...when no estimate within a range is better than any other, the midpoint of the range should be accrued.” Additionally, Generally Accepted Accounting Principles (GAAP) states that, when no estimate is better than any other within a given range, the most conservative estimate in the range, i.e. highest, should be chosen. Despite that guidance, significant research suggests that senior insurance management has invoked its discretionary powers with some regularity in opting for point estimates that do not align with those accounting principles.

The financial effects of over/under-reserving have both immediate and near-term effects on an insurer’s financial position and how it may be perceived in the marketplace. Over-reserving has the effect of increasing liabilities and expenses in the current period. As liabilities increase, policyholder surplus decreases, assuming assets remain fixed. Additionally, as expenses increase reported net profits decrease, as do taxes. Under-reserving has the opposite effect on insurer financial reports. Over-reserving is generally viewed as conservative behavior (as encouraged by SSAP and GAAP) and likely to be perceived in a positive light by potential investors and the marketplace in general. Under-reserving, however, is generally perceived in a less positive light by potential investors and the marketplace in general; considered relatively aggressive (e.g. overly optimistic) in its recognition of liabilities and statements of earnings. Previous literature on earning management has found significant evidence of the use of loss reserves to smooth insurer earnings and/or achieve specific outcomes on financial reports. Motivations for reserve manipulation include taxes reduction and income smoothing incentives (Anderson, 1973, Grace, 1990, Petroni, 1992, and Smith, 1980), financial distress levels (Gaver and Paterson, 2001 and Petroni, 1992), unanticipated inflation (Grace, 1990 and Weiss, 1985), and book of business in long-tailed product lines (Petroni, 1992 and Petroni and Beasley, 1996). According to Petroni (1992), the primary motivation to underestimate loss reserves is a decreasing function of the actual financial position of the insurer. With regard to the effect on stock market reaction, Anthony and Petroni (1997) find that financial markets provide smaller earnings response coefficients to insurers with more variable reserve estimation error than to insurers with less variation in their estimation error. Gaver and Paterson (2001) report that
major consulting groups insist on relatively more conservative loss reserving behavior as compared to smaller, less influential actuarial consulting firms. Brown, Ma, and Wang (2009) and Eckles and Halek (2010) provide evidence that the managers of publicly traded insurers manipulate loss reserves to impact share prices and maximize their personal compensation. These latter papers introduce the potential influence of share appreciation and shareholder pressure—an issue associated only with publicly traded insurers. More recently, Brandt, Ma, and Pope (2013) examine the impact of the Sarbanes-Oxley Act of 2002 on publicly traded insurers and find that the imposition of additional regulation had no significant impact on the reserving behavior of publicly traded insurers.

The persistent pattern of loss reserve errors may be explained by the cost of insurer capital. Access to appropriate amounts of capital is a critical factor in the ability of an insurer to fulfill its obligations to its policyholders. A significant body of literature examines the fundamentals of the insurance industry’s demand for capital (see for example, Keilholz, 2000; Cummins and Doherty, 2002; Exley and Smith, 2006). Cummins and Lamm-Tennant (1994) create a theoretical model that expresses the cost of capital as a measure of both insurance and financial leverage where insurance leverage is defined to be the ratio of policy reserves to assets and financial leverage is described as the ratio of financial debt to assets. Cummins and Phillips (2003) examines the cost of equity capital by line of insurance and compares the results of the CAPM estimate with that of the Fama-French three factor cost of capital model.

The main interest of this research is to identify the relationship loss reserve errors share with the cost of other common sources of insurer capital. We hypothesize that senior insurance management, in their efforts to smooth their cost of capital, may engage in earnings management by intentionally over-reserving during periods of relatively cheap alternative capital and conversely, under-reserving during periods when alternative sources of capital are relatively more expensive. Major sources of insurer capital include both external and internal markets. Externally, publicly traded insurers (and to a lesser degree privately held insurers) rely significantly on the equity markets for capital. Lacking similar access to that market, mutual insurers sometimes engage in demutualization in order access that source. Some insurers also participate in the CAT bond market, albeit to a limited degree. Reinsurance, a form of off-balance sheet risk capital, also serves as a major source of capital for loss payments and to a lesser degree, surplus relief. Investment return and realized capital gains are another major source of capital for insurers. Internally, insurers generate capital from its business operations, the reevaluation of balance sheet values, and the reduction of shareholder and/or policyholder dividends. The reevaluation of balance sheet values includes changes to loss development and to an insurer’s unrealized capital gains/loss account. Thus, we test the following four hypotheses:

*Hypothesis 1: Insurers are more likely to over-reserve when the cost of capital from selling insurance is lower.*

Policyholder premiums represent a major source of internally generated capital. Given that insurers operate in a competitive marketplace, the price insurers charge for their product can
be considered a bid for business and thus, correctly viewed a cost of that capital. When insurers are able to charge higher prices, they are more likely to over-reserve as the cost of capital from selling insurance is relatively lower.

Hypothesis 2: Insurers are more likely to over-reserve when the cost of capital in the equity markets is lower.

Both investment income and realized capital gains/losses are a function of the general strength of the capital markets. While percentages fluctuate significantly, these sources of capital may represent in excess of 50 percent of an insurer’s net revenue in any given year. Therefore, the general conditions in the capital markets are of significant importance with respect to an insurer’s capital structure. The cost of obtaining capital through investment is relatively cheaper when market yield high return. Everything else equal, insurers may be more likely to over-reserve when cost of capital from the equity markets is lower.

Hypothesis 3: Insurers are more likely to over-reserve when the cost of shareholder equity capital is lower.

Shareholder equity represents a major source of capital for publicly traded insurers and to a lesser degree, for privately held insurers. The capacity-constraint hypothesis has received significant support in the literature as rationale for the existence of the underwriting cycle (e.g. Niehaus and Terry, 1993; Gron, 1994). The relationship between loss reserves and the cost of equity capital has also been established empirically (Cummins and Lamm-Tennant, 1994). Given their lack of shareholder structure, mutual insurers are not subject to fluctuations in the equity markets. For other insurers, insurance industry average return on equity reflects the cost of capital from the equity market. We expect stock insurers to be more likely to over-reserve when cost of shareholder equity capital is lower.

Hypothesis 4: Insurers are more likely to over-reserve when the cost of reinsurance is lower.

Primary insurers typically allocate approximately anywhere from 10-20 percent of their gross premium revenues to reinsurance as a means of providing surplus relief and accessing risk capital – a form of off-the-balance-sheet capitalization. When reinsurance is affordable and readily available, it represents a good opportunity for insurers to obtain additional surplus through reinsurance transaction. Browne et al. (2012) report reserve errors to be related to reinsurance usage. When cost of reinsurance is lower globally, we expect insurers to be more likely to over-reserve.

Research Methodology

This study examines determinants of insurers’ reserve errors by considering both macro-level influences as well as firm specific factors. Following previous studies (e.g. Petroni, 1992; Beaver et al., 2003), the size of a reserve error is defined as:

\[ \text{Error}_{i,t} = [\text{Incurred Losses}_{i,t} - \text{Incurred Losses}_{i,t+5}] \]
where $Incurred Losses_{i,t}$ is insurer $i$’s estimated incurred losses and allocated expenses at the end of year $t$ for premium earned in year $t$. $Incurred Losses_{i,t+5}$ is the re-estimation of the incurred losses and expenses made five years later for premiums earned in year $t$. A positive (negative) value of $Error_i$ indicates insurer $i$ has overstated (understated) reserve errors.\footnote{Previous studies that examine the magnitude of reserve errors have sometimes used the absolute value of reserve errors to control for the direction of over/under-reserving errors (see for example, Browne et al., 2009 and Brandt et al., 2013). Given our interest in assessing whether insurers tend to over- or under-reserve, as opposed to the magnitude of such errors, similar segmentation of our data based on the direction error would have little merit in this analysis. Our approach here is consistent with that of Grace and Leverty (2012) and Eckles and Halek (2010).}

Previous studies have found that a five-year period is sufficient to observe statistically significant reserve errors (see for example, Smith, 1980 and Kazenski et al., 1992). To control for the variation in insurer size, reserve error will be scaled using a firm’s total admitted assets (Petroni, 1992; Gaver and Paterson, 2001).

Insurer’s loss reserve estimation from year to year may be highly correlated. To capture the dynamic effect of economic behavior, we include a lagged reserve error along with other exogenous variables as our explanatory variables. Even though the coefficient of the lagged dependent variable may not be of direct interest, estimation using dynamics models may be crucial for obtaining consistent estimates of other parameters. Therefore, we estimate the following equation:

$$y_{i,t} = \alpha y_{i,t-1} + \delta k_i + \gamma x_i + \phi \mu_i + \epsilon_{i,t}$$

(1)

where $y_{i,t}$ represents reserve error for firm $i$ at year $t$ and $y_{i,t-1}$ is its lagged value. $k$ and $x$ are matrices of industry level and firm level variables, respectively. $\mu_i$ is set of dummy variables that identify the organizational structure of insurers and $\epsilon_{i,t}$ is the error term. At the industry level, we control for cost of capital from four sources: insurance premiums, investment opportunities, shareholder equity, and reinsurance. Our proxies for the cost of that capital include: the insurance premium rate, the annual rate of return for S&P 500, the insurance industry return on equity, and the price of reinsurance, respectively. As a means of controlling for the level of reliance insurers have for each of the main sources of capital, we identify the weight each source of capital (i.e. premiums, investment income and realized capital gains, shareholder equity, and reinsurance) represents as a component of total capital and include those variables in the analysis. Specifically, we include the ratio of premiums to policyholder’s surplus, percentage of investment in stocks, percentage of owner’s equity in policyholder’s surplus and one minus reinsurance retention ratio for each firm to capture insurer’s exposure to each source of capital. Additionally, we include several other firm level factors that have been found in the academic literature to affect reserve errors, including: firm size, group affiliation, line of business as well as geographic diversification, organization forms, income smoothing and tax minimization motives.
Our data will be collected from several sources. The NAIC annual statement contains information that allows for the construction of the variable that measures the insurer’s reserve errors as well as other control variables. Insurance industry level data and capital market data will be obtained from the SNL database and S&P, respectively. Insurer rating information is available from the Best’s Key Rating Guide. Our sample will cover all property casualty insurers that report positive values on assets and net premium written and we will utilize data from 1996 to 2011 for our analysis. This sample period allows us to calculate reserve errors for operating years 1999 to 2006 as well as average return on assets in the past three years for each operating year. This time period covers both a hard market as well as a soft market which allows us to examine the impact of various market conditions on insurer’s reserving behavior.

We use generalized method of moments (GMM) estimators to estimate equation (1) as proposed by Arellano and Bond (1991) and Arellano and Bover (1995). When taking the first-difference of each variable, individual fixed effects are eliminated from the equation in GMM models and lagged values of the repressors are used as instruments. Given our interest in controlling for various organization forms, we use system GMM estimators so time-invariant variables can be included as regressors. Another benefit of system GMM is the ability to treat firm specific regressors as endogenous variables so the effects of loss reserve errors on insurer financial statement can also be controlled in the empirical models. While the reserve error patterns of insurers employing different organizational forms are similar, the intensity of the experience differs significantly. To capture the varying effects environmental factors have on insurer’s reserving behavior for different types of firms, we also re-estimate equation (1) separately for publicly traded stock insurers, privately held stock insurers and mutual insurers. As a robustness check, we will also estimate alternative models using panel data fixed effects and random effects models. To account for serial correlation in reserve estimation, our standard errors will adjust for potential autocorrelation in panel data models. Additionally, we will cluster our standard errors by firm, as well as by time period, to adjust the standard errors for possible dependence across the residuals (Thompson, 2006 and Peterson, 2009).

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2 When a lagged dependent variable is included in the model, OLS and static panel data methodologies are biased and inconsistent due to the correlation between the lagged dependent variable and company specific effects. Arellano and Bond (1991) and Arellano and Bover (1995) developed the GMM estimators that produce consistent and unbiased coefficient estimates when lagged dependent variables are present.
Reference


D. Expected Outcome from the Project

We expect to present the preliminary results of our research at the 2013 American Risk and Insurance Association Annual Conference. Additionally, we have targeted the *Journal of Risk and Insurance* as an outlet for publication.

E. Importance to the Discipline

The cost and availability of capital underlie the ability of the insurance industry to function. While insurers are required to establish their own loss reserve estimates, those estimates materially affect the structure of their cost of capital. Therefore, insurer management is incentivized to manipulate those estimates to achieve reporting and operational outcomes during periods of relatively higher/lower alternative sources of capital. In contrast, both regulatory and accounting standards call for “best guess” estimates that do not allow for contemplation of the insurer’s cost of capital. If our hypotheses are substantiated, they will imply that the industry, as a whole, tends to take advantage of the accounting leverage that loss reserve manipulation provides. In a marketplace that has recently been the subject of related accounting scandals (e.g. *State of New York v AIG*) and generally suffers from a lack of public trust, the illumination of current managerial decision-making in the industry should be of acute interest to multiple entities, including regulators, legislators, investors, the industry itself, and of course, the general public. While the findings (if our hypotheses are supported) may cause some to question industry accounting practices, they will also provide many insurers in the industry who abstain from similar tactics with an opportunity to positively differentiate themselves from the rest of market.

Additionally, our study contributes to the literature on insurer loss reserving behavior in several ways. First, this is the first to examine comprehensively the effect market environment has on insurer’s loss reserving behavior. Previous studies examining loss-reserving behavior have been limited to firm level analysis, but neglected to consider systematic influences at the broader environment. We believe the missing variable biases may have resulted in model misspecification in some previous studies. In this research we consider not only firm specific factors that may have contributed to specific loss reserving behavior but also the implications of the cost of alternative sources of insurer capital at the macro level. This study also uses a more sophisticated methodology that controls for dynamic responses. We estimate dynamic models by using system GMM that incorporate lagged reserve errors while previous studies in this area have used static models. System GMM not only allow us to include time-invariant variables in the model, but also has the ability to treat firm specific regressors as endogenous variables so the effects of loss reserve errors on insurer financial statement can also be controlled in the empirical models, which yield more accurate inferences with regard to the model results.