Three Essays on Insurer Loss Reserve Errors

by

Evan Mark Eastman

(Under the Direction of David L. Eckles)

Abstract

My dissertation investigates three areas related to insurer loss reserve errors. Property-liability insurers are required to report revisions to their initial estimates of loss reserves for future claim payment. Comparing these revisions to the initial estimate creates a direct measure of managerial bias. I first examine whether firms manage loss reserves asymmetrically in response to deviations from a target financial strength rating. I find evidence of income-increasing earnings management for firms with actual ratings below their target, but no evidence of reserve management for firms at or above their target rating. In my second essay I examine whether reserve management related to executive compensation is consistent across ownership structures, and only find evidence of reserve management for stock insurers. Finally, I examine and find evidence to support the hypothesis that managerial style plays a role in determining reserve error magnitude and accuracy.

Index words: Accounting Discretion, Insurance, Reserve Management, Ratings, Executive Compensation, Executive Fixed Effects, External Monitoring

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# Dedication

This dissertation is dedicated to my parents, Anne and Evan Eastman.

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# Chapter 1
# Insurer Loss Reserves

## 1.1 Introduction

Insurer loss reserves have frequently been used as a measure of managerial discretion within the accounting and insurance literature. They provide a strong measure of managerial discretion that has several advantages over residual-based measures traditionally used in the accounting literature (e.g., Jones, 1991). Reporting requirements for insurance firms require reporting of an initial estimate of sufficient loss reserves, as well as development over time, which has allowed researchers to compare initial estimates to actual outcomes. By isolating the discretionary component of loss reserve errors, researchers are able to examine how firms respond to various incentives, such as earnings smoothing (e.g., Weiss, 1985; Beaver, McNichols, and Nelson, 2003; Grace and Leverty, 2012), regulation (e.g., Petroni, 1992; Gaver and Paterson, 2004; Grace and Leverty, 2010), and executive compensation (e.g., Eckles and Halek, 2010; Eckles et al., 2011).

In this dissertation, I examine several topics, all related to insurer loss reserve errors. In this chapter, I provide an overview of the measurement and literature related to loss reserve errors. In the Chapter 2 I examine incentives related to insurer financial strength ratings. Specifically, I examine whether firms manage loss reserves if they deviate from a target rating. In Chapter 3 I examine the intersection of reserve management, executive bonus compensation, and ownership structure. Ownership structure in the insurance industry allows me to examine whether incentives to manage earnings in an attempt to increase bonus compensation differs across public, private, and mutual firms. Finally, in Chapter 4 I examine whether managerial style plays a role in determining loss reserve errors.

## 1.2 Loss Reserve Error Measurement

Loss reserves are a liability on a property-liability insurer's balance sheet representing the estimated cost of settling claims.[1] They are generally the largest liability.[2] In general, a firm's actuaries will present a recommended range of acceptable loss reserves, with management choosing the ultimate loss reserve amount for a given year. As claims occur and are reported over time, an insurer will revise their original loss reserve estimate for each year. These revisions, called development, indicate whether the insurer initially under- or overreserved. This information, as well as information on the settlement of claims, is reported to the National Association of Insurance Commissioners (NAIC) in annual statutory filings on Schedule P.

An excerpt from Schedule P can be found in Table 1.1. These data are used to construct the loss reserve error for firm $i$ for year $t$ as follows:[3]

$$Error_{i,t} = Incurred\ Losses_{i,t} - Incurred\ Losses_{i,t+n} \tag{1.1}$$

This error is calculated as the initial loss reserve estimate in year $t$ minus the total incurred losses in year $t+n$. The sum of the boxed values under column 6 in Table 1.1 are the incurred losses in year $t$ and the sum of the boxed values under column 11 are the incurred losses in year $t+n$. The error, also used in previous studies (e.g., Beaver, McNichols, and Nelson, 2003; Gaver and Paterson, 2004; Grace and Leverty, 2010), will be positive if the initial loss reserve estimate is overestimated and negative if the initial loss reserve is understated. To

[1] This is also true for life insurers and health insurers. Life insurers are not required to make detailed reporting for their life business in the life statutory filings, likely since there is less discretion in reserving for life insurance due to the existence of accurate mortality tables. Health insurers do report reserve development, though it is only for four years instead of the 10 years reported for property-liability firms in Schedule P.

[2] The percentage of liabilities tends to be between 40 and 50 percent depending on the sample period (Petroni, 1992; Gaver and Paterson, 2004; Berry-Stölzle, Eastman, and Xu, 2016).

[3] Note that in Chapter 3, I use the negative of this number for consistency with Eckles and Halek (2010).

control for insurer size and to express the loss reserve error as a percentage, this difference is typically scaled by the firm's total assets.[4]

According to McNichols (2000), there are several advantages to using loss reserve errors as a measure of earnings management. For one, it is a material accrual, as the loss reserve is generally the largest liability on an insurer's balance sheet. Also, due to reporting requirements, the development of loss estimates over time are observable, which allows comparisons of revisions to the original accounting estimate. The discretionary manipulation of loss reserves has been frequently utilized in the literature because of its strength as a measure of earnings management compared to models that use regression residuals as a measure of managerial discretion (e.g., Jones, 1991; Dechow, Sloan, and Sweeney, 1995; Kang and Sivaramakrishnan, 1995). Finally, loss reserve errors have been linked to various incentives such as earnings smoothing, regulation, and executive compensation.

## 1.3 Prior Literature

The majority of prior literature on insurer loss reserve errors has examined incentives related to managing the loss reserve relative to a specific incentive. In the accounting literature the reserve error has been used as a proxy for "earnings management." In the remainder of this section, I provide an overview of some of the major areas where prior literature has investigated incentives for reserve management.

### 1.3.1 Earnings Smoothing

Weiss (1985) and Grace (1990) examine whether insurers use loss reserve management to smooth their income. The idea of "income smoothing" is that firms can manage reserves to make earnings more consistent from year to year such that the firm is perceived to be less

[4]Prior studies report that results are generally robust to different scaling variables. Beaver, McNichols, and Nelson (2003), Gaver and Paterson (2004), and Eckles and Halek (2010) report that their results are robust to scaling choice. Petroni and Beasley (1996) report results with reserve error scaled by both assets and 1.6 × (the larger of assets or net premiums written)$^{\frac{2}{3}}$ and find their results to be robust.

risky. As loss reserve management impacts a firm's earnings, firms could manage reserves up or down to make earnings appear more consistent over time. Weiss (1985) specifically examines a group of firms operating in automobile liability lines and tests whether they smooth underwriting income. She documents a negative and statistically significant relationship between two measures of combined ratio and insurer loss reserve error, which provides support for income smoothing. Grace (1990) also tests for and finds evidence of income smoothing. Specifically, she finds that a firm's average income over the past three years scaled by premiums earned is positively related to under-reserving, which she interprets as evidence of earnings smoothing.

Beaver, McNichols, and Nelson (2003) test for earnings management across the earnings distribution. Specifically, they examine whether firms manage their loss reserves to achieve a certain target for earnings. They find evidence that firms with a small positive profit tended to under-reserve, suggesting that they under-reserved to achieve this profit. They also find evidence of under-reserving for firms with low earnings, consistent with financially weak firms under-reserving (e.g., Petroni, 1992; Grace and Leverty, 2012). They also find evidence that reserve management differs across organizational forms. Specifically, Beaver, McNichols, and Nelson (2003) find that public and mutual firms manage reserves to avoid losses, whereas privately held stock firms do not. Unlike, Beaver, McNichols, and Nelson (2003), Grace and Leverty (2012) do not find evidence that firms manage reserves to avoid a loss. They suggest that by controlling for a broader set of incentives to manage reserves compared to Beaver, McNichols, and Nelson (2003) they are more directly capturing this incentive. In failing to find a result, they suggest that firms do not manage reserves to avoid a loss.

Berry-Stölzle, Carson, and Song (2016) suggest that insurers could potentially smooth earnings not only through loss reserve discretion, but also through internal capital markets transfers. They expect, therefore, that unaffiliated firms—firms that are not members of a group—can only smooth earnings through reserve management, while affiliated firms—firms that are members of a group—can substitute between internal capital market transfers (in the form of reinsurance) and reserve discretion. Berry-Stölzle, Carson, and Song (2016) find empirical evidence of unaffiliated insurers smoothing earnings with loss reserves to a greater extent compared to affiliated insurers, which they interpret as evidence of a substitution effect between internal capital markets and loss reserves.

### 1.3.2 Regulation

Regulation is a major area of research involving loss reserve management. These studies have examined both solvency and rate regulation incentives.

Studies on solvency regulation have generally focused on the Insurance Regulatory Information System (IRIS) ratios. These ratios are used as an initial screening for financially weak insurers. Each ratio has a "usual" range. If an insurer has four or more ratios outside the usual range, they are subjected to further regulatory scrutiny, providing an incentive to stay in the usual range. There have historically been between 11 and 12 ratios. As noted by Gaver and Paterson (2004), eight of the 12 ratios are improved through under-reserving, while one is worsened through under-reserving. There is no impact on the remaining ratios.

The earliest study on the IRIS ratios and reserving manipulation is Petroni (1992). She finds evidence that firms that are "close" to violating their fourth IRIS ratio, thus causing regulatory intervention, tend to under-reserve. Specifically, she examines insurers who would have triggered their ratio in the absence of under-reserving, and finds that firms appear to manipulate to prevent triggering the fourth ratio.

Gaver and Paterson (1999) suggest that firms' incentives to manipulate reserves to avoid violating IRIS ratios changed following the 1994 adoption of risk-based capital (RBC) requirements. They find evidence to support this claim. Gaver and Paterson (2004) find evidence consistent with Petroni (1992) that firms who would have had four or more IRIS ratio violations tended to manage reserves in a manner that resulted in three or fewer ratio violations.

Grace and Leverty (2012), however, suggest that since eight of the 12 IRIS ratios can be improved by under-reserving these previous empirical findings may simply be driven by financial weak firms under-reserving.[5] They provide support for this claim by including a predicted probability of insolvency in their models. They find that this probability of insolvency is significantly related to under-reserving, suggesting that financially weak firms may under-reserve to improve perceived performance, but not necessarily as a result of managing reserves to avoid IRIS ratio violations.[6]

A relatively less studied area related to reserve management is rate regulation. The two main studies in this area are Nelson (2000) and Grace and Leverty (2010). Nelson (2000) hypothesizes that firms subject to stringent rate regulation will have an incentive to under-reserve in an attempt to convince regulators that they can charge a lower price. Grace and Leverty (2010), on the other hand, suggest that these strictly regulated firms will have an incentive to overreserve. This is the result of rate regulation suppressing prices below the cost of providing insurance in these states and lines. Insurers will overreserve to try to convince regulators that higher rates are required for insurers to continue offering insurance.

While Nelson (2000) finds evidence consistent with firms under-reserving when subjected to stringent rate regulation, Grace and Leverty (2010) suggest that her tests are incomplete as they do not consider other discretionary and non-discretionary incentives that determine loss reserve errors. In their multivariate tests, Grace and Leverty (2010) find evidence that

[5] Petroni (1992) also finds evidence that financially weak firms tend to under-reserve, when financial weakness is measured independently of IRIS violations.

[6] Grace and Leverty (2010) also use the predicted probability of insolvency as a control variable and find similar results to Grace and Leverty (2012).

as firms write proportionally more business in states and lines that are subject to stringent rate regulation, they tend to overreserve, consistent with their hypothesis.[7]

### 1.3.3 External Monitoring

While the other areas highlighted in this review consider *whether* firms manipulate reserves, there is also a strand of literature that considers their *ability* to manipulate. These studies generally focus on whether high quality external monitoring can prevent firms from manipulating their loss reserves.

Petroni and Beasley (1996) are the first to consider whether audit firm type plays a role in reserve accuracy. They fail to find evidence that reserve accuracy, measured as the absolute value of the loss reserve error, differs in cases where an insurer has a Big 8 auditor. Gaver and Paterson (2001) extend this work by considering not only the audit firm, but also the actuarial firm that audits the insurer. Their results suggest that high quality auditing by Big 6 auditors alone is not enough to mitigate reserve errors. Big 6 auditors are less effective at decreasing reserving errors when they use non-Big 6 actuaries. Gaver and Paterson (2001) interpret this result to indicate that expertise is also necessary when auditing insurers, as loss reserves are unique to insurance firms.

Gaver and Paterson (2007) examine whether the importance of an insurer to their auditor allows them to exercise more discretion in setting their loss reserve. They hypothesize that if an insurer is financially important to an auditor, they may "go easy on them" to preserve their business. They fail to find evidence of this and find that audit firms who receive a large portion of their business form an insurer are actually harder on these insurers when they are financially weak.

[7] Grace and Leverty (2012) include a stringent rate regulation variable in their models and find evidence consistent with Grace and Leverty (2010).

### 1.3.4 Executive Compensation

A relatively recent strand of literature has examined whether executives at insurance firms manage loss reserves to maximize their overall compensation. Examining executive compensation is a particularly strong incentive, as it relates directly to an executive's utility, unlike other incentives which relate to a firm's performance. Browne, Ma, and Wang (2009) examine whether executives have an incentive to manipulate reserves if they receive a higher proportion of equity compensation. They find evidence that firms with executives who have more exposure to movements in stock price are more likely to under-reserve. The interpret this as consistent with firms under-reserving (i.e., overstating earnings) in an effort to increase stock price. Browne, Ma, and Wang (2009) do not, however, find evidence of reserve manipulation related to other executive compensation incentives. Specifically, they find no evidence that the percentage of executive compensation in bonus or long-term incentive plans influences reserving.

Eckles and Halek (2010) also investigate how executive compensation influences reserve manipulation. They find evidence that managers holding more restricted stock tend to under-reserve. This could be as a result of executives looking to sell their restricted stock (assuming the restricted stock conditions have been satisfied) inflating earnings in the current period through under-reserving. Additionally, Eckles and Halek (2010) find that managers manipulate reserves to increase their overall bonus pay. Specifically, the find that executives of firms with "good" or "poor" performance tend to overreserve, while executives of firms with "adequate" performance tend to under-reserve.[8] This is consistent with managers overreserving when they are either too far from triggering a bonus payment ("poor" performance) or already having maximized their bonus payment ("good" performance). Managers who

[8] Eckles and Halek (2010) measure performance as a firm's return on assets. They then create indicators for "poor," "adequate," and "good" performance which is interacted with the percentage of total compensation that is a bonus.

can increase their current-period bonus compensation under-reserve to improve perceived firm performance ("adequate" performance).

Eckles et al. (2011) consider whether strong corporate governance can prevent executives from manipulating reserves to increase their compensation. Measuring corporate governance with board size, percentage of outside directors, and CEO/Chairman duality, they find that stronger governance can mitigate the ability of executives to manage reserves to increase their overall compensation.

## 1.4 Conclusions

While a good deal of work has already been done examining the incentives and determinants related with insurer loss reserve errors, there is still a good deal of emerging work in this area. For example, a few recent papers (e.g., Eckles, Halek, and Zhang, 2014; Carson, Eastman, and Eckles, 2016; Carson, Eckles, and Song, 2016) use reserve error volatility as a proxy for earnings quality. There has also been relatively little work examining the interaction of insurer loss reserves and capital markets (e.g., Beaver and McNichols, 1998; Petroni, Ryan, and Wahlen, 2000). In the remaining chapters of this dissertation, I examine three areas—ratings, compensation/ownership structure, and managerial style—that I feel make meaningful contributions to the established, yet evolving literature on insurer loss reserves.

Table 1.1: Excerpt from Schedule P—Part 2

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Excerpt from the 2011 Annual Statement of ACE American Ins Co.* | | | | | | | | | |
| | *NAIC Property-Liability Annual Statement: Schedule P—Part 2—Summary* | | | | | | | | | |
| | *Incurred Net Losses and Defense and Cost Containment Expenses Reported at Year End ($000 omitted)* | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Accident Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
| Prior | 5,078,038 | 5,071,351 | 5,797,589 | 6,254,020 | 6,226,103 | 6,196,693 | 6,272,376 | 6,319,513 | 6,380,162 | 6,556,014 |
| 2002 | 1,500,643 | 1,577,357 | 1,781,499 | 1,694,376 | 1,764,741 | 1,730,440 | 1,693,571 | 1,701,902 | 1,710,655 | 1,698,728 |
| 2003 | | 2,287,425 | 2,070,036 | 2,193,082 | 2,128,955 | 2,009,994 | 2,005,987 | 1,950,893 | 1,965,579 | 1,922,897 |
| 2004 | | | 2,888,365 | 2,592,836 | 2,603,694 | 2,278,069 | 2,235,793 | 2,246,927 | 2,187,825 | 2,172,853 |
| 2005 | | | | 3,435,994 | 3,284,263 | 2,962,984 | 2,845,413 | 2,812,629 | 2,784,845 | 2,774,656 |
| 2006 | | | | | 3,062,746 | 2,886,813 | 2,880,132 | 2,813,843 | 2,753,745 | 2,601,211 |
| 2007 | | | | | | 3,285,381 | 3,003,720 | 2,927,313 | 2,893,535 | 2,896,689 |
| 2008 | | | | | | | 3,516,789 | 3,555,336 | 3,548,912 | 3,519,332 |
| 2009 | | | | | | | | 2,782,336 | 2,690,015 | 2,637,746 |
| 2010 | | | | | | | | | 2,942,142 | 2,952,660 |
| 2011 | | | | | | | | | | 3,452,200 |

Note: This table is an excerpt from the National Association of Insurance Commissioner's annual statutory filing. Schedule P—Part 2 data are used to construct loss reserve errors. Loss reserve errors are defined as $Error_{i,t} = \textit{Incurred Losses}_{i,t} - \textit{Incurred Losses}_{i,t+n}$. I use 5-year errors, so $n = 5$. For the firm-year represented in the above table, I sum the top 6 values in column 6, (which equal 19,070,502) and subtract from that the sum of values in column 11 (17,726,359). The loss reserve error equals 1,344,143. Here, the firm overreserved by approximately $1.3 billion. In general, a negative number indicates under-reserving, while a positive value indicates overreserving.

# Chapter 2
# Target Financial Strength Ratings

## 2.1 Introduction

Prior research has shown, perhaps not surprisingly, evidence of firms managing earnings to achieve a specific (target) rating. Notably, in a recent study Alissa et al. (2013) find empirical evidence that firms manage earnings in *both* directions (i.e., upward and downward) in an effort to move a rating upward or downward towards a target rating. Intuitively it seems clear that firms will manage earnings upwards to improve a rating, however, Alissa et al. (2013) also note that there may be incentives for above-target-rating firms to *reduce* their rating. Relying on survey results presented in Graham and Harvey (2001), Alissa et al. (2013) point out that firms consider a rating to be "too high" as creating an unnecessary cost. This response is contrary to results in the target capital structure literature, where Kisgen (2006, 2009) finds evidence that firms reduce leverage following a ratings downgrade, but make no adjustment following an upgrade. Although there may exist differential incentives, Alissa et al. (2013) indeed find evidence of a symmetric effect with firms managing earnings in both directions ostensibly to improve or even reduce a rating. Using a unique dataset as well as improving upon the methodology in Alissa et al. (2013), I am able to disentangle the effects and show a more intuitively appealing result where firms only manage earnings to improve their financial rating. My study should be viewed as unifying the notion of firms managing earnings to obtain higher ratings (e.g., Alissa et al., 2013) yet forgoing earnings management in instances when a given rating is too "high" (as in the target capital structure literature, e.g., Kisgen (2006, 2009)).

Studies involving earnings management and specific targets (e.g., ratings, leverage, etc.) are inherently difficult. Studying earnings management, broadly, is itself not simple since observing the actual management of earnings is challenging. Though valiant attempts are made to derive a measure of earnings management, measurement error certainly exists. Similarly, since firms rarely (if ever) publicly announce a ratings goal, studying incentives around a "target" rating, that must be estimated, also introduces measurement error. Using a unique dataset, my sample allows me to minimize the measurement error associated with these two important variable constructions. Further, the results presented account (econometrically) for what measurement error does remain.

In order to minimize the measurement error, I turn to the property and liability (P&L) insurance industry for examination. For a number of reasons, the P&L insurance industry is an excellent laboratory to investigate this specific issue. First, I minimize the measurement error around earnings measurement by using loss reserve errors as a measure of earnings management. Each year insurers accrue a liability for unpaid losses. Over time, they must disclose how these estimated losses develop as they reflect actual losses paid and changes in estimates. This allows for observability of the actual error made in the original accounting estimate. McNichols (2000) suggests that commonly used earnings management models based on model residuals (e.g., Jones, 1991; Dechow, Sloan, and Sweeney, 1995; Kothari, Leone, and Wasley, 2005) can be unreliable and instead recommends focusing on specific accruals that are material to a firm.[1] Indeed, loss reserve errors have been frequently used as a measure of managerial discretion, being linked to various incentives, such as income smoothing (Weiss, 1985; Beaver, McNichols, and Nelson, 2003), financial weakness (Gaver

[1]Loss reserves are material as they are generally the largest liability on an insurer's balance sheet. Petroni (1992), for example, reports that the average firm in her sample has loss reserves that account for 44.3 percent of total liabilities. The average firm during my sample period (1992-2008) has loss reserves that account for 42.2 percent of total liabilities.

and Paterson, 2004; Grace and Leverty, 2012), regulation (Nelson, 2000; Grace and Leverty, 2010), and executive compensation (Eckles and Halek, 2010; Eckles et al., 2011).

To mitigate measurement error around estimation of a "target rating," I note that a subset of insurers (commercial insurers) are dependent on a specific rating, "A-." A rating of at least "A-" is particularly important for commercial writers, as many corporations will not purchase insurance from insurers with a rating below "A-." Epermanis and Harrington (2006) and Halek and Eckles (2010) find empirical evidence that there are substantial costs associated with an insurer's failure to maintain a rating of at least "A-." Further, Alissa et al. (2013) note that investors are particularly aware of "investment grade" ratings, providing an incentive for firms to managing earnings around a specific rating.[2] Here, I have a specific subsample of firms (those with a commercial focus) where this "investment grade" rationale particularly holds. For these firms I argue an exogenous target is given (i.e., "A-") which allows me to minimize estimation error (associated with estimating a "target rating").

An additional advantage of focusing on the insurance industry is that there exists an industry-specific financial strength rating. A.M. Best (Best) has offered financial strength ratings of insurers since its incorporation in 1899. These ratings represent Best's opinion on an insurer's ability to continue to pay claims to policyholders in the future. Indeed, financial strength ratings have been shown to be positively associated with insolvency risk (Pottier and Sommer, 2002; Doherty, Kartasheva, and Phillips, 2012). Unlike credit ratings, which can focus on an individual security, financial strength ratings reflect the firm as a whole.[3] Since ratings serve as an insolvency measure, they are important to an insurer as many corporate insurance purchasers have minimum ratings requirements and personal-lines consumers are price sensitive with respect to ratings (e.g., Berger, Cummins, and Tennyson,

[2]Alissa et al. (2013) do consider a "investment grade cutoff," though a heterogenous set of firms will perceive differing advantages to achieving an investment grade rating. For commercial insurers, the advantages to achieving an "A-" is much more consistent.

[3]Credit ratings certainly reflect the strength of a firm, but will also reflect the idiosyncrasies of an individual security. Financial strength ratings remove this source of variability.

1992). Accordingly, losing a high rating is associated with significant costs (Doherty and Phillips, 2002). Capital markets also react negatively to ratings downgrades (Halek and Eckles, 2010; Wade, Liebenberg, and Blau, 2016). For these reasons insurers will have incentives to achieve and maintain a high target rating.

Another advantage of using insurers stems from regulatory reporting requirements. Because most firms are required to report financial information to regulators, my sample is broader, consisting of different organizational forms. The insurance industry has a variety of ownership structures including public and private stock firms, as well as mutual companies. Therefore, my study is not restricted to only publicly traded firms. These differing organizational forms each have separate agency conflicts that may influence the incentives of managers to manipulate loss reserves (Mayers, Shivdasani, and Smith, 1997; Cummins, Weiss, and Zi, 1999; Burgstahler, Hail, and Leuz, 2006).

I find evidence that firms manage earnings upward, through under-reserving (i.e., under-reporting losses), when they are below their target financial strength rating. I find no evidence of reserve management for firms that have an actual rating above their target financial strength rating. This result is robust to alternative definitions of target rating. More specifically, in addition to using an ordered probit model to estimate a target rating (as in Alissa et al. (2013)) I also focus on insurers writing predominantly commercial lines and measure their target as "A-."[4] I also use past ratings as a proxy for a target rating and adapt a model from the target leverage literature (e.g., Flannery and Rangan, 2006) to test my hypotheses that firms will manage reserves to attain a target rating.

Alissa et al. (2013) is the most similar study to mine.[5] They find that firms use accruals-based and real activities earnings management in order to attempt to achieve a target S&P

[4]As noted above, Epermanis and Harrington (2006) and Halek and Eckles (2010) find evidence that maintaining a rating of "A-" is particularly important to insurers.

[5]Jung, Soderstrom, and Yang (2013) examine earnings *smoothing* incentives related to credit ratings. Demirtas and Cornaggia (2013) examine earnings management incentives around initial credit ratings.

credit rating. My study extends and improves on Alissa et al. (2013) in several important ways. First, I explicitly examine the asymmetric effect of managerial incentives around ratings. That is, I examine whether incentives to manage earnings differ between above-target rating firms and below-target rating firms.[6] My empirical finding that incentives do differ between these two groups is a significant contribution that is both consistent with literature examining how firms adjust leverage following ratings changes (Kisgen, 2006, 2009) and intuitively appealing with regards to managerial incentives.[7] This finding is strikingly stable across all of my tests.

Second, I utilize a unique group of firms that allows me to minimize estimation error with regards to the measurement of earnings management and the measurement of a "target rating." Insurers have been used in prior studies to provide better measurement of earnings management (Petroni, 1992; Gaver and Paterson, 2004; Grace and Leverty, 2010), but I also leverage another benefit of utilizing insurers by considering the existence of an industry-specific target rating to provide a better measure of a ratings target. In addition to this measure, I also consider alternative definitions of target ratings that are not considered by Alissa et al. (2013). For any remaining measurement error, I account for econometric issues created when there is a generated regressor present in my model. Finally, I also examine whether high quality external monitoring (i.e., Big 4 audit firms and Big 4 actuarial firms) can mitigate the ability for firms to manage earnings if they are below their target rating.

My study contributes to the literature on earnings management, in general, and loss reserve management, in particular. My study also contributes to the literature on ratings, providing further evidence that ratings are highly important to firms (Kisgen, 2006, 2009). The findings in this paper both extend and complement the findings of Alissa et al. (2013)

[6]In footnote 20 of Alissa et al. (2013), the authors note that their results, of a symmetric response, are consistent when considering above- and below-target firms, though results are not presented.

[7]That is, it is easy to imagine why a manager may desire to undertake activities that increase a rating, but a bit harder to consider a manager undertaking activities to reduce a given rating.

and provide further support for the idea that firms manage earnings in response to deviations from expected ratings, albeit in an asymmetric fashion.

The rest of my paper proceeds as follows. In Section 2.2 I provide background on insurer loss reserve errors and financial strength ratings, as well as a brief summary of prior literature. In Section 2.3 I develop my testable hypotheses. In Section 2.4 I describe my research design. In Section 2.5 I describe my data and provide my empirical results. In Section VI I end with a brief conclusion.

## 2.2 Background

### 2.2.1 Financial Strength Ratings

A.M. Best financial strength ratings reflect the agency's opinion on a firm's ability to meet its obligation to pay policyholders and to, therefore, remain solvent. Unlike debt ratings, financial strength ratings reflect the risk of the firm overall, as opposed to one security. Insurers have numerous incentives to maintain a high financial strength rating as they are of interest to regulators, consumers (corporate or individual), and agents.

Doherty and Phillips (2002) examine whether rating standards have changed over time, and find evidence that the increased stringency of A.M. Best is one potential explanation for the capital buildup of P&L insurers in the 1990s. Pottier and Sommer (2002) find empirical evidence that A.M. Best ratings are better predictors of insolvency compared to measures used by regulators (e.g., Risk-Based Capital (RBC) ratios). Epermanis and Harrington (2006) document that firms experience a decrease in premiums written following ratings downgrades. They find that this effect is stronger for firms that write primarily in commercial lines of insurance. Halek and Eckles (2010) examine market reactions to financial strength ratings changes. They document significant negative market reactions to ratings downgrades. Additionally, Halek and Eckles (2010) find evidence that reactions are significantly higher in magnitude for firms that experience the loss of a rating of "A-." Wade, Liebenberg, and Blau (2016) find empirical evidence of abnormally high short selling for insurers prior to a ratings downgrade. This suggests that investors can anticipate ratings downgrades and profit from negative reactions.

## 2.3 Hypothesis Development

Since A.M. Best financial strength ratings represent the overall ability of a firm to meet policyholder obligations, they are important to firms. Negative consequences of a low financial strength rating, such as not being able to sell to certain corporate customers, lower prices, and negative stock market reactions, provide an incentive for below-target-rating firms to take action to achieve a higher rating. Additionally, Kisgen (2006, 2009) notes in his analysis of leverage and credit ratings, that there may be incentives for firms to attempt to obtain upgrades, but not necessarily downgrades.

Alissa et al. (2013), however, note there may also be incentives for above-target-rating firms to *reduce* their financial strength rating. Graham and Harvey (2001) survey CFOs and find that firms view a rating that is higher than expected as an unnecessary cost.[8] Alissa et al. (2013) conclude, following their empirical analysis, that firms above (below) their target rating tend to manage earnings downward (upward). However, their empirical strategy does not allow them to disentangle whether this result is driven by above-target firms or below-target firms (or both). I propose that the costs associated with being below a target rating are significantly greater than those imposed for being above a target rating. I, therefore, separately examine above-rating and below-rating firms in my analysis.

As firms are penalized by consumers and investors for having a low rating and they (potentially) incur unnecessary costs for being above target ratings, they have an incentive

[8] Graham and Harvey (2001) are concerned with credit ratings unlike my study which investigates financial strength ratings.

to manage reserves if they are not at their target rating.[9] Therefore, firms below their target rating could make income-increasing earnings management decisions (underreserving) in an effort to achieve a higher financial strength rating. Further, firms above their target rating could make income-decreasing earnings management decisions (overreserving) in an effort to achieve a lower financial strength rating. This is consistent with the empirical findings of Alissa et al. (2013) on a sample of non-financial firms using credit ratings. I additionally examine whether the empirical findings in Alissa et al. (2013) are driven by either above-target or below-target firms.

A firm is likely better able to estimate its own loss exposure, and thus its level of loss reserves, than A.M. Best due to information asymmetry that exists between a firm and A.M. Best. A firm's actuaries and managers have full access to information on the policies they have written. A.M. Best relies on their own model to estimate loss reserves, which may differ from the one used by each firm (A.M. Best, 2014). Since changes in income are more observable than mistakes in reserving, firms can under (over)reserve to improve (reduce) performance in an effort to achieve a higher (lower) rating.

I, therefore, propose the following hypothesis:

**H1**: *Firms that deviate from their target financial strength rating will manage their loss reserves.*

A finding supporting both hypotheses would be consistent with Alissa et al. (2013). I also expect that if the finding of Alissa et al. (2013) is driven by one group of firms, it will be those that are below their target rating in opposed to those that are above their target rating. The costs for being below a target are significantly higher than any costs that a firm may incur for being above their target. For example, Epermanis and Harrington (2006) finds

[9] While Best does not reveal its ratings formula, they do state some of the main variables they consider. Best specifically notes that "Operating Performance" is a key criteria, stating "Profitable insurance operations are essential for a company to operate as a going concern (A.M. Best, 2014, p. 15)."

that firms experiencing a ratings downgrade see a larger and statistically stronger decline in net premiums written compared to firms experiencing an upgrade. Similarly, Halek and Eckles (2010) find that there is an asymmetric response to ratings changes from the stock market, where downgrades experience a larger decline in stock price compared to ratings upgrades.

I, therefore, propose the following hypothesis:

**H2**: *Firms below their target financial strength rating will tend to underreserve while firms above their target rating manage reserves to a lesser extent.*

A finding in support of this hypothesis is partially consistent with the findings in Alissa et al. (2013). While Alissa et al. (2013) finds firms below their target rating manage earnings (as **H2** suggests), they also find evidence that this result persists for firms with a rating above a certain target (contrary to **H2**). Thus, finding support for **H2** would either provide a significant contribution by finding evidence of an asymmetric response to deviations from a target rating, consistent with findings in the target leverage literature (Kisgen, 2006, 2009), or verify the symmetric incentives of Alissa et al. (2013).

Prior research has examined how external monitoring can influence insurer reserving practices (e.g., Petroni and Beasley, 1996; Gaver and Paterson, 2001, 2007; Gaver, Paterson, and Pacini, 2012). When establishing loss reserves, firms are required to obtain an auditor to assess the accuracy of management's estimate. In addition to being examined by auditors, actuaries are also required to assess and submit an opinion regarding the adequacy of management's initial loss reserve estimate.[10] High quality monitoring by both audit firms and actuarial firms could result in a lessened ability for managers of insurance firms to manage reserves. Notably, Gaver and Paterson (2001) find evidence that high quality monitoring by both audit and actuarial firms results in more conservative loss reserve estimates.

[10]Gaver and Paterson (2001) note that while some firms rely on internal actuaries, the majority of firms obtain a statement from external actuaries.

In my present setting, I predict that high quality external monitoring will lessen the ability of firms to manage reserves if they deviate from their target rating. I particularly focus on firms with ratings *below* their target rating, since I expect the incentives will be strongest for these firms (see **H2**). I expect to observe high quality external monitoring (i.e., Big 4 audit firms and their affiliated Big 4 actuarial firms) resulting in a reduction of the ability of firms below their target rating to understate reserves.

I, therefore, propose the following hypothesis:

**H3**: *High quality external monitors (Big 4 audit firms and Big 4 actuaries) mitigate the ability of firms that deviate from their target ratings to manage earnings.*

I expect to empirically observe firms with high quality external monitoring and a rating below their target rating to either overreserve or at least for this effect to cancel out any underreserving I observe for firms below their target rating when I do not control for external monitoring. A finding supporting this hypothesis would be consistent with Gaver and Paterson (2001).[11]

## 2.4 Research Design

In order to estimate a target financial strength rating, I use an ordered probit model. For non-insurers, Alissa et al. (2013) use an ordered probit to estimate Standard & Poor's long-term credit rating as a function of various firm characteristics such as size, profitability, operating risk, asset specialization, and future growth options, using the fitted values from this regression to create an expected rating. Numerous studies using insurers (e.g., Pottier and Sommer, 1999; Doherty and Phillips, 2002) use ordered probit models to estimate determinants of A.M. Best ratings for insurance firms. Using the strategy of Alissa et al. (2013)

[11] Petroni and Beasley (1996) do not document a difference in reserve errors between firms with Big 8 auditors and those without. However, they do not control for the effect of having a "Big N" actuarial firm, which subsequent studies (e.g., Gaver and Paterson, 2001) have shown to be an important consideration.

and the variables identified by these insurance-specific studies, I adopt the following ordered probit model:

$$\begin{aligned} Rating_{i,t} = {} & \gamma_1 Size_{i,t} + \gamma_2 Product\ Diverse_{i,t} + \gamma_3 Longtail_{i,t} + \gamma_4 Reinsurance_{i,t} \\ & + \gamma_5 Geo\ Herf_{i,t} + \gamma_6 Growth_{i,t} + \gamma_7 ROA_{i,t} + \gamma_8 ROI_{i,t} + \gamma_9 Kenny\ Ratio_{i,t} \\ & + \gamma_{10} Earthquake_{i,t} + \gamma_{11} Surplus_{i,t} + \gamma_{12} Group_{i,t} + \gamma_{13} Hurricane_{i,t} + u_{i,t} \end{aligned} \tag{2.1}$$

where:

$i,t =$ Firm $i$ in year $t$;

$Rating_{i,t} =$ Firm $i$'s A.M. Best financial strength rating in year $t$, where 8 corresponds to the highest rating ("A++") and 1 corresponds to the lowest rating ("B-");

$Size_{i,t} =$ The natural log of firm $i$'s total assets in year $t$;

$Product\ Diverse_{i,t} =$ 1 minus a Herfindahl index based on firm $i$'s net premiums written across 24 lines of business in year $t$;[12]

$Longtail_{i,t} =$ The percentage of firm $i$'s net premiums written in long-tailed lines of business in year $t$;[13]

[12] Using net premiums written data from the Underwriting and Investment Exhibit (Part 1B-Premiums Written) in the annual statutory filings, I make the following adjustments as described in Berry-Stölzle et al. (2012). Fire and Allied Lines is defined as the sum of "Fire" and "Allied Lines." Accident and Health is defined as the sum of "Group Accident and Health," "Credit Accident and Health," and "Other Accident and Health." Medical Malpractice is defined as the sum of "Medical Malpractice—Occurrence" and "Medical Malpractice—Claims Made." Products Liability is defined as the sum of "Products Liability—Occurrence" and "Products Liability—Claims Made." Auto is defined as the sum of "Private Passenger Auto Liability," "Commercial Auto Liability," and "Auto Physical Damage." Reinsurance is defined as the sum of "Nonproportional Assumed Property," "Nonproportional Assumed Liability," and "Nonproportional Assumed Financial Lines." After these combinations I am left with 24 lines of business from which I construct the Herfindahl Index: Accident and Health, Aircraft, Auto, Boiler and Machinery, Burglary and Theft, Commercial Multi Peril, Credit, Earthquake, Farmowners', Financial Guaranty, Fidelity, Fire and Allied lines, Homeowners, Inland Marine, International, Medical Malpractice, Mortgage Guaranty, Ocean Marine, Other, Other Liability, Products Liability, Reinsurance, Surety, and Workers' Compensation.

[13] I define the following lines as long-tailed lines of business: Farmowners', Homeowners, Commercial Multi Peril, Medical Malpractice, Workers' Compensation, Products Liability, Auto Liability, and Other Liability.

$Reinsurance_{i,t} =$ Firm $i$'s reinsurance premiums ceded divided by the sum of direct premiums written and reinsurance assumed in year $t$;

$Geo\ Herf_{i,t} =$ A geographic Herfindahl index based on direct premiums written in the fifty U.S. states and Washington D.C. in year $t$;

$Growth_{i,t} =$ The percent change in firm $i$'s net premiums written from year $t-1$ to year $t$;

$ROA_{i,t} =$ Firm $i$'s net income divided by total assets in year $t$;

$ROI_{i,t} =$ Firm $i$'s net investment income divided by total assets in year $t$;

$Kenny\ Ratio_{i,t} =$ Firm $i$'s net premiums written divided by policyholder surplus in year $t$;

$Earthquake_{i,t} =$ The percentage of firm $i$'s net premiums written in earthquake insurance in year $t$;

$Surplus_{i,t} =$ The ratio of firm $i$'s policyholder surplus to total assets in year $t$;

$Group_{i,t} =$ A binary variable equal to 1 if firm $i$ is a member of a group and 0 otherwise;

$Hurricane_{i,t} =$ The percentage of firm $i$'s direct premiums written in hurricane-prone states in year $t$;[14] and

$u_{i,t} =$ The error term for firm $i$ in year $t$.

An alternative methodology includes a set of regulatory ratios, the Insurance Regulatory Information System (IRIS) ratios, as control variables in the ratings determinants model. However, prior research, such as Petroni (1992), Gaver and Paterson (1999, 2004), and Grace and Leverty (2012) examine whether insurers manipulate reserves in order to avoid violating four IRIS ratios, which would trigger regulatory intervention. Therefore, since reserve manipulation can affect the IRIS ratios, I must first calculate the "unmanipulated"

[14]These include the Gulf states—Texas, Louisiana, Mississippi, Alabama, and Florida—and the south Atlantic states—Georgia, South Carolina, and North Carolina (Cheng and Weiss, 2012).

IRIS ratios. Here, I remove the observed error in reserves, essentially assuming a reserve error of zero.[15] Using the following model, I again estimate ordered probit models for each year in my sample using "unmanipulated" IRIS ratios:[16]

$$Rating_{i,t} = \alpha_1 Size_{i,t} + \alpha_2 Mutual_{i,t} + \alpha_3^{'} X_{i,t}^{IRIS} + \eta_{i,t} \tag{2.2}$$

where $Rating_{i,t}$ is firm $i$'s A.M. Best financial strength rating in year $t$, where 8 corresponds to the highest rating ("A++") and 1 corresponds to the lowest rating ("B-") in year $t$. $Size_{i,t}$ is the natural log of firm $i$'s assets in year $t$. $Mutual_{i,t}$ is a binary variable equal to 1 if firm $i$ is organized as a mutual in year $t$ and 0 otherwise. $X_{i,t}^{IRIS}$ is a vector of firm $i$'s unmanipulated IRIS ratios in year $t$. $\eta$ is a random error term. I estimate a separate model for each year in my sample (1992-2008). I next use the estimated coefficients from these models to calculate a target rating using a firm's observed IRIS ratios (i.e., those including any reserve manipulation). I use this target as an alternative definition of a firm's target financial strength rating.

Consistent with Alissa et al. (2013), I use the results from these ordered probit models to construct a firm's target financial strength rating.[17] This target rating is the rating that has the highest fitted probability from equation (2.1) or equation (2.2). I then construct $Difference_{i,t}$, which is $Rating_{i,t}$ minus the target rating. $Difference_{i,t}$ is positive for firms with actual rating above expected rating (over-rated firms) and negative for firms with actual rating below expected rating (under-rated firms).

[15]See Gaver and Paterson (1999) for a description of calculating "unmanipulated" IRIS ratios.

[16]I use the following ratios in my estimation: gross premiums written to policyholders' surplus, net premiums written to policyholders' surplus, change in net premiums written, surplus aid to policyholders' surplus, two-year overall operating ratio, investment yield, gross change in policyholders' surplus, adjusted liabilities to liquid assets, gross agents' balances (in collection) to policyholders' surplus, one-year reserve development to policyholders' surplus, two-year reserve development to policyholders' surplus, and estimated current reserve deficiency to policyholders' surplus.

[17]Empirical results from my ordered probit models of equation (2.1) and equation (2.2) are presented in the appendix.

Table 2.1 provides the distribution of actual ratings compared to target ratings. These results are generally as expected, as most ratings are at their target. Fewer firms are predicted to have low ratings ("B+" or less) compared to the actual number of firms with these ratings. The largest deviation appears at "B++", where only 18 firm-years have "B++" as a target, while 1,589 firm-years have a rating of "B++". A possible explanation for this distribution is the importance for many firms of attaining a rating of at least "A-." I note that the number of firms targeting an "A-" rating (7,848) is substantially larger than the number of firms with "A-" rating (4,735). If it is important for firms to have an "A-" rating this could explain the low number of firms targeting a "B++" rating.[18]

Table 2.2 provides the average reserve error scaled by total assets by the intersection of actual and target rating. Positive values indicate overreserving while negative values indicate underreserving. Overall, there are no strong trends in this table. There are a few cases of firms below their target rating underreserving, but these results are not consistent.

Table 2.3 examines whether *Difference* provides an adequate measure of target rating for a firm. I would expect to see a firm's actual rating move toward its target rating over time if this is a reasonable measure of target rating. As in Alissa et al. (2013), I estimate: $\Delta \mathit{Difference}_{i,t+k} = \theta_0 + \theta_1 \mathit{Difference}_{i,t} + \omega_{i,t}$. A negative estimated coefficient of $\theta_1$ indicates mean reversion and would provide evidence that ratings do trend towards the target rating. The results in Table 2.3 provide evidence that *Difference* mean reverts over $t+1$, $t+3$, and $t+5$.

This method of measuring deviation from a target rating captures a firm's target rating in that it is the rating a firm can expect to receive based on its observable firm characteristics. Since A.M. Best does not make its exact rating formula public, firms cannot take actions to

[18] While it is possible that this is an artifact of using an ordered probit model to calculate a target rating (e.g., Cantor and Metz, 2006), I emphasize again that there is good reason to believe firms—or at least a subset of firms—are targeting a rating of at least "A-" (Epermanis and Harrington, 2006). Additionally, my subsequent tests provide similar results and would not be impacted by any concerns about using an ordered probit model to calculate my target ratings.

directly influence their rating. According to A.M. Best, they also take into account qualitative factors when assessing their rating (A.M. Best, 2014). Therefore, based on observable factors, this fitted value of a target rating proxies the financial strength rating a firm is targeting. In subsequent sections I employ different measures of target ratings as robustness checks. Notably, I take advantage of a subset of insurers—those writing predominantly in commercial lines of business—which have a particular target rating. While my research design is largely the same in these tests, measurement error associated with my target rating is substantially mitigated.

In order to test for whether firms engage in earnings management activities when their current financial strength rating differs from their target financial strength rating, I employ the following ordinary least squares (OLS) regression:

$$RE_{i,t} = \beta_0 + \beta_1 Difference_{i,t} + \beta_2^{'} X_{i,t} + \beta_3^{'} I_t + \epsilon_{i,t} \tag{2.3}$$

$$RE_{i,t} = \psi_0 + \psi_1 Above\ Target_{i,t} + \psi_2 Below\ Target_{i,t} + \psi_3^{'} X_{i,t} + \psi_4^{'} I_t + \epsilon_{i,t} \tag{2.4}$$

where $RE_{i,t}$ is reserve error scaled by total assets. $Difference_{i,t}$ is the difference between $Rating_{i,t}$ and a firm's target financial strength rating. I also disaggregate $Difference_{i,t}$ into two variables, *Above Target* and *Below Target* to examine the potential of an asymmetric effect in being either above or below a target rating. *Above Target* (*Below Target*) is equal to the number of notches above (below) a firm's actual rating is relative to their target rating, and zero otherwise.[19] **H1** predicts a positive coefficient estimate of $Difference_{i,t}$ ($\beta_1 > 0$). **H2** predicts a negative estimated coefficient of $Below\ Target_{i,t}$ ($\psi_2 < 0$) and a positive estimated coefficient of $Above\ Target_{i,t}$ ($\psi_1 > 0$), and also predicts that the magnitude of the coefficient estimate of $Below\ Target_{i,t}$ will be larger than $Above\ Target_{i,t}$ ($|\psi_1| < |\psi_2|$). $X_{i,t}$ is a vector of

[19] In unreported results, I also perform empirical tests using binary variables to represent whether a firm is above or below their target rating. While this captures the asymmetric responses to deviations from target rating, information—notably information about the distance from a target rating—is lost in this specification. Regardless, the results are consistent when using either specification.

firm-level control variables to account for discretionary and non-discretionary determinants of a firms' loss reserve error. $I_t$ is a vector of year fixed effects. $\epsilon_{i,t}$ is a random error term.

I include the following variables in order to isolate the effect of deviations from a target financial strength rating on loss reserve errors. Long-tailed lines of business require more managerial discretion, which would provide managers more discretion over reserves (Petroni and Beasley, 1996; Beaver, McNichols, and Nelson, 2003; Grace and Leverty, 2010). *Growth* controls for the incentive to underreserve in an attempt to take advantage of growth opportunities. Harrington and Danzon (1994) find that firms will use reinsurance to attempt to hide this underreserving, so I also include *Reinsurance*. *Tax Shield* proxies for an insurer's taxable income, as an insurer can overreserve to delay its current tax liability (Grace, 1990; Petroni, 1992; Eckles and Halek, 2010). I measure *Tax Shield* as an insurer's net income plus developed reserves, scaled by assets. I include *Size* as larger insurers are likely to have advantages in accurately calculating reserves as they, for example, likely employ more actuaries (Aiuppa and Trieschmann, 1987). *Product Diverse* and *Geo Herf* control for firm complexity, which is likely to increase the difficulty in correctly estimating the initial loss reserve. Managers of firms organized as mutuals are likely to have less discretion compared to managers of stock firms, so I include a mutual binary variable (Mayers, Shivdasani, and Smith, 1997; Cummins, Weiss, and Zi, 1999).[20] Firms organized as groups may reserve differently compared to unaffiliated firms, so I include a group indicator variable (Powell, Sommer, and Eckles, 2008). Firms may also have incentives to smooth earnings and could underreserve in order to attain a positive profit (Beaver, McNichols, and Nelson, 2003). I control for this incentive with *Small Profit*. Finally, prior literature has found evidence that financially weak insurers tend to underreserve (Petroni, 1992; Grace and Leverty, 2012). Similar to Grace and Leverty (2010, 2012) I regress a binary variable equal to one if an insurer became insolvent

[20]The insurance industry has multiple types of organizational forms, but stocks and mutuals are the most prominent. In firms organized as mutuals, policyholders act as the firms owners, whereas in stock firms the owners are the shareholders.

on an insurer's IRIS ratios and then use predicted values from this model as my measure of *Insolvent*.

## 2.5 Results

### 2.5.1 Data

My data on insurer financial strength ratings come from A.M. Best from 1992 to 2008.[21] Other insurer characteristics come from insurer's annual statutory filings with the NAIC from 1991 to 2013.[22] I include only property-liability insurers domiciled in the United States. Life and health insurers are excluded, as their managers have less discretion in reserving practices due to the existence of well-established actuarial tables (Petroni, 1992). Additionally, the statutory filings for life and health insurers do not contain sufficient data to calculate five-year loss reserve errors.

My final sample consists of firms who have been rated by A.M. Best and have statements from annual statutory filings with the NAIC from 1991 to 2013. My analysis is based on affiliated and unaffiliated individual insurers.[23,24] I keep only stock and mutual firms in my sample.[25] I exclude observations that are missing any of the variables needed for the analysis. Values of *Reinsurance*, *Geo Herf*, *Product Diverse*, and *Longtail* that are outside their theoretically possible range (i.e., less than zero or greater than one) are set equal to

[21] I would like to thank A.M. Best for providing the ratings data in electronic form.

[22] The reserve error calculation requires five years of data. For example, the 2003 reserve error is calculated using data from 2007. Therefore, the most recent five years of available data (2009-2013) are excluded.

[23] Some insurers are organized as a group, where they operate under common ownership with other insurance firms. For example, as of 2011, the Allstate Insurance Group is comprised of numerous subsidiaries, such as Allstate Fire and Casualty Insurance Company, Encompass Insurance Company, and Esurance Insurances Services. The NAIC statements provide financial information consolidated at the group level and also for each subsidiary. Approximately 80 percent of my sample firms are organized as groups, which is consistent with prior studies (Grace and Leverty, 2010, 2012)

[24] Eckles and Halek (2010) and Eckles et al. (2011) conduct their analysis on groups and unaffiliated single insurers. Grace and Leverty (2010, 2012) conduct their analysis at the affiliated and unaffiliated single insurer level, but report that their results are robust to conducting analysis at the group and unaffiliated insurer level.

[25] This restriction results in the exclusion of Reciprocals, Lloyd's organizations, and Risk Retention Groups.

the bounded value. I exclude firms who have an A.M. Best financial strength rating that is lower than a "B-", as these firms are severely vulnerable to insolvency.[26] All continuous variables are winsorized at the one percent level.

Table 2.4 provides summary statistics for my sample. From 1992 to 2008, the sample consists of 18,680 firm-year observations which represents 1,909 unique firms. Using assets as a scaling factor, the average magnitude of $RE$ is 0.0110. The median reserve error is positive, indicating that the majority of firms overreserved in my sample, which is consistent with prior studies on reserve errors (e.g., Beaver, McNichols, and Nelson, 2003; Gaver and Paterson, 2004; Grace and Leverty, 2010). Specifically, 61.9 percent of the firm-years in my sample had a firm overreserving. The average firm in the sample has an A.M. Best financial strength rating between "A-" and "A" (*Rating*=5.4781). The median rating is an "A" (*Rating*=6). The average value of *Difference* is -0.2170 which indicates that the average firm is below their expected financial strength rating.

### 2.5.2 Main Results

Table 2.5 provides the results from my OLS model examining whether deviation from a target financial strength rating is a significant determinant of insurer loss reserve errors. The dependent variable is loss reserve error scaled by total assets ($RE$). Standard errors are presented beneath each coefficient estimate in parentheses. Standard errors are bootstrapped and account for firm-level clustering. A potential issue with the analysis in Alissa et al. (2013) is that they do not account for the presence of an estimated independent variable in their estimation. Since I follow their methodology, *Difference* contains an estimate (from my

[26]This is consistent with Alissa et al. (2013), who find that their results do not change based on restricting their sample to firms with an S&P rating greater than "B-."

ordered probit models) of each firm's target rating. I perform 1,000 bootstrap replications to deal with any issues related to *Difference* being a generated regressor (Pagan, 1984).[27]

Column (1) of Table 2.5 provides a baseline model that does not include any variables controlling for deviations from a target financial strength rating. The results in column (2) include *Difference* as an independent variable. The estimated coefficient of *Difference* is positive and statistically significant at the one percent level. This is consistent with my hypothesis and provides evidence that firms above (below) their target financial strength rating tend to over (under)reserve. This is also consistent with the results in Alissa et al. (2013). However, as with Alissa et al. (2013), this construction of *Difference* does not allow me to disentangle asymmetric incentives to manage reserves whether a firm is above or below their target rating. As noted above, I, therefore, create two new variables, *Above Target* and *Below Target*, to be equal to the number of notches above or below a firm's actual rating relative to their target rating (*Above Target* (*Below Target*) is set to zero if the firm is below or (above) their target).[28] The results from this model are presented in column (3) of Table 2.5. These results are consistent with an asymmetric response to being above and below a target rating. Specifically, the estimated coefficient of *Above Target* is not statistically significant, providing empirical evidence that firms with a rating above their target do not appear to manage reserves. However, the estimated coefficient of *Below Target* is negative and statistically significant at the one percent level. This provides empirical support for my hypothesis that firms with a rating below their target tend to underreserve (income-increasing discretionary accruals). Taken together, these results also suggest that firms have

[27]In untabulated results, I also perform feasible generalized least squares estimation of my model. Prior studies, such as Grace and Leverty (2012) use this methodology in estimating the determinants of reserve errors. My results are statistically consistent with the results presented in the paper.

[28]Again, I also perform the empirical tests using binary variables to represent whether a firm is above or below their target rating. The current method captures both the asymmetric response as well as the distance from a target rating. The results are consistent when using a binary variable to only capture the asymmetric response.

more incentive to manage reserves when their actual rating is below their target rating, but not when their actual rating is above their target rating.

The results in columns (2) and (3) of Table 2.5 use a full set of control variables to calculate my *Difference*, and also, therefore, my *Above Target* and *Below Target* variables. In columns (4) and (5) of Table 2.5 I use the alternative approach to estimating target ratings using a firm's IRIS ratios. These results are consistent with those in columns (2) and (3). The estimated coefficient of *Difference* is significant and positive, which is consistent with my hypothesis. Again, however, when I allow for an asymmetric response to being above a target rating or below a target rating, I only find evidence of reserve management for firms below their target rating. Specifically, the estimated coefficient of *Above Target* is not statistically significant, but the estimated coefficient of *Below Target* is significant at the five percent level and is negative, indicating underreserving.

Overall, the results in columns (2), (3), (4), and (5) of Table 2.5 provide empirical support for my hypothesis that firms manage reserves to achieve a target financial strength rating. In addition, I find evidence that this result is driven by firms whose actual ratings are below their estimated target ratings. These firms tend to underreserve, whereas firms whose actual ratings are above their target ratings do not tend to manage reserves.

### 2.5.3 Natural Experiment: Commercial Insurers

A particular advantage of focusing on the P&L insurance industry is that I have a subset of firms where I can identify an (essentially) exogenously determined target rating. Specifically, P&L insurers who write predominantly commercial lines have particularly strong incentives to target a rating of at least "A-." Prior research, such as Epermanis and Harrington (2006) and Halek and Eckles (2010), find evidence that a rating of "A-" is particularly important for commercial insurers. Measurement error associated with my prior definition of a target rating (and the definition used by Alissa et al. (2013)) is substantially reduced in these tests, as I no longer rely on estimating a target rating.[29]

In order to test whether insurers particularly target a rating of "A-," I employ the two ordinary least squares (OLS) regression models. I estimate equations (2.3) and (2.4) and define the target rating as "A-" for all firms. In the second model, I decompose *Difference* into firms that are above and below their target rating, in this case "A-." *Above A-* is equal to *Difference* if *Difference* is positive, and zero otherwise. *Below A-* is equal to negative one times *Difference* if *Difference* is negative, and zero otherwise. This allows me to capture an asymmetric response to being above or below a rating of "A-." In this case I focus on firms operating in commercial lines, since a rating of "A-" is particularly important for these firms. Accordingly, I estimate this model for firms writing at least a certain amount of commercial lines.[30] Specifically, I estimate both equations ((2.3) and (2.4) with a target of "A-") separately for firms writing more than 60, 70, 80, and 90 percent of net premiums written in commercial lines. I also estimate models for firms writing exclusively in commercial lines of business. As in my main model, I expect to observe a positive estimated coefficient for *Difference*. In addition, I expect to observe a positive coefficient estimate on *Above A-* and a negative coefficient estimate on *Below A-*. I also expect the magnitude of the coefficient estimate for *Below A-* to be larger than the coefficient estimate for *Above A-*.

Table 2.6 provides OLS estimates of the determinants of reserve errors for firms writing more than 60, 70, 80, and 90 percent of their annual net written premiums in commercial lines and also insurers who write 100 percent of premiums in commercial lines. The dependent

[29] Again, Alissa et al. (2013) do consider an investment grade cut-off. However, the incentive for firms to meet this investment grade requirement will vary by firm. My subsample of commercial insurers will face a much more consistent incentive to meet the "A-" rating requirement.

[30] Consistent with Cummins and Xie (2013) I define the following lines as commercial: fire, allied lines, commercial multi peril, mortgage guaranty, ocean marine, inland marine, financial guaranty, medical malpractice, group accident and health, credit accident and health, workers' compensation, other liability, products liability, commercial auto liability, aircraft, fidelity, surety, burglary and theft, boiler and machinery, credit, international, and reinsurance.

variable is reserve error scaled by total assets (*RE*). Columns (1), (3), (5), (7), and (9) are models where *Difference* is the variable of interest. I predict a positive and significant relationship between *Difference* and *RE*. In columns (2), (4), and (6), the variables of interest are *Below A-*, where I predict a negative sign, and *Above A-*, where I predict a positive sign. However, if there is an asymmetric response to being above or below a target rating, I would fail to find significance for the estimated coefficient of *Above A-*. Columns (1) and (2) are for firms writing more than 60 percent of net premiums written in commercial lines, columns (2) and (3) are for firms writing more than 70 percent of net premiums written in commercial lines, columns (5) and (6) are for firms writing more than 80 percent of net premiums written in commercial lines, columns (7) and (8) are for firms writing more than 90 percent of net premiums written in commercial lines, and columns (9) and (10) are for firms writing 100 percent of net premiums written in commercial lines. Standard errors are presented beneath each coefficient estimate and are clustered at the firm level.[31] All regressions include year fixed-effects.

Overall, the results in Table 2.6 are consistent across the five subsets of commercial-lines focused firms. In columns (1), (3), and (5), the estimated coefficient of *Difference* is significant and positive. This is consistent with firms with ratings above "A-" overreserving and firms with ratings below "A-" underreserving. However, the estimated coefficients for *Difference* for the subsets of the most commercial-focused firms are not statistically different from zero (columns (7) and (9)).

Additionally, I again find an asymmetric response once I include variables that separate above- and below-target firms with only below-target firms showing any evidence of reserve management. Specifically, the results in columns (2), (4), (6), (8), and (10) provide empirical evidence that firms below their target rating of "A-" tend to underreserve. The estimated

[31]Even though *Difference* is not an estimated in these models, I still bootstrap the standard errors since *Insolvent* is an estimated regressor.

coefficient of *Below A-* is negative and significant at the one percent level in all five models. I also note that the estimated coefficient increases in magnitude as firms write proportionally more commerical lines. However, I do not find statistical significance on *Above A-* in any of the models where it is included. Here, using an "exogenously" given rating target, I find qualitatively similar results from before with an estimated rating target.

### 2.5.4 Additional Tests

One potential issue with the analysis in Alissa et al. (2013) and my prior analysis is the question of whether I are accurately capturing a firm's actual target financial strength rating. I now consider two alternative measures, in addition to my natural experiment, of a firm's target financial strength rating.

#### Past Ratings as Target Ratings

Another potential way to measure a firm's target financial strength rating is to examine a firm's past rating. If a firm's target is relatively consistent over time and a firm generally is at its target rating, this measure should capture a firm's target rating and any deviation from it in the current period. Accordingly, I calculate three alternative targets using a firm's past rating. Specifically, I use a firm's prior year rating (*Rating* in $t-1$) as well as the firm's rolling average financial strength rating over the past two, three, four, and five years. For each of these measures of target, I construct *Difference* as before, where it is a firm's *Rating* minus target rating. I then re-estimate equation (2.3), again controlling for discretionary and non-discretionary determinants of a firm's loss reserve error. I also estimate models including variables representing if a firm is above or below its target rating instead of *Difference* to examine whether the incentive to manage reserves is stronger for above-target or below-target rating firms. *Above Target* is defined as *Difference* if a firm's actual rating is above their target rating, and zero otherwise. *Below Target* is defined as negative one times *Difference* if a firm's actual rating is below their target rating, and zero otherwise.

Table 2.7 provides results for my OLS estimation of the determinants of insurer reserve error. The variable of interest in columns (1), (3), (5), (7), and (9) is *Difference* while the variables of interest in columns (2), (4), (6), (8), and (10) are *Above Target* and *Below Target.* Columns (1) and (2) use a firm's rating in year $t-1$ as a measure of target, columns (3) and (4) use a firm's average rating over the past two years as a target rating, columns (5) and (6) use a firm's average rating over the past three years as a target rating, columns (7) and (8) use a firm's average rating over the past four years, and columns (9) and (10) use a firm's average rating over the past five years. All models include year fixed effects. Firm-level clustered standard errors are presented beneath each coefficient estimate. Standard errors are caluclated from 1,000 bootstrap replications to account for the presence of an estimated regressor (*Insolvent*).

In all five models including *Difference* (columns (1), (3), (5), (7), and (9)) the estimated coefficient of *Difference* is positive and statistically significant. This empirical result is consistent with both my hypothesis as well as my previous empirical results. In my models allowing for an asymmetric response to above-target firms and below-target firms, I find evidence that below-target firms tend to understate reserves, while I find almost no evidence of reserve management for above-target firms. Specifically, I find a negative and statistically significant estimated coefficient on all five models including *Below Target* (columns (2), (4), (6), (8), and (10)). I find significance in only one instance (column (2)) for the estimated coefficient of *Above Target*, and in the single case where it is significant, it is significant at only the ten percent level.

Taken together, these results are, again, consistent with firms below their target having strong incentives to manage reserves to achieve their target rating, but firms above their target having little incentive to achieve a lower rating. The combined result using past ratings to measure a firm's target rating are consistent with my prior results and with those of Alissa et al. (2013) (using the ordered probit model to estimate a target rating). As before, extending Alissa et al. (2013), my results suggest, however, that firms are mainly incentivized to manage reserves when they are below a target, but not above a target.

**Alternative Target Rating Estimation**

Prior empirical work in corporate finance has examined the speed with which firms adjust to their target capital structure (Flannery and Rangan, 2006). An alternative to measuring a target rating as in Alissa et al. (2013) is to use the methodology of studies examining adjustment towards target capital structure, but instead of target leverage, substitute target rating. The limitation of this methodology is that leverage is a continuous variable, while rating is discrete. The methodology of calculating target leverage generally relies on using a lagged dependent variable (leverage normally, but financial strength rating in my case). An issue here would be that there is no well-established econometric method to include a lagged dependent variable in an ordered probit model, which is how studies would normally estimate a ratings-determinants model (Doherty and Phillips, 2002). I, therefore, run the model treating *Rating* as though it were continuous. While this has clear limitations, taken with my prior evidence, this can provide additional support for my hypotheses.

In adopting the Flannery and Rangan (2006) model, I first model a firm's target financial strength rating as a function of various firm characteristics related to firm insolvency risk:

$$Rating^*_{i,t} = \beta X_{i,t-1} \tag{2.5}$$

where $Rating^*$ is a firm's target financial strength rating and $X$ is a vector of firm characteristics related to a firm's financial strength rating. I use the same variables in this model as I used previously in the ordered probit estimation.

In the absence of any frictions, I would expect a firm to always be at its target rating. However, in the presence of frictions, there is the potential for a firm to deviate. In this case, I would expect a firm to make adjustments to move towards its target rating. Again, taking from the Flannery and Rangan (2006) model, the partial adjustment model is as follows:

$$Rating_{i,t} - Rating_{i,t-1} = \lambda \left( Rating^{*}_{i,t} - Rating_{t-1} \right) + \delta_{i,t} \tag{2.6}$$

where each year a firm closes a certain proportion of the gap between it's actual rating (*Rating*) and its target rating (*Rating*$^*$). This proportion of the gap is $\lambda$ in equation (2.6). I substitute equation (2.5) into equation (2.6), which provides the following model:

$$Rating_{i,t} = \lambda \beta X_{i,t-1} + (1 - \lambda) \, Rating_{i,t-1} + \delta_{i,t} \tag{2.7}$$

I now empirically estimate this model, where *Rating* is a function of a firm's past rating (at $t-1$) and a vector of firm-specific characteristics. I can specifically estimate the value of the speed of adjustment, $\lambda$. Next, I rearrange equation (2.6) to yield an empirical estimate of a target rating as follows:

$$Rating^{*}_{i,t} = \frac{1}{\lambda} \left[ Rating_{i,t} - Rating_{i,t-1} - \delta_{i,t} \right] + Rating_{i,t-1} \tag{2.8}$$

I then calculate *Difference* as before, where *Difference* is defined as *Rating* minus *Rating*$^*$ from equation (2.8). I estimate equation (2.3) with this alternative definition of target rating. I also, as in my prior analysis, provide results for a model including variables—*Above Target* and *Below Target*—that allow for an asymmetric response to being above or below a target rating. As in prior sections, *Above Target* is defined as *Difference* if a firm's actual rating is above their target rating, and zero otherwise and *Below Target* is defined as negative one times *Difference* if a firm's actual rating is below their target rating, and zero otherwise. One issue here is that this methodology produces a continuous target rating variable, *Rating*$^*$. With this construction, firms will only be at their target rating if *Rating*$^*$ is *exactly* equal to *Rating*. I, therefore, round values of *Rating*$^*$ to create a discrete target rating variable.[32]

Table 2.8 provides OLS estimates of models estimating the determinants of loss reserve errors scaled by total assets. Column (1) includes *Difference* as the variable of interest, while column (2) includes variables for firms above their target rating (*Above Target*) and for firms below their target rating (*Below Target*). Standard errors are included in parentheses beneath each coefficient estimate. Standard errors account for firm-level clustering. Standard errors are bootstrapped to account for the presence of estimated regressors (Pagan, 1984). Both models include year fixed-effects.

The results in column (1) of Table 2.8 are consistent with firms above their target rating overreserving and firms below their target rating underreserving. However, in my second model, which allows me to identify whether this is driven by above- or below-target firms, I find evidence that firms below their target rating underreserve, as seen in the negative estimated coefficient of *Below Target*, while I fail to find evidence of reserve management for firms above their target rating. These results are consistent with my prior results.

### 2.5.5 External Monitoring

I next examine whether external monitoring can mitigate the behavior of firms below their target ratings. I have provided empirical evidence in this paper that firms below their target rating tend to understate their reserves. Extant studies in the area of loss reserve management have examined the interaction between external monitors (i.e., auditors) and reserve management (e.g., Petroni and Beasley, 1996; Gaver and Paterson, 2001, 2007). I propose that high quality external auditing can detect and prevent management of the loss reserve in an attempt to achieve a target financial strength rating. In examining insurer

[32]For example, target rating is defined as being equal to 4 for values of *Rating*$^*$ between 3.5 and 4.5.

loss reserves, I consider not only the audit firm, but also the external actuaries responsible for the "Statement of Actuarial Opinion" which speaks to the adequacy of the loss reserve. Gaver and Paterson (2001) find evidence that high quality auditing and also a high quality external actuary is necessary to prevent biased loss reserves. I therefore examine whether the combination of "high quality" auditing and actuaries results in a reduced ability of firms below their target rating underreserving.

For my empirical analysis considering external monitors, I require the identify of the external auditor and the external actuarial firm responsible for auditing each firm's statutory filings. This information is reported in the statutory filings each year, but is only available in the data provided from the NAIC from 2005 to 2008.[33] Therefore, I perform my analysis on the sub-sample of firms with available information on the audit firm and actuarial firm from 2005 to 2008.

Consistent with Gaver and Paterson (2001), I construct a binary variable (*Big 4*) that is equal to one if a firm's financial statements were examined by both a Big 4 auditor and a Big 4 actuary and zero otherwise.[34] I include this variable in equation (2.3) and also interact it with *Below Target* to examine whether it mitigates underreserving.[35] I predict that if high quality external monitoring is effective in mitigating reserve management, the estimated coefficient on the interaction term *Big 4*Below Target* will be positive. I perform Wald tests to examine whether the overall effect of *Below Target + Big 4*Below Target* is statistically different from zero. A non-significant test statistic of the Wald test is consistent with high quality external monitoring reducing the ability of firms to manage reserves if they

[33] Specifically, this data is available in the annual statutory filings on the "General Interrogatories" page. The identity of the audit firm is data item "9 What is the name and address of the independent certified public accountant or accounting firm retained to conduct the annual audit?" The identity of the actuarial firm is data item "10 What is the name, address and affiliation (officer/employee of the reporting entity or actuary/consultant associated with an actuarial consulting firm) of the individual providing the statement of actuarial opinion/certification?"

[34] As in Gaver and Paterson (2001), a Big 4 actuarial firm is one that is affiliated with a Big 4 auditor.

[35] Since I find no evidence of above-target rating firms managing reserves, I do not interact *Big 4* with *Above Target*.

are below their target rating. In addition to testing this for my main model, I also examine whether external monitoring reduces reserve management using my test of commercial lines insurers.

The results of my main model are presented in Table 2.9. I present results from OLS models with standard errors presented beneath each coefficient estimate. I perform 1,000 bootstrap replications to account for the presence of an estimated regressor in these models. The dependent variable is the five-year reserve error scaled by total assets. All regressions include year fixed effects.

The results in column (1) of Table 2.9 are a re-estimation of equation (2.3). Since I are now examining a reduced sample due to the limited availability of data needed to construct my *Big 4* variable, I establish that my main result of a negative and significant estimated coefficient on *Below Target* holds during the sample period from 2005 to 2008. The results on column (2) of Table 2.9 include *Big 4*. The estimated coefficient on *Big 4* is not statistically different from zero. However, my main result, that *Below Target* loads negatively and significantly, holds.

The main result of interest in Table 2.9 is in column (3). Here, the estimated coefficient on the interaction term *Big 4**Below Target* is positive, but not significant. The $p$-value for the Wald test (presented at the bottom of Table 2.9) that the estimated coefficients of *Below Target* and *Big 4**Below Target* are not statistically different from zero fails to reject the null hypothesis ($p$-value = 0.6656). This provides empirical evidence that is consistent with high quality external monitoring mitigating the ability of firms to manage reserves if they are below their target financial strength rating.

Table 2.10 provides results from my commercial lines test of reserve management for commercial lines insurers including *Big 4*. Since a rating of "A-" is an exogenous rating I can take to be a target for firms writing predominantly in commercial lines, this provides a clean test of reserve management to achieve a target rating. As in the "*Commercial Insurers*" section, I examine insurers writing more than 60, 70, 80, and 90 percent of net premiums in commercial lines, as well as firms writing entirely in commercial lines. In columns (1), (3), (5), (7), and (9) I estimate models excluding *Big 4* to establish that my main results of a negative and significant estimated coefficient of *Below A-* holds on my reduced sample period from 2005 to 2008 (which is when the data necessary to calculate *Big 4* is available). The results in columns (2), (4), (6), (8), and (10) of Table 2.10 include *Big 4* and the interaction term *Big 4***Below A-*. I perform a Wald test of whether the estimated coefficient of *Below A-* plus the estimated coefficient of *Big 4***Below A-* is statistically different from zero. Failure to reject the null provides empirical support for my hypothesis that high quality auditing reduces the ability of firms to manage earnings if they are below their target financial strength rating.

The results in columns (1), (3), (5), (7), and (9) indicate that my prior result that firms below a rating of "A-" tend to underreserve. The estimated coefficient of *Below A-* is negative and significant (at the one percent level) in all five models, indicating that my result holds for this sub-sample. In columns (2), (4), (6), (8), and (10) of Table 2.10, I include *Big 4* and the interaction term *Big 4***Below A-*. *Big 4* is significant in columns (2), (4), (6), and (10), and in this case it is negative, which is not consistent with higher quality monitoring resulting in more conservative financial reporting (as found in Gaver and Paterson (2001)). However, I find that the estimated coefficient of *Big 4***Below A-* is positive in all five models, though it is not statistically different from zero in three of the five models. The Wald tests that the estimated coefficients of *Below A-* and *Big 4***Below A-* are equal to zero are presented at the bottom of the table. In all five cases, the $p$-values indicate that the test fails to reject the null ($p$-values $> 0.10$ in all three cases). This result provides some empirical support for my hypothesis that firms below their target rating ("A-" in this case) do not tend to underreserve if they have both a Big 4 auditor and a Big 4 actuary. This is consistent with stronger external monitoring reducing the ability of firms to manage reserves.

## 2.6 Conclusion

Recent studies in the accounting literature examine the relation between earnings management and ratings (Alissa et al., 2013; Demirtas and Cornaggia, 2013; Jung, Soderstrom, and Yang, 2013). I extend the literature by examining the relation between earnings management—measured by insurer loss reserve errors—and financial strength ratings for a sample of property and liability insurance firms. I are specifically interested in the asymmetric incentives to manage earnings depending on whether a firm is above or below their target rating.

The P&L insurance industry is well-suited for this analysis for at least four reasons. First, measurement error in my earnings management proxy—insurer loss reserve errors—is significantly reduced compared to other common measures of earnings management. Second, I take advantage of a natural experiment by examining a subgroup of firms—firms operating predominantly in commercial lines—where I have an exogenously determined target rating. Third, P&L insurers are subject to external monitoring from actuaries in addition to auditors, allowing me to examine the role of external monitoring in mitigating earnings management. Fourth, I make use of insurer financial strength ratings in opposed to corporate debt ratings. These ratings serve to assess the financial strength of an entire enterprise in opposed to a single security.

My primary contribution to the literature is to document that there is an asymmetric earnings management response depending on whether firms are above or below their target rating. My empirical tests provide evidence that firms are only incentivized to manage earnings if they are below their target rating, but not if they are above. This is consistent with, but a substantial contribution beyond, the work of Alissa et al. (2013). This result is consistent across all of my empirical tests, including in my natural experiment on commercial lines insurers. Documenting this asymmetric incentive provides an important extension of this literature as, while there are potential incentives to target a lower rating (e.g., Graham and Harvey, 2001), I find no evidence of firms managing earnings if they are above their target.

I contribute to several streams of literature. First, I contribute to the literature examining earnings management incentives surrounding ratings (Alissa et al., 2013; Demirtas and Cornaggia, 2013; Jung, Soderstrom, and Yang, 2013). I also specifically contribute to the literature examining insurer incentives to manage loss reserves (Petroni, 1992; Beaver, McNichols, and Nelson, 2003; Gaver and Paterson, 2004; Grace and Leverty, 2010). My results provide evidence that in addition to previously hypothesized incentives to manage loss reserves, financial strength ratings are another determinant of insurer loss reserve errors. Finally, I contribute to the literature examining how external monitoring can influence insurer reserving (Petroni and Beasley, 1996; Gaver and Paterson, 2001, 2007). My study provides evidence that external monitoring of Big 4 audit and actuarial firms can mitigate reserve manipulation related to deviations from a target financial strength rating.

Table 2.1: Distribution of Actual Ratings compared to Target Ratings

| | Target Rating | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Actual Rating | A++ | A+ | A | A- | B++ | B+ | B | B- | Total Actual |
| A++ | 213 | 446 | 496 | 111 | 0 | 0 | 0 | 0 | 1,266 |
| A+ | 147 | 966 | 1,704 | 674 | 1 | 0 | 1 | 0 | 3,493 |
| A | 74 | 848 | 2,702 | 1,750 | 0 | 7 | 1 | 0 | 5,382 |
| A- | 16 | 374 | 1,758 | 2,549 | 1 | 32 | 1 | 4 | 4,735 |
| B++ | 3 | 38 | 339 | 1,135 | 6 | 49 | 9 | 10 | 1,589 |
| B+ | 1 | 26 | 165 | 917 | 6 | 134 | 17 | 20 | 1,286 |
| B | 0 | 3 | 65 | 502 | 3 | 49 | 7 | 12 | 641 |
| B- | 0 | 1 | 14 | 210 | 1 | 34 | 7 | 21 | 288 |
| Total Expected | 454 | 2,702 | 7,243 | 7,848 | 18 | 305 | 43 | 67 | 18,860 |

Note: This table shows the distribution of actual financial strength ratings by target financial strength ratings. Target ratings are calculated based on estimation of equation (2.1). Expected ratings are the rating level with the highest fitted probability from equation (2.1). Actual ratings are presented by row and expected ratings are presented by column.

Table 2.2: Reserve Errors by Intersection of Actual and Target Ratings

| | Target Rating | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Actual Rating | A++ | A+ | A | A- | B++ | B+ | B | B- |
| A++ | -0.0203 | -0.0252 | -0.0314 | -0.0001 | 0.0026 | -0.0855 | -0.0402 | |
| A+ | 0.0244 | 0.0143 | 0.0012 | -0.0031 | 0.0332 | -0.0022 | -0.0038 | 0.2109 |
| A | 0.0125 | 0.0046 | 0.0100 | 0.0117 | 0.0085 | -0.0188 | -0.0122 | -0.0195 |
| A- | 0.0239 | 0.0079 | 0.0242 | 0.0243 | 0.0161 | 0.0135 | 0.0219 | -0.0123 |
| B++ | | -0.0946 | | 0.0813 | 0.0379 | 0.0574 | 0.0114 | 0.0016 |
| B+ | | | 0.0256 | 0.0016 | -0.0022 | 0.0197 | 0.0333 | -0.0075 |
| B | | | 0.0102 | 0.0307 | 0.0000 | 0.0562 | -0.1482 | -0.0076 |
| B- | | | | -0.0064 | 0.0629 | 0.0057 | | -0.0643 |

Note: This table shows the average loss reserve error by the intersection of actual and target rating. Positive values indicate overreserving while negative values indicate underreserving.

Table 2.3: Reversion to Target Ratings

| Dependent Variable: $\Delta Difference_{t+k}$ | | | |
| --- | --- | --- | --- |
| | t+1 | t+3 | t+5 |
| *Difference* | -0.1731*** | -0.3507*** | -0.4763*** |
| | (0.0056) | (0.0101) | (0.0133) |
| Intercept | -0.0190*** | -0.0312*** | -0.0599*** |
| | (0.0056) | (0.0118) | (0.0168) |
| $R^2$ | 9.46% | 19.96% | 27.73% |
| Observations | 16,093 | 12,927 | 10,178 |

Note: This table reports results from ordinary least squares regressions.The dependent variable is $\Delta Difference_{t+k}$. *Difference* is *Rating* minus a firm's target rating. *t*-statistics are presented in parentheses beneath each coefficient estimate. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table 2.4: Descriptive Statistics

| Variable | Mean | Std. | Min | Percentiles 10th | 25th | 50th | 75th | 90th | Max |
|---|---|---|---|---|---|---|---|---|---|
| *RE* | 0.0110 | 0.0904 | -0.4560 | -0.0753 | -0.0148 | 0.0121 | 0.0489 | 0.0972 | 0.3407 |
| *Rating* | 5.4781 | 1.5276 | 1.0000 | 3.0000 | 5.0000 | 6.0000 | 7.0000 | 7.0000 | 8.0000 |
| *Difference* | -0.2170 | 1.3101 | -6.0000 | -2.0000 | -1.0000 | 0.0000 | 1.0000 | 1.0000 | 5.0000 |
| *Size* | 18.4088 | 1.7389 | 13.4680 | 16.2661 | 17.1387 | 18.2846 | 19.5631 | 20.7887 | 22.8629 |
| *Reinsurance* | 0.3813 | 0.2864 | 0.0000 | 0.0388 | 0.1309 | 0.3233 | 0.5992 | 0.8226 | 1.0000 |
| *Tax Shield* | 0.0292 | 0.0441 | -0.1721 | -0.0167 | 0.0102 | 0.0298 | 0.0499 | 0.0740 | 0.2226 |
| *Geo Herf* | 0.5232 | 0.3744 | 0.0441 | 0.0703 | 0.1441 | 0.4598 | 1.0000 | 1.0000 | 1.0000 |
| *Mutual* | 0.2448 | 0.4300 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 |
| *Product Diverse* | 0.4688 | 0.3068 | 0.0000 | 0.0000 | 0.1518 | 0.5656 | 0.7162 | 0.8013 | 1.0000 |
| *Longtail* | 0.6745 | 0.2793 | 0.0000 | 0.1013 | 0.6160 | 0.7347 | 0.8517 | 0.9913 | 1.0000 |
| *Group* | 0.7675 | 0.4225 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| *Growth* | 0.1864 | 1.0045 | -2.0068 | -0.1889 | -0.0391 | 0.0518 | 0.1664 | 0.4237 | 10.2893 |
| *Small Profit* | 0.0336 | 0.1801 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| *Small Loss* | 0.0100 | 0.0996 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| *Profit* | 0.7551 | 0.4300 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| *Insolvent* | 0.0131 | 0.0163 | 0.0000 | 0.0000 | 0.0007 | 0.0093 | 0.0207 | 0.0308 | 0.7058 |
| *ROA* | 0.0278 | 0.0447 | -0.2254 | -0.0180 | 0.0089 | 0.0286 | 0.0488 | 0.0728 | 0.2204 |
| *ROI* | 0.0447 | 0.0207 | -0.0123 | 0.0216 | 0.0317 | 0.0432 | 0.0558 | 0.0681 | 0.1294 |
| *Hurricane* | 0.2225 | 0.3166 | 0.0000 | 0.0000 | 0.0000 | 0.0712 | 0.2962 | 0.8952 | 1.0000 |
| *Kenny Ratio* | 1.1023 | 0.7383 | 0.0000 | 0.2164 | 0.5339 | 1.0021 | 1.5485 | 2.0982 | 4.3884 |
| *Earthquake* | 0.0018 | 0.0064 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0004 | 0.0040 | 0.0512 |
| *Surplus-to-Assets* | 0.4275 | 0.1830 | 0.0387 | 0.2361 | 0.2936 | 0.3815 | 0.5219 | 0.7082 | 0.9999 |

Note: This table reports descriptive statistics for the years 1992 to 2008. The full sample is 18,680 firm-years, consisting of 1,909 unique firms. *RE* is the five-year loss reserve error scaled by total assets. *Rating* is a firm's A.M. Best financial strength rating, where 8 corresponds to the highest rating ("A++") and 1 corresponds to the lowest rating ("B-"). *Difference* is the difference between *Rating* and a firm's target rating. *Size* is the natural log of total assets. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Tax Shield* is a firm's net income plus developed reserves divided by total assets. *Geo Herf* is the geographic Herfindahl index. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Product Diverse* is 1 minus the line of business Herfindahl index. *Longtail* is the proportion of premiums written in longtailed lines. *Group* is a binary variable equal to 1 for a group and 0 otherwise. *Growth* is the one year change in net premiums written. *Small Profit* is a binary variable equal to 1 if a firm has earnings in the bottom 5 percent of the earnings distribution. *Small Loss* is a binary variable equal to 1 if a firm has earnings in the top 5 percent of the negative earnings distribution. *Profit* is a binary variable equal to 1 if a firm has earnings in the top 90 percent of the positive earnings distribution. *Insolvent* is an estimated probability of insolvency based on IRIS ratios. *ROA* is a firm's net income scaled by total assets. *ROI* is a firm's net investment income divided by total assets. *Hurricane* is the percentage of a firm's direct premiums written in hurricane-prone states. *Kenny Ratio* is net premiums written divided by policyholder surplus. *Earthquake* is the percentage of net premiums written in earthquake insurance. *Surplus-to-Assets* is policyholder surplus divided by total assets.

Table 2.5: Main Regression Results

| Dependent Variable: Reserve Error | | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| *Difference* | | 0.0041*** | | 0.0019* | |
| | | (0.0010) | | (0.0010) | |
| *Above Target* | | | -0.0009 | | -0.0009 |
| | | | (0.0016) | | (0.0017) |
| *Below Target* | | | -0.0070*** | | -0.0036** |
| | | | (0.0017) | | (0.0016) |
| *Size* | -0.0021** | -0.0022** | -0.0024** | -0.0021** | -0.0022** |
| | (0.0010) | (0.0009) | (0.0010) | (0.0010) | (0.0010) |
| *Reinsurance* | -0.0353*** | -0.0356*** | -0.0355*** | -0.0360*** | -0.0359*** |
| | (0.0045) | (0.0045) | (0.0046) | (0.0045) | (0.0045) |
| *Tax Shield* | 0.1723*** | 0.1789*** | 0.1787*** | 0.1684*** | 0.1682*** |
| | (0.0307) | (0.0299) | (0.0301) | (0.0301) | (0.0301) |
| *Geo Herf* | 0.0073* | 0.0076* | 0.0082* | 0.0076* | 0.0079* |
| | (0.0044) | (0.0044) | (0.0045) | (0.0043) | (0.0043) |
| *Mutual* | 0.0081** | 0.0081** | 0.0078** | 0.0078** | 0.0076** |
| | (0.0037) | (0.0036) | (0.0036) | (0.0038) | (0.0038) |
| *Product Diverse* | -0.0005 | -0.0008 | -0.0017 | -0.0008 | -0.0013 |
| | (0.0053) | (0.0053) | (0.0052) | (0.0054) | (0.0052) |
| *Longtail* | 0.0188*** | 0.0191*** | 0.0196*** | 0.0192*** | 0.0196*** |
| | (0.0060) | (0.0061) | (0.0057) | (0.0059) | (0.0058) |
| *Group* | 0.0008 | 0.0004 | 0.0011 | 0.0000 | 0.0004 |
| | (0.0046) | (0.0044) | (0.0047) | (0.0046) | (0.0046) |
| *Growth* | -0.0001 | -0.0002 | -0.0002 | -0.0003 | -0.0003 |
| | (0.0007) | (0.0007) | (0.0007) | (0.0007) | (0.0007) |
| *Small Profit* | -0.0080** | -0.0077* | -0.0076** | -0.0078* | -0.0078** |
| | (0.0038) | (0.0039) | (0.0039) | (0.0041) | (0.0037) |
| *Small Loss* | -0.0058 | -0.0063 | -0.0067 | -0.0060 | -0.0063 |
| | (0.0059) | (0.0061) | (0.0061) | (0.0059) | (0.0063) |
| *Profit* | 0.0086*** | 0.0075*** | 0.0071** | 0.0083*** | 0.0081*** |
| | (0.0028) | (0.0028) | (0.0029) | (0.0029) | (0.0029) |
| *Insolvent* | -0.0522 | -0.0436 | -0.0298 | -0.0498 | -0.0440 |
| | (0.1369) | (0.1258) | (0.1299) | (0.1301) | (0.1314) |
| Intercept | 0.0384** | 0.0418** | 0.0481** | 0.0398** | 0.0434** |
| | (0.0191) | (0.0188) | (0.0196) | (0.0198) | (0.0195) |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 8.22% | 8.56% | 8.70% | 8.29% | 8.33% |
| Wald $\chi^2$ | 707.42 | 736.57 | 717.18 | 728.36 | 670.92 |
| Observations | 18,680 | 18,680 | 18,680 | 18,680 | 18,680 |

Note: This table reports coefficient estimates from OLS estimation. The dependent variable, *RE* is a firm's loss reserve error scaled by total assets. *Difference* is a firm's financial strength rating (*Rating*) minus a firm's target rating. *Above Target* is equal to *Difference* if *Difference* is positive and 0 otherwise. *Below Target* is equal to -1 times *Difference* if *Difference* is negative and 0 otherwise. *Size* is the natural log of total assets. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Tax Shield* is a firm's net income plus developed reserves divided by total assets. *Geo Herf* is the geographic Herfindahl index. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Product Diverse* is 1 minus the line of business Herfindahl index. *Longtail* is the proportion of premiums written in longtailed lines. *Group* is a binary variable equal to 1 for a group and 0 otherwise. *Growth* is the one year change in net premiums written. *Small Profit* is a binary variable equal to 1 if a firm has earnings in the bottom 5 percent of the earnings distribution. *Small Loss* is a binary variable equal to 1 if a firm has earnings in the top 5 percent of the negative earnings distribution. *Profit* is a binary variable equal to 1 if a firm has earnings in the top 90 percent of the positive earnings distribution. *Insolvent* is an estimated probability of insolvency based on IRIS ratios. Standard errors are presented beneath each coefficient estimate. Bootstrapped standard errors are from 1,000 replications and account for firm-level clustering. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

## Table 2.6: Commercial Lines Regression Results

| | Dependent Variable: Reserve Error | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | >60% | | >70% | | >80% | | >90% | | =100% | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| *Difference* | 0.0037*** | | 0.0037** | | 0.0042** | | 0.0034 | | 0.0042 | |
| | (0.0014) | | (0.0016) | | (0.0021) | | (0.0024) | | (0.0029) | |
| *Above A-* | | -0.0010 | | -0.0017 | | -0.0027 | | -0.0053* | | -0.0063 |
| | | (0.0018) | | (0.0022) | | (0.0027) | | (0.0032) | | (0.0048) |
| *Below A-* | | -0.0091*** | | -0.0101*** | | -0.0124*** | | -0.0126*** | | -0.0127*** |
| | | (0.0026) | | (0.0031) | | (0.0036) | | (0.0040) | | (0.0043) |
| *Size* | -0.0046*** | -0.0043*** | -0.0054*** | -0.0051*** | -0.0064*** | -0.0060*** | -0.0060*** | -0.0055*** | -0.0020 | -0.0018 |
| | (0.0014) | (0.0014) | (0.0015) | (0.0016) | (0.0019) | (0.0017) | (0.0021) | (0.0021) | (0.0029) | (0.0027) |
| *Reinsurance* | -0.0373*** | -0.0362*** | -0.0388*** | -0.0377*** | -0.0396*** | -0.0384*** | -0.0413*** | -0.0393*** | -0.0355** | -0.0324** |
| | (0.0060) | (0.0056) | (0.0068) | (0.0068) | (0.0080) | (0.0076) | (0.0091) | (0.0089) | (0.0147) | (0.0145) |
| *Tax Shield* | 0.1485*** | 0.1465*** | 0.1510*** | 0.1490*** | 0.1515*** | 0.1490*** | 0.1413*** | 0.1392*** | 0.1280* | 0.1309* |
| | (0.0376) | (0.0382) | (0.0434) | (0.0423) | (0.0476) | (0.0477) | (0.0520) | (0.0515) | (0.0751) | (0.0788) |
| *Geo Herf* | 0.0028 | 0.0034 | 0.0021 | 0.0028 | 0.0009 | 0.0017 | 0.0005 | 0.0015 | 0.0086 | 0.0091 |
| | (0.0053) | (0.0052) | (0.0057) | (0.0062) | (0.0069) | (0.0068) | (0.0078) | (0.0077) | (0.0108) | (0.0101) |
| *Mutual* | 0.0132*** | 0.0128*** | 0.0177*** | 0.0169*** | 0.0223*** | 0.0212*** | 0.0263*** | 0.0254*** | 0.0213** | 0.0211** |
| | (0.0051) | (0.0047) | (0.0062) | (0.0059) | (0.0078) | (0.0075) | (0.0089) | (0.0087) | (0.0103) | (0.0103) |
| *Product Diverse* | -0.0010 | -0.0025 | 0.0042 | 0.0029 | 0.0125 | 0.0112 | 0.0143* | 0.0130 | 0.0482*** | 0.0472*** |
| | (0.0058) | (0.0054) | (0.0067) | (0.0067) | (0.0077) | (0.0076) | (0.0081) | (0.0081) | (0.0102) | (0.0096) |
| *Longtail* | 0.0260*** | 0.0258*** | 0.0266*** | 0.0264*** | 0.0277*** | 0.0273*** | 0.0319*** | 0.0310*** | 0.0393*** | 0.0369*** |
| | (0.0062) | (0.0062) | (0.0066) | (0.0065) | (0.0067) | (0.0067) | (0.0069) | (0.0070) | (0.0089) | (0.0089) |
| *Group* | -0.0081 | -0.0075 | -0.0098 | -0.0094 | -0.0104 | -0.0099 | -0.0109 | -0.0100 | -0.0185** | -0.0171** |
| | (0.0056) | (0.0054) | (0.0064) | (0.0065) | (0.0070) | (0.0067) | (0.0075) | (0.0075) | (0.0088) | (0.0087) |
| *Growth* | 0.0003 | 0.0002 | 0.0007 | 0.0006 | 0.0011 | 0.0010 | 0.0008 | 0.0007 | -0.0017 | -0.0019 |
| | (0.0008) | (0.0008) | (0.0010) | (0.0010) | (0.0010) | (0.0011) | (0.0012) | (0.0012) | (0.0017) | (0.0017) |
| *Small Profit* | -0.0020 | -0.0023 | -0.0022 | -0.0026 | -0.0021 | -0.0026 | 0.0003 | -0.0008 | -0.0045 | -0.0062 |
| | (0.0047) | (0.0048) | (0.0056) | (0.0059) | (0.0070) | (0.0070) | (0.0079) | (0.0080) | (0.0127) | (0.0127) |
| *Small Loss* | -0.0113 | -0.0124 | -0.0144 | -0.0156 | -0.0231* | -0.0244* | -0.0316 | -0.0330* | -0.0326 | -0.0337 |
| | (0.0085) | (0.0085) | (0.0110) | (0.0108) | (0.0140) | (0.0142) | (0.0192) | (0.0186) | (0.0278) | (0.0269) |
| *Profit* | 0.0139*** | 0.0140*** | 0.0163*** | 0.0164*** | 0.0203*** | 0.0204*** | 0.0238*** | 0.0237*** | 0.0318*** | 0.0306*** |
| | (0.0037) | (0.0036) | (0.0044) | (0.0042) | (0.0048) | (0.0048) | (0.0056) | (0.0054) | (0.0081) | (0.0083) |
| *Insolvent* | -0.1044 | -0.0903 | -0.0894 | -0.0772 | -0.0975 | -0.0850 | -0.1476 | -0.1368 | -0.2539 | -0.2312 |
| | (0.1540) | (0.1456) | (0.1591) | (0.1535) | (0.1753) | (0.1736) | (0.2133) | (0.2034) | (0.2978) | (0.2871) |
| Constant | 0.0738*** | 0.0742*** | 0.0882*** | 0.0893*** | 0.1075*** | 0.1097*** | 0.1048** | 0.1062** | 0.0271 | 0.0347 |
| | (0.0286) | (0.0269) | (0.0306) | (0.0330) | (0.0380) | (0.0351) | (0.0428) | (0.0421) | (0.0546) | (0.0522) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Wald $\chi^2$ | 650.20 | 685.08 | 605.47 | 613.40 | 433.04 | 431.04 | 320.01 | 372.04 | 184.32 | 204.12 |
| $R^2$ | 10.20% | 10.44% | 10.70% | 11.00% | 10.80% | 11.23% | 10.89% | 11.44% | 12.97% | 13.52% |
| Observations | 14,674 | 14,674 | 12,039 | 12,039 | 9,644 | 9,644 | 7,694 | 7,694 | 3,923 | 3,923 |

Note: This table reports results from OLS regressions. The dependent variable (*RE*) is loss reserve error scaled by total assets. *Difference* is a firm's actual financial strength rating (*Rating*) minus a firm's target rating ("A-"). *Above A-* is equal to *Difference* if *Difference* is positive and 0 otherwise. *Below A-* is equal to -1 times *Difference* if *Difference* is negative and 0 otherwise. *Size* is the natural log of total assets. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Tax Shield* is a firm's net income plus developed reserves divided by total assets. *Geo Herf* is the geographic Herfindahl index. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Product Diverse* is 1 minus the line of business Herfindahl index. *Longtail* is the proportion of premiums written in longtailed lines. *Group* is a binary variable equal to 1 for a group and 0 otherwise. *Growth* is the one year change in net premiums written. *Small Profit* is a binary variable equal to 1 if a firm has earnings in the bottom 5 percent of the earnings distribution. *Small Loss* is a binary variable equal to 1 if a firm has earnings in the top 5 percent of the negative earnings distribution. *Profit* is a binary variable equal to 1 if a firm has earnings in the top 90 percent of the positive earnings distribution. *Insolvent* is an estimated probability of insolvency based on IRIS ratios. All regressions include year indicators. Standard errors are presented beneath each coefficient estimate in parentheses. Bootstrapped standard errors are from 1,000 replications and account for firm-level clustering. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

# Table 2.7: Past Rating as Target Results

Dependent Variable: Reserve Error

| | Last Year | | Last 2 Years | | Last 3 Years | | Last 4 Years | | Last 5 Years | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| *Difference* | 0.0045*** | | 0.0047*** | | 0.0049*** | | 0.0037** | | 0.0036* | |
| | (0.0014) | | (0.0016) | | (0.0018) | | (0.0018) | | (0.0019) | |
| *Above Target* | | 0.0038* | | 0.0039 | | 0.0036 | | 0.0016 | | -0.0008 |
| | | (0.0021) | | (0.0024) | | (0.0026) | | (0.0028) | | (0.0030) |
| *Below Target* | | -0.0052** | | -0.0055** | | -0.0063** | | -0.0059** | | -0.0084*** |
| | | (0.0022) | | (0.0025) | | (0.0026) | | (0.0029) | | (0.0031) |
| *Size* | -0.0020** | -0.0020** | -0.0015 | -0.0016 | -0.0014 | -0.0014 | -0.0010 | -0.0011 | -0.0005 | -0.0006 |
| | (0.0009) | (0.0009) | (0.0010) | (0.0010) | (0.0010) | (0.0011) | (0.0011) | (0.0011) | (0.0012) | (0.0013) |
| *Reinsurance* | -0.0321*** | -0.0321*** | -0.0303*** | -0.0303*** | -0.0285*** | -0.0285*** | -0.0276*** | -0.0275*** | -0.0252*** | -0.0249*** |
| | (0.0045) | (0.0045) | (0.0049) | (0.0047) | (0.0053) | (0.0054) | (0.0061) | (0.0062) | (0.0068) | (0.0066) |
| *Tax Shield* | 0.1563*** | 0.1563*** | 0.1402*** | 0.1402*** | 0.1366*** | 0.1366*** | 0.1497*** | 0.1492*** | 0.1412** | 0.1398** |
| | (0.0335) | (0.0343) | (0.0380) | (0.0377) | (0.0444) | (0.0438) | (0.0511) | (0.0487) | (0.0585) | (0.0591) |
| *Geo Herf* | 0.0022 | 0.0022 | 0.0031 | 0.0032 | 0.0051 | 0.0052 | 0.0063 | 0.0064 | 0.0070 | 0.0071 |
| | (0.0043) | (0.0042) | (0.0043) | (0.0045) | (0.0048) | (0.0050) | (0.0052) | (0.0054) | (0.0057) | (0.0058) |
| *Mutual* | 0.0066* | 0.0066* | 0.0049 | 0.0048 | 0.0021 | 0.0021 | 0.0017 | 0.0016 | 0.0008 | 0.0007 |
| | (0.0035) | (0.0036) | (0.0035) | (0.0036) | (0.0040) | (0.0038) | (0.0041) | (0.0043) | (0.0043) | (0.0042) |
| *Product Diverse* | -0.0034 | -0.0035 | -0.0005 | -0.0006 | 0.0023 | 0.0022 | 0.0054 | 0.0053 | 0.0089 | 0.0087 |
| | (0.0054) | (0.0053) | (0.0057) | (0.0059) | (0.0063) | (0.0063) | (0.0069) | (0.0070) | (0.0080) | (0.0078) |
| *Longtail* | 0.0235*** | 0.0235*** | 0.0238*** | 0.0239*** | 0.0236*** | 0.0237*** | 0.0243*** | 0.0245*** | 0.0254*** | 0.0258*** |
| | (0.0062) | (0.0061) | (0.0061) | (0.0063) | (0.0071) | (0.0069) | (0.0078) | (0.0076) | (0.0086) | (0.0087) |
| *Group* | 0.0010 | 0.0011 | 0.0011 | 0.0011 | 0.0012 | 0.0012 | 0.0011 | 0.0012 | 0.0002 | 0.0004 |
| | (0.0046) | (0.0043) | (0.0046) | (0.0048) | (0.0052) | (0.0050) | (0.0056) | (0.0053) | (0.0058) | (0.0058) |
| *Growth* | 0.0011 | 0.0011 | 0.0014* | 0.0014* | 0.0014 | 0.0014 | 0.0020* | 0.0020* | 0.0023* | 0.0023* |
| | (0.0007) | (0.0007) | (0.0007) | (0.0007) | (0.0010) | (0.0010) | (0.0011) | (0.0011) | (0.0012) | (0.0012) |
| *Small Profit* | -0.0074* | -0.0075* | -0.0073 | -0.0073* | -0.0088* | -0.0089* | -0.0097* | -0.0098* | -0.0051 | -0.0054 |
| | (0.0043) | (0.0042) | (0.0045) | (0.0044) | (0.0052) | (0.0051) | (0.0059) | (0.0056) | (0.0059) | (0.0060) |
| *Small Loss* | -0.0121 | -0.0122 | -0.0095 | -0.0096 | -0.0063 | -0.0065 | -0.0071 | -0.0073 | -0.0086 | -0.0091 |
| | (0.0082) | (0.0084) | (0.0079) | (0.0079) | (0.0082) | (0.0084) | (0.0088) | (0.0087) | (0.0096) | (0.0097) |
| *Profit* | 0.0078*** | 0.0077*** | 0.0096*** | 0.0095*** | 0.0074** | 0.0073** | 0.0055 | 0.0053 | 0.0052 | 0.0049 |
| | (0.0030) | (0.0030) | (0.0031) | (0.0031) | (0.0035) | (0.0034) | (0.0038) | (0.0037) | (0.0043) | (0.0043) |
| *Insolvent* | -0.1237 | -0.1224 | -0.0674 | -0.0657 | -0.3381** | -0.3356** | -0.4143** | -0.4092** | -0.4443** | -0.4330** |
| | (0.1564) | (0.1582) | (0.1601) | (0.1661) | (0.1688) | (0.1661) | (0.1797) | (0.1693) | (0.1747) | (0.1768) |
| Intercept | 0.0346* | 0.0348* | 0.0212 | 0.0215 | 0.0411** | 0.0345 | 0.0317 | 0.0335 | 0.0189 | 0.0218 |
| | (0.0206) | (0.0205) | (0.0210) | (0.0207) | (0.0206) | (0.0217) | (0.0225) | (0.0229) | (0.0255) | (0.0257) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Wald $\chi^2$ | 562.12 | 584.37 | 427.60 | 445.54 | 324.54 | 360.79 | 237.64 | 264.15 | 229.74 | 232.98 |
| $R^2$ | 7.21% | 7.21% | 6.57% | 6.57% | 6.58% | 6.59% | 6.79% | 6.80% | 7.34% | 7.42% |
| Observations | 17,855 | 17,855 | 15,343 | 15,343 | 12,581 | 12,581 | 10,265 | 10,265 | 8,257 | 8,257 |

Note: This table reports results from OLS regressions. The dependent variable is loss reserve error scaled by total assets. *Difference* is the difference between *Rating* and a firm's target rating. *Above Target* is equal to *Difference* if *Difference* is positive and 0 otherwise. *Below Target* is equal to -1 times *Difference* if *Difference* is negative and 0 otherwise. Each column uses a different lag of *Rating* as a measure of target rating. *Size* is the natural log of total assets. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Tax Shield* is a firm's net income plus developed reserves divided by total assets. *Geo Herf* is the geographic Herfindahl index. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Product Diverse* is 1 minus the line of business Herfindahl index. *Longtail* is the proportion of premiums written in longtailed lines. *Group* is a binary variable equal to 1 for a group and 0 otherwise. *Growth* is the one year change in net premiums written. *Small Profit* is a binary variable equal to 1 if a firm has earnings in the bottom 5 percent of the earnings distribution. *Small Loss* is a binary variable equal to 1 if a firm has earnings in the top 5 percent of the negative earnings distribution. *Profit* is a binary variable equal to 1 if a firm has earnings in the top 90 percent of the positive earnings distribution. *Insolvent* is an estimated probability of insolvency based on IRIS ratios. All regressions include year indicators. Standard errors are presented beneath each coefficient estimate in parentheses. Bootstrapped standard errors are from 1,000 replications and account for firm-level clustering. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table 2.8: Target Rating Model Results

| Dependent Variable: Reserve Error | | |
|---|---|---|
| | (1) | (2) |
| *Difference* | 0.0020*** | |
| | (0.0007) | |
| *Above Target* | | 0.0005 |
| | | (0.0015) |
| *Below Target* | | -0.0026*** |
| | | (0.0009) |
| *Size* | -0.0021** | -0.0021** |
| | (0.0010) | (0.0010) |
| *Reinsurance* | -0.0368*** | -0.0363*** |
| | (0.0048) | (0.0047) |
| *Tax Shield* | 0.1659*** | 0.1660*** |
| | (0.0298) | (0.0302) |
| *Geo Herf* | 0.0056 | 0.0059 |
| | (0.0045) | (0.0047) |
| *Mutual* | 0.0053 | 0.0052 |
| | (0.0037) | (0.0037) |
| *Product Diverse* | -0.0004 | -0.0008 |
| | (0.0055) | (0.0054) |
| *Longtail* | 0.0218*** | 0.0218*** |
| | (0.0064) | (0.0064) |
| *Group* | 0.0012 | 0.0013 |
| | (0.0048) | (0.0048) |
| *Growth* | 0.0003 | 0.0003 |
| | (0.0008) | (0.0008) |
| *Small Profit* | -0.0077* | -0.0077* |
| | (0.0041) | (0.0044) |
| *Small Loss* | -0.0135 | -0.0136 |
| | (0.0087) | (0.0085) |
| *Profit* | 0.0064** | 0.0063** |
| | (0.0027) | (0.0028) |
| *Insolvent* | -0.1111 | -0.1098 |
| | (0.1611) | (0.1644) |
| Intercept | 0.0485** | 0.0499** |
| | (0.0209) | (0.0217) |
| Year FE | Yes | Yes |
| $R^2$ | 7.87% | 7.88% |
| Wald $\chi^2$ | 587.76 | 570.26 |
| Observations | 16,066 | 16,066 |

Note: This table reports results from OLS regressions. The dependent variable ($RE$) is loss reserve error scaled by total assets. *Difference* is the difference between *Rating* and a firm's target rating. *Above Target* is equal to *Difference* if *Difference* is positive and 0 otherwise. *Below Target* is equal to -1 times *Difference* if *Difference* is negative and 0 otherwise. Standard errors are presented in parentheses beneath each coefficient estimate. Standard errors are from 1,000 bootstrap replications. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

## Table 2.9: Main Model with External Monitoring

Dependent Variable: Reserve Error

| | (1) | (2) | (3) |
|---|---|---|---|
| *Above Target* | -0.0015 | -0.0015 | -0.0013 |
| | (0.0024) | (0.0025) | (0.0024) |
| *Below Target* | -0.0063** | -0.0063** | -0.0090*** |
| | (0.0027) | (0.0027) | (0.0033) |
| *Big 4* | | -0.0035 | -0.0013 |
| | | (0.0038) | (0.0040) |
| *Big 4*Below Target* | | | 0.0074 |
| | | | (0.0045) |
| *Size* | -0.0017 | -0.0017 | -0.0021* |
| | (0.0011) | (0.0011) | (0.0011) |
| *Reinsurance* | -0.0243*** | -0.0245*** | -0.0254*** |
| | (0.0059) | (0.0055) | (0.0057) |
| *Tax Shield* | 0.1901*** | 0.1883*** | 0.1937*** |
| | (0.0440) | (0.0457) | (0.0458) |
| *Geo Herf* | 0.0005 | 0.0003 | 0.0006 |
| | (0.0055) | (0.0053) | (0.0054) |
| *Mutual* | -0.0062 | -0.0061 | -0.0062 |
| | (0.0040) | (0.0040) | (0.0040) |
| *Product Diverse* | 0.0168** | 0.0167*** | 0.0170** |
| | (0.0065) | (0.0064) | (0.0067) |
| *Longtail* | 0.0391*** | 0.0391*** | 0.0391*** |
| | (0.0073) | (0.0072) | (0.0073) |
| *Group* | -0.0048 | -0.0045 | -0.0056 |
| | (0.0050) | (0.0051) | (0.0049) |
| *Growth* | -0.0008 | -0.0008 | -0.0009 |
| | (0.0014) | (0.0015) | (0.0014) |
| *Small Profit* | -0.0101 | -0.0101 | -0.0101 |
| | (0.0071) | (0.0066) | (0.0070) |
| *Small Loss* | -0.0121 | -0.0123 | -0.0117 |
| | (0.0124) | (0.0122) | (0.0119) |
| *Profit* | 0.0030 | 0.0030 | 0.0029 |
| | (0.0043) | (0.0043) | (0.0043) |
| *Insolvent* | 0.0059 | 0.0039 | -0.0146 |
| | (0.1458) | (0.1445) | (0.1466) |
| Intercept | 0.0348 | 0.0344 | 0.0428* |
| | (0.0228) | (0.0227) | (0.0233) |
| Year FE | Yes | Yes | Yes |
| *Below Target+Big 4*Below Target* = 0 | | | 0.6656 |
| $R^2$ | 6.00% | 6.04% | 6.26% |
| Wald $\chi^2$ | 134.51 | 139.92 | 131.41 |
| Observations | 4,239 | 4,239 | 4,239 |

Note: This table reports results from OLS regressions. The dependent variable (*RE*) is loss reserve error scaled by total assets. *Difference* is the difference between *Rating* and a firm's target rating. *Above Target* is equal to *Difference* if *Difference* is positive and 0 otherwise. *Below Target* is equal to -1 times *Difference* if *Difference* is negative and 0 otherwise. *Big 4* is a binary variable equal to 1 if a firm had both a Big 4 auditor and a Big 4 actuary and 0 otherwise. Standard errors are presented in parentheses beneath each coefficient estimate. Standard errors are from 1,000 bootstrap replications. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

# Table 2.10: Commercial Lines Results with External Monitoring

| | Dependent Variable: Reserve Error | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | >60% | | >70% | | >80% | | >90% | | =100% | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| *Above A-* | 0.0025 | 0.0029 | 0.0036 | 0.0040 | 0.0033 | 0.0040 | 0.0014 | 0.0023 | -0.0009 | -0.0006 |
| | (0.0023) | (0.0024) | (0.0027) | (0.0028) | (0.0032) | (0.0032) | (0.0042) | (0.0042) | (0.0065) | (0.0068) |
| *Below A-* | -0.0122*** | -0.0148*** | -0.0143*** | -0.0183*** | -0.0177*** | -0.0248*** | -0.0196*** | -0.0271*** | -0.0221*** | -0.0281*** |
| | (0.0037) | (0.0041) | (0.0046) | (0.0045) | (0.0055) | (0.0055) | (0.0056) | (0.0057) | (0.0076) | (0.0086) |
| *Big 4* | | -0.0080* | | -0.0095* | | -0.0104* | | -0.0068 | | -0.0262** |
| | | (0.0044) | | (0.0052) | | (0.0064) | | (0.0075) | | (0.0131) |
| *Big 4*Below A-* | | 0.0079 | | 0.0114 | | 0.0178* | | 0.0191* | | 0.0162 |
| | | (0.0075) | | (0.0096) | | (0.0100) | | (0.0109) | | (0.0155) |
| *Size* | -0.0030** | -0.0032** | -0.0037** | -0.0040** | -0.0041** | -0.0048** | -0.0038* | -0.0045** | -0.0031 | -0.0030 |
| | (0.0014) | (0.0015) | (0.0017) | (0.0016) | (0.0020) | (0.0019) | (0.0022) | (0.0022) | (0.0035) | (0.0036) |
| *Reinsurance* | -0.0302*** | -0.0310*** | -0.0322*** | -0.0327*** | -0.0369*** | -0.0375*** | -0.0367*** | -0.0366*** | -0.0287 | -0.0300* |
| | (0.0070) | (0.0070) | (0.0079) | (0.0077) | (0.0090) | (0.0089) | (0.0099) | (0.0101) | (0.0175) | (0.0169) |
| *Tax Shield* | 0.0552 | 0.0512 | 0.0587 | 0.0568 | 0.0448 | 0.0433 | 0.0214 | 0.0242 | 0.0982 | 0.1020 |
| | (0.0935) | (0.0912) | (0.1035) | (0.1023) | (0.1068) | (0.1111) | (0.1213) | (0.1217) | (0.1680) | (0.1741) |
| *Geo Herf* | 0.0024 | 0.0016 | 0.0025 | 0.0012 | 0.0061 | 0.0040 | 0.0053 | 0.0030 | 0.0166 | 0.0141 |
| | (0.0064) | (0.0060) | (0.0072) | (0.0070) | (0.0081) | (0.0080) | (0.0093) | (0.0091) | (0.0136) | (0.0134) |
| *Mutual* | 0.0011 | 0.0010 | 0.0030 | 0.0027 | 0.0073 | 0.0071 | 0.0079 | 0.0082 | 0.0086 | 0.0072 |
| | (0.0054) | (0.0055) | (0.0068) | (0.0065) | (0.0080) | (0.0079) | (0.0090) | (0.0090) | (0.0116) | (0.0119) |
| *Product Diverse* | 0.0115* | 0.0116* | 0.0117 | 0.0114 | 0.0167* | 0.0164* | 0.0233** | 0.0226** | 0.0723*** | 0.0692*** |
| | (0.0065) | (0.0063) | (0.0080) | (0.0082) | (0.0092) | (0.0093) | (0.0099) | (0.0097) | (0.0137) | (0.0130) |
| *Longtail* | 0.0402*** | 0.0396*** | 0.0406*** | 0.0398*** | 0.0415*** | 0.0406*** | 0.0426*** | 0.0417*** | 0.0462*** | 0.0436*** |
| | (0.0078) | (0.0074) | (0.0076) | (0.0079) | (0.0082) | (0.0082) | (0.0084) | (0.0084) | (0.0108) | (0.0108) |
| *Group* | -0.0081 | -0.0092 | -0.0103 | -0.0117* | -0.0120 | -0.0145* | -0.0111 | -0.0143* | -0.0136 | -0.0152 |
| | (0.0067) | (0.0063) | (0.0072) | (0.0069) | (0.0078) | (0.0083) | (0.0090) | (0.0085) | (0.0118) | (0.0113) |
| *Growth* | 0.0003 | 0.0003 | 0.0006 | 0.0005 | 0.0012 | 0.0011 | 0.0012 | 0.0011 | 0.0009 | 0.0006 |
| | (0.0015) | (0.0016) | (0.0016) | (0.0015) | (0.0017) | (0.0017) | (0.0019) | (0.0020) | (0.0028) | (0.0028) |
| *Small Profit* | -0.0057 | -0.0033 | -0.0040 | -0.0014 | -0.0037 | 0.0003 | 0.0068 | 0.0099 | 0.0212 | 0.0247 |
| | (0.0096) | (0.0099) | (0.0109) | (0.0104) | (0.0110) | (0.0109) | (0.0126) | (0.0125) | (0.0245) | (0.0226) |
| *Small Loss* | -0.0102 | -0.0107 | -0.0127 | -0.0135 | -0.0152 | -0.0160 | -0.0033 | -0.0050 | 0.0419** | 0.0367** |
| | (0.0141) | (0.0131) | (0.0162) | (0.0148) | (0.0185) | (0.0184) | (0.0258) | (0.0245) | (0.0202) | (0.0182) |
| *Profit* | 0.0133* | 0.0139* | 0.0141* | 0.0144* | 0.0171* | 0.0175* | 0.0257** | 0.0250** | 0.0341** | 0.0329** |
| | (0.0072) | (0.0071) | (0.0082) | (0.0086) | (0.0093) | (0.0092) | (0.0107) | (0.0106) | (0.0159) | (0.0164) |
| *Insolvent* | -0.0409 | -0.0596 | -0.0345 | -0.0588 | -0.0239 | -0.0551 | -0.0682 | -0.0960 | 0.0623 | 0.0346 |
| | (0.2210) | (0.2147) | (0.2922) | (0.2532) | (0.2577) | (0.2469) | (0.2785) | (0.2571) | (0.4697) | (0.4801) |
| Intercept | 0.0592* | 0.0652** | 0.0746** | 0.0839** | 0.0797* | 0.0969** | 0.0671 | 0.0854* | 0.0247 | 0.0322 |
| | (0.0303) | (0.0325) | (0.0351) | (0.0333) | (0.0420) | (0.0394) | (0.0455) | (0.0450) | (0.0683) | (0.0693) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Below A-+Big 4*Below A-* = 0 | | 0.3077 | | 0.4284 | | 0.4511 | | 0.4184 | | 0.3787 |
| Wald $\chi^2$ | 87.00 | 102.93 | 97.31 | 95.01 | 97.50 | 97.24 | 89.36 | 96.17 | 105.72 | 124.94 |
| $R^2$ | 6.11% | 6.40% | 6.55% | 6.98% | 7.75% | 8.49% | 8.93% | 9.65% | 16.88% | 17.98% |
| Observations | 3,478 | 3,478 | 2,873 | 2,873 | 2,343 | 2,343 | 1,858 | 1,858 | 968 | 968 |

Note: This table reports results from OLS regressions. The dependent variable (*RE*) is loss reserve error scaled by total assets. *Difference* is a firm's actual financial strength rating (*Rating*) minus a firm's target rating ("A-"). *Above A-* is equal to *Difference* if *Difference* is positive and 0 otherwise. *Below A-* is equal to -1 times *Difference* if *Difference* is negative and 0 otherwise. *Big 4* is a binary variable equal to 1 if a firm had both a Big 4 auditor and a Big 4 actuary and 0 otherwise. *Size* is the natural log of total assets. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Tax Shield* is a firm's net income plus developed reserves divided by total assets. *Geo Herf* is the geographic Herfindahl index. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Product Diverse* is 1 minus the line of business Herfindahl index. *Longtail* is the proportion of premiums written in longtailed lines. *Group* is a binary variable equal to 1 for a group and 0 otherwise. *Growth* is the one year change in net premiums written. *Small Profit* is a binary variable equal to 1 if a firm has earnings in the bottom 5 percent of the earnings distribution. *Small Loss* is a binary variable equal to 1 if a firm has earnings in the top 5 percent of the negative earnings distribution. *Profit* is a binary variable equal to 1 if a firm has earnings in the top 90 percent of the positive earnings distribution. *Insolvent* is an estimated probability of insolvency based on IRIS ratios. All regressions include year indicators. Standard errors are presented beneath each coefficient estimate in parentheses. Bootstrapped standard errors are from 1,000 replications and account for firm-level clustering. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

# Chapter 3
# Executive Compensation and Ownership Structure

## 3.1 Introduction

Whether executives manage earnings to increase their own compensation has been extensively studied in the accounting and finance literature (e.g., Healy, 1985; Gaver, Gaver, and Austin, 1995; Holthausen, Larcker, and Sloan, 1995). Healy (1985) shows the mechanisms which incent executives to manipulate earnings to maximize bonus pay with later studies examining the degree to which executives respond to these mechanisms. Due to data limitations, however, the prior studies connecting earnings management and executive compensation have focused exclusively on executives of publicly traded firms. Of course, these incentives may differ for non-publicly traded firms. Indeed, agency theory suggests that managers of firms with different ownership structures will have different incentives and will be subject to different monitoring mechanisms (e.g., Jensen and Meckling, 1976; Mayers and Smith, 1981). Here, I examine the variation in earnings management across publicly traded stock firms, privately-held stock firms, and privately-held customer-owned (mutual) firms.

For aligning incentives and monitoring purposes, ownership structure is but one tool firms can employ. Another, explicit, form of monitoring emanates from the choice of external auditors. High-quality external monitoring can mitigate a manager's ability/incentive to manipulate earnings for purposes of maximizing compensation. In addition to the implicit monitoring in place by choice of organizational form, I also examine the role of explicit external monitors in mitigating managerial earnings manipulation. Finally, I are able to exploit my unique dataset to determine whether or not earnings management is specifically associated with certain decision makers (e.g., CEOs).

In order to test the relationships discussed above, I turn to the insurance industry for a unique source of data. The insurance industry provides an excellent laboratory to examine how incentives to manage earnings differ across organizational structures. In addition to publicly traded and privately-held stock firms, a substantial portion of the insurance industry is comprised of policyholder-owned (mutual) firms.[1] Further, because a few states require insurers to report compensation for all licensed insurers, I have access to executive compensation data for a broader set of managers. That is, I are not limited to only publicly traded firms. In addition to having a unique mix of ownership structures, examining the property-casualty (P/C) insurance industry allows me to use loss reserve errors as my measure of accruals-based earnings management (e.g., Petroni, 1992; Gaver and Paterson, 1999; Beaver, McNichols, and Nelson, 2003; Gaver and Paterson, 2004).

In this paper, I examine whether the use of earnings management to maximize executive compensation differs across ownership structures in the U.S. property-casualty insurance industry. Specifically, I examine whether incentives to manage earnings differs across publicly traded and privately-held stock firms. Prior research on earnings management and executive compensation has generally found evidence that managers of publicly traded firms manage earnings (e.g., Healy, 1985; Gaver, Gaver, and Austin, 1995; Holthausen, Larcker, and Sloan, 1995; Eckles and Halek, 2010), but no research, to my knowledge, has examined the interaction of earnings management and executive compensation with regard to privately-held stock firms. Additionally, I examine whether managers of mutual firms manage earnings in an effort to increase their incentive-based bonus compensation. As with privately-held stock

[1] There are actually several distinct organizational forms, but mutual and stock firms together represent the majority of insuring entities in the U.S.. In 2005 (the last year in my sample) 69 percent of insurers were organized as stocks and 17 percent were organized as mutuals. The largest other groups were risk retention groups (7 percent), reciprocals (3 percent), and Lloyd's organizations (2 percent).

firms, mutuals have generally not been examined in prior executive compensation studies. My paper is the first, to my knowledge, to broadly study the relationship between organizational structure and the incentive of managers to manage earnings to maximize their incentive-based compensation.

In addition to the organizational structure, I examine whether high-quality, external monitoring can mitigate managers' loss reserve manipulation. Monitoring loss reserve management requires high-quality monitoring in the form of, not only auditors, but also external actuaries, as they possess a particular expertise in loss reserve establishment (Gaver and Paterson, 2001). Finally, I also specifically examine whether the compensation structure of certain decision makers (i.e., CEOs and internal actuaries) influences management of earnings. In insurance firms, actuaries possess an expertise in establishing loss reserves and, therefore, could potentially have a greater ability to manage loss reserves in an effort to maximize their compensation.

The ability to observe accounting errors is another reason that insurance firms offer a unique laboratory in which to study accounting manipulation. Insurers are required to report initial annual estimates of losses, which are counted as expenses with respect to net income.[2] Therefore, higher (lower) loss estimates can serve to reduce (increase) the net income of an insurer. Though all firms have similar discretionary accounting items, insurers are required to show how these estimated expenses (the losses) develop over time. Each year, insurers are required to re-estimate prior years' loss estimates to reflect actual payments made as well as changes in estimates. Over time, these estimates converge to the actual loss amount

[2]These are estimates in the sense that an insurer has not finalized loss amounts on known claims or an insurer has not yet been notified about loss occurrences. The latter are known as incurred but not reported (IBNR).

incurred.[3] The process, then, allows for the observability of the actual error made in the original accounting estimate.

Given this appropriate set of data, I regress insurer loss reserve errors on the proportion of an executive's compensation that is paid as a bonus along with other control variables for determinants of reserve errors.[4] My sample is comprised of P/C insurers from 2003-2005. I use executive compensation data collected from filings with the Nebraska Department of Insurance. Nebraska is the one state that a) requires this compensation filing and b) for which I had access to the filings. The filings are required of all insurers operating in the state and therefore allow me to examine differences between ownership structures. I, therefore, perform my analysis on different subgroups of ownership structures, specifically publicly traded stock, privately-held stock, and mutual firms. I also interact bonus compensation with a variable representing high-quality, external monitoring to examine whether auditors and external actuaries can mitigate managers' loss reserve manipulation to increase their bonus compensation. I perform this analysis separately for all top executives at a firm, chief executive officers (CEOs), and actuaries.

I offer five main results. First, consistent with prior literature (e.g., Eckles and Halek, 2010), I find evidence that managers of publicly traded insurers tend to manage reserves as they receive a greater proportion of their compensation as a bonus. Second, I find evidence that managers of privately-held stock firms tend to manage reserves. Specifically, I

[3]The degree to which the actual loss amount is known at any point varies by the type of insurance written. Long-tailed lines of business will have a longer time between the time of the claim and the time the loss is paid. For example, liability lines are considered long-tailed since legal proceedings can take a considerable amount of time (Grace and Leverty, 2012).

[4]Bonuses are not the only compensation component that can create incentives for managers to manipulate earnings. Aboody and Kasznik (2000) show that equity-based compensation (e.g., options and restricted stock) also creates incentives for managers to manipulate earnings. Bergstresser and Philippon (2006) empirically show that firms with CEOs who have their compensation closely tied to stock price use discretionary accruals to manipulate earnings. Burns and Kedia (2006) find a positive relationship between the sensitivity of a CEO's option portfolio to stock price and the probability of financial misreporting. Browne, Ma, and Wang (2009) find that insurer loss reserve manipulation is linked to stock-based compensation. Since the majority of my sample are private stock firms and mutual insurers, I use bonuses as my primary incentive-based compensation measure.

find evidence of overreserving when analyzing all top executives of a firm, but evidence of underreserving as bonus compensation increases when analyzing CEOs only.[5] Third, I find no evidence of reserve management for executives of mutual firms in relation to their bonus compensation. Fourth, I find evidence that reserve manipulation related to executive compensation can be partially mitigated by high-quality, external monitoring (i.e., Big 4 audit and actuarial firms). Finally, I find evidence that actuaries manipulate reserves for stock firms (specifically for publicly traded insurers), but not for mutual firms.

I make several contributions to the literature. First, I contribute to the earnings management literature. I provide evidence that incentives related to earnings management differ across ownership structures when examining a relatively strong earnings management incentive—executive compensation. Second, I contribute to the literature examining ownership structure and agency theory. My results suggest that ownership structure plays an important role in determining management behavior. Third, I contribute to the executive compensation literature by examining how executive compensation differs across ownership structures. Fourth, I find some evidence that high-quality, external monitoring can mitigate firms' reserve manipulation. Finally, I contribute to the reserve error literature in that I provide further evidence of reserve management related to executive compensation, but show that incentives differ across public, private, and mutual firms.

The remainder of my paper is organized as follows. Section 3.2 provides background on executive bonus schemes and organizational form. Here, I also develop my hypotheses. Sections 3.3 and 3.4 present my model and discuss my data, respectively. Section 3.5 presents my results and section 3.6 concludes the paper.

[5] As I describe in Section 2, under (over)reserving refers to under- (over-)stating the initial loss reserve estimate relative to eventual reserve development. Under (over)reserving will increase (decrease) current-period net income.

## 3.2 Background and Hypothesis Development

### 3.2.1 Executive Compensation

While the literature on executive compensation is broad, I focus specifically on the interaction between bonus plans and earnings management (e.g., Healy, 1985; Gaver, Gaver, and Austin, 1995; Holthausen, Larcker, and Sloan, 1995; Guidry, Leone, and Rock, 1999). Healy (1985) finds that managerial bonus plans based on incentives will induce managers to choose accounting procedures that maximize their compensation. Though the obvious incentives suggest increasing earnings in the current year, it could also involve shifting earnings to future years. Healy (1985) provides two scenarios where managers may decrease earnings in the current year. First, a manager's bonus may already be maximized based on a high level of firm performance. In this case, there are no longer incentives to manipulate earnings any higher. Second, a firm could perform at such a low level where the manager believes he/she has no chance of receiving a bonus. Again, there is no incentive to manipulate earnings any higher. This creates a "bonus call spread" (see Figure 1) where, at the extremes, a manager will want to decrease earnings through discretionary measures, and a center where the manager has incentives to increase earnings in order to receive higher overall compensation. Using non-insurer data, Gaver, Gaver, and Austin (1995) extend Healy (1985) and find results more consistent with the earnings smoothing hypothesis, in that managers below the bonus threshold engage in income-increasing discretionary accruals as opposed to "taking a bath" and engaging in income-decreasing discretionary accruals. Similarly, Holthausen, Larcker, and Sloan (1995) also find evidence that CEOs manage discretionary accruals, though only in certain regions of the contract. Guidry, Leone, and Rock (1999) use business unit-level data and examine whether managers use discretionary accruals to maximize their bonuses. Unlike Gaver, Gaver, and Austin (1995) and Holthausen, Larcker, and Sloan (1995), they find evidence that managers in the center bonus range (the manager has incentives to manage earnings upwards) make income-increasing discretionary accruals relative to those managers who are no longer incentivized to increase earnings.

In the first study to link earnings manipulation measured by insurer loss reserves to executive compensation, Eckles and Halek (2010) find that executives manipulate reserves in order to increase their compensation. Specifically, they find that managers of firms that are ineligible for a bonus (due to either extremely poor or extremely good performance) tend to make earnings-decreasing decisions (overreserving), while managers receiving bonuses tend to make earnings-increasing decisions (underreserving). In addition to bonuses, they consider numerous other forms of compensation, including restricted stock and stock options and find that managers holding restricted stock tend to underreserve. However, they find no relation between the awarding of stock options, awarding of restricted stock, or long-term incentive plans and reserve errors.[6] In another study, Eckles et al. (2011) investigate whether the earnings management that occurs in the insurance industry may be tempered by board structure. They use reserve errors as a more accurate proxy for earnings management compared to other methods commonly used in the corporate governance literature. In addition to finding executive compensation results consistent with Eckles and Halek (2010), they find that certain board structures lead to more earnings management.

### 3.2.2 Ownership Structure

The relationship between firm owners and managers within a corporation can be viewed as an agency relationship (Jensen and Meckling, 1976). Firm owners, normally shareholders, have a number of mechanisms they can use to attempt to align the incentives of managers with their own, such as incentive-based or equity-based compensation. There are also moni-

[6]Browne, Ma, and Wang (2009) also investigate the relation between insurer loss reserve errors and executive compensation. They find that firms with stock option packages that are more sensitive to the value of stock tend to underreserve to a greater extent. They jointly consider bonus payment and long-term incentive pay in their study and do not find any relation with loss reserve errors.

toring mechanisms, such as the board of directors, and market-based disciplining measures, such as the threat of takeover that further align the incentives of shareholders and managers (Fama, 1980; Fama and Jensen, 1983). Within privately-held firms, however, the nature of this relationship changes. In many cases, the owners of the firm will also be the owners, completely mitigating any agency issues. In cases where managers and owners are not the same, however, owners may be left with fewer control mechanisms. For example, owners can no longer offer equity-based compensation, as shares of the firm are not publicly traded. The distinction between publicly traded and privately-held stock firms has received a good deal of attention in accounting and finance research in areas such as accounting conservatism (Ball and Shivakumar, 2005; Nichols, Wahlen, and Wieland, 2009), earnings smoothing (Beatty, Ke, and Petroni, 2002; Beaver, McNichols, and Nelson, 2003), and dividend policy (Michaely and Roberts, 2012).

A unique aspect of the insurance industry is that it is primarily comprised of two distinct organization forms, mutual firms and stock firms (Mayers and Smith, 1988). Mutuals are organized such that the policyholders also act as the owners of the firm whereas stock firms are owned by the holders of common stock. Differences in these ownership structures have been extensively studied, as each ownership structure conveys specific benefits to a firm's operations (e.g., Mayers and Smith, 1981, 1986; Mayers, Shivdasani, and Smith, 1997; Cummins, Weiss, and Zi, 1999).

The differences between the two organizational forms, and in particular the inability of mutual owners to transfer their ownership rights, have important implications for corporate control. Mayers, Shivdasani, and Smith (1997) point out that many of the corporate control mechanisms available to stock insurers, such as monitoring by capital markets, stock-based compensation, and the threat of external takeover, are not available to owners of mutual firms. The lack of monitoring mechanisms could allow managers of mutuals to have more discretion in running the firm, which could include discretionary accounting decisions. In particular, I are interested in how earnings management decisions may differ across organizational forms.

Prior research related to ownership structure's impact on earnings management provides mixed results (see Dechow, Ge, and Schrand (2010) for an excellent review of the literature). Prior studies in this area are primarily interested in ownership structure's role as a governance mechanism which could potentially mitigate earnings management. Gul, Chen, and Tsui (2003), Kim and Yi (2006), and Larcker, Richardson, and Tuna (2007) all find some relation between discretionary accruals and managerial ownership. Little research, however, has examined the relation between insurer earnings management and organization form.[7]

### 3.2.3 Hypotheses

While previous literature has found that there are numerous explanations for insurer loss reserve manipulation (such as income smoothing or regulatory avoidance), here I suggest that managers also have an incentive to manipulate loss reserves to increase their own compensation. Though other causes of reserve manipulation, such as avoiding regulatory action, will indirectly increase a manager's utility, loss reserve manipulation that increases a manager's overall compensation provides a direct benefit to the manager. I, therefore, expect to see the portion of compensation based on firm value or firm performance to have an impact on reserve errors.

As mentioned earlier, bonus payouts, as discussed by Healy (1985) and Gaver, Gaver, and Austin (1995), follow a "bonus call spread." For low levels of firm performance, the amount of bonus awarded is flat until the first bonus threshold is reached. Once the threshold is reached there is an increasing bonus paid (not necessarily linear) based on firm performance.

[7]Prior studies analyzing the determinants of loss reserve errors have typically simply controlled for mutuals and publicly traded firms when appropriate (e.g., Grace and Leverty, 2010). Beaver, McNichols, and Nelson (2003) consider differences between public, private, and mutual firms in their analysis of earnings smoothing and find that public and mutual firms manage reserves to avoid losses, while private firms do not. No studies have examined the relationship between loss reserve errors and executive compensation for privately-held or mutual firms.

The payoff will increase until the second threshold is reached, where the bonus payoff will be capped (and the marginal bonus received is zero). Though my dataset does not allow me to observe these threshold levels, I do observe the exact amount of compensation paid to managers in the form of a bonus.[8]

Eckles and Halek (2010) examine proxy statements of the publicly traded insurers in their sample and find that many firms have bonus plans with both a cap and a floor. Mutual insurers are not required to submit proxy statements, so I are unable to observe the details of their bonus schemes. However, in the 2012 and 2013 National Association of Mutual Insurance Companies (NAMIC) Executive Compensation Studies, which provide summaries of various aspects of executive compensation for managers of mutual firms, they report that approximately 80 percent of mutuals use some form of incentive plan and the most common performance measure used to determine incentive pay is profit or net income. This suggests that reserve manipulation could influence bonus pay for mutual executives.

Ultimately, managers have incentives to overreserve prior to attaining the level of firm performance necessary for the first threshold, where they will not be able to attain the bonus threshold even with underreserving, or after the second threshold, where manipulation will not provide any marginal benefit as they have already maximized their bonus payout. On the other hand, managers will have incentives to underreserve in the increasing portion of the "bonus call spread," where higher earnings leads to higher compensation. Based on this I test the following hypotheses:

[8]Eckles and Halek (2010) interact percent of bonus compensation with binary variables that represent firm performance based on annual percentage change in net income. They find that "good" and "poor" performance interacted with bonus is associated with overreserving, while "adequate" performance interacted with firm performance is associated with underreserving. In unreported results, I find my data yield qualitatively similar results to Eckles and Halek (2010).

*H1(a)*: Managers who have no marginal payout from their bonus plan in period $t$ will be incentivized to make earnings decreasing decisions and will therefore overreserve in period $t$.

*H1(b)*: Managers who have increasing payouts from their bonus plan in period $t$ will be incentivized to make earnings increasing decisions and will therefore underreserve in period $t$.

I are also able to test hypotheses related to particular decision-makers within the firm. First, I propose that CEOs are particularly likely to manage reserves to maximize their bonus compensation relative to other executives. As the leader of the firm, the CEO has decision-making power, and would, therefore be able to make reserving decisions to directly benefit his or her own bonus compensation. CEOs will exhibit the same behavior as described in *H1* above, where certain scenarios incentivize different earnings management behaviors. I propose the following hypotheses:

*H2(a)*: Chief executive officers who have no marginal payout from their bonus plan in period $t$ will be incentivized to make earnings decreasing decisions and will therefore overreserve in period $t$.

*H2(b)*: Chief executive officers who have increasing payouts from their bonus plan in period $t$ will be incentivized to make earnings increasing decisions and will therefore underreserve in period $t$.

I also propose that actuaries have the ability to manipulate reserves to maximize their utility derived from incentive-based bonus compensation. Internal actuaries possess a particular expertise in establishing loss reserves and so I expect that they have a large degree of input in establishing the loss reserve.[9] As with CEOs, actuaries receiving a bonus would

[9] I distinguish between internal and external actuaries. My study focuses on internal actuaries in that they are employed by the insurer. External actuaries discussed in prior reserve error studies (e.g., Gaver and Paterson, 2001; Grace and Leverty, 2013) are employed by audit firms.

have the same incentives to over or underreserve in certain situations. I offer the following hypotheses:

*H3(a)*: Internal actuaries who have no marginal payout from their bonus plan in period $t$ will be incentivized to make earnings decreasing decisions and will therefore overreserve in period $t$.

*H3(b)*: Internal actuaries who have increasing payouts from their bonus plan in period $t$ will be incentivized to make earnings increasing decisions and will therefore underreserve in period $t$.

However, since actuaries possess an expertise I might expect them to reserve at a level that is consistent with the expected losses of the firm. Studies on external actuaries, such as Grace and Leverty (2013), find the independence of external monitors is only effective if coupled with the technical knowledge of actuaries in mitigating discretionary causes of reserve errors. Here, I examine the incentives of internal actuaries. I therefore propose the following hypothesis related to internal actuaries:

*H4*: Internal actuaries, who possess an expertise in establishing loss reserves, do not engage in loss reserve manipulation in an effort to increase their own bonus compensation.

My dataset also allows me to compare mutual and stock insurers. Due to data limitations, few studies have been able to study the compensation of mutual insurers. Mayers and Smith (1992) study executive compensation for life insurers and test the *managerial discretion hypothesis*. They find empirical evidence that executives of mutual insurers receive less compensation than executives of stock insurers. They hypothesize that this is due to mutuals having a comparative advantage in business activities that require less managerial discretion. Therefore, they are compensated at a lower level compared to stock insurer executives. Additionally, this also suggests mutual executives may receive less incentive pay. Another possibility is that managers of different organizational structures could have different incentives built into their compensation contracts that may not be based on objective measures, such as earnings. Ke, Petroni, and Safieddine (1999) find that compensation for managers of private stock insurers is less responsive to accounting measures compared to managers of publicly traded insurers. If that were also the case for managers of mutual insurers, I would observe less earnings management, even if they are subject to fewer controls. Another possibility is that mutual firms receive greater scrutiny from external monitors, such as regulators or ratings agencies, primarily due to the challenges mutuals have in raising capital (Viswanathan and Cummins, 2003; Erhemjamts and Leverty, 2010). Essentially, mutual firms are organized to benefit policyholders. Since this is the case, aligning the incentives of managers and policyholders in compensation contracts could involve factors—either quantitative or qualitative—that are difficult to manipulate through loss reserves. These arguments form the basis for the following hypothesis:

*H5*: Managers of mutual insurers will not be incentivized to manage loss reserves relative to managers of stock insurers, as their incentive based compensation is at a lower level or not based on measures that are affected by loss reserve manipulation.

Alternatively, Mayers and Smith (1992) hypothesize that managers of mutuals are not subject to the same disciplining forces as managers of stock firms and subsequently, they may receive more compensation. This could result in higher compensation for managers of mutual insurers. This forms the basis for the following, competing, hypothesis of *H5*:

*H6*: Managers of mutual insurers will have greater incentives to manage loss reserves compared to stock managers as a result of being insulated from market disciplining forces.

Prior work has examined how external monitoring can influence insurer reserving practices (e.g., Petroni and Beasley, 1996; Gaver and Paterson, 2001, 2007; Grace and Leverty, 2013). Independent auditors are required to assess the adequacy of an insurer's loss reserve estimate. In addition to an external auditor, an actuary is required to assess the accuracy of the initial loss reserve estimate and to submit an opinion. While some firms use internal actuaries, some insurers use external actuaries. Gaver and Paterson (2001) find empirical evidence that high-quality monitoring by both audit firms and actuarial firms results in more conservative loss reserve estimates.

In my present setting, I are interested in whether high-quality monitoring by Big 4 audit firms and affiliated Big 4 actuarial firms can prevent managers from managing the loss reserve in an attempt to increase their (overall) bonus compensation. I expect high-quality external monitoring to be able to detect this behavior and prevent these discretionary loss reserve errors. I, therefore, propose the following hypothesis:

*H7*: High-quality external monitors will mitigate the ability of managers to manage reserves to increase their incentive based compensation.

I expect to empirically observe firms with Big 4 auditors and actuaries to "undo" any reserve management related to an executive's bonus compensation. Since I do not predict a direction of this reserve management, I expect high-quality external monitoring to move in the opposite direction of any compensation-related reserve management. A finding supporting this hypothesis would be consistent with Gaver and Paterson (2001).

## 3.3 Research Design

In order to test my hypotheses, I employ the following model:

$$\begin{aligned}
RE_{i,t} = {} & \beta_0 + \beta_1 Bonus_{i,t} + \beta_2 Bonus_{i,t} * Public_{i,t} + \beta_3 Bonus_{i,t} * Mutual_{i,t} + \beta_4 Mutual_{i,t} \\
& + \beta_5 Public_{i,t} + \beta_6 Over_{i,t} * Length_{i,t} + \beta_7 Under_{i,t} * Length_{i,t} + \beta_8 Size_{i,t} \\
& + \beta_9 Tax\ Shield_{i,t} + \beta_{10} Longtail_{i,t} + \beta_{11} Loss_{i,t} + \beta_{12} Small\ Profit_{i,t} + \beta_{13} Profit_{i,t} \\
& + \beta_{14} Reinsurance_{i,t} + \beta_{15} Product\ Herf_{i,t} + \beta_{16} ln(Capital/Assets)_{i,t} \\
& + \beta_{17} Other\ Comp_{i,t} + \sum_{F.E.}^{Year} + \epsilon_{i,t}
\end{aligned} \tag{3.1}$$

where:

$i,t$ = Firm $i$ in year $t$;

$RE_{i,t}$ = Firm $i$'s incurred losses in year $t$+5 minus incurred losses in year $t$, scaled by total assets;

$Bonus_{i,t}$ = The percentage of total executive compensation for executives of firm $i$ reported in the form of a bonus in year $t$;

$Public_{i,t}$ = A binary variable equal to one if firm $i$ is publicly traded in year $t$ and zero otherwise;

$Mutual_{i,t}$ = A binary variable equal to one if firm $i$ is a mutual firm in year $t$ and zero otherwise;

$Over_{i,t}$ = A binary variable equal to one if firm $i$ overreserved in year $t$ and zero otherwise;

$Under_{i,t}$ = A binary variable equal to one if firm $i$ underreserved in year $t$ and zero otherwise;

$Length_{i,t} =$ Firm $i$'s loss reserve in year $t$ divided by total liabilities in year $t$;[10]

$Size_{i,t} =$ The natural log of firm $i$'s total assets in year $t$;

$Tax\ Shield_{i,t} =$ The sum of firm $i$'s net income and estimated reserve divided by total assets in year $t$;

$Longtail_{i,t} =$ The proportion of firm $i$'s net premiums written in long-tailed lines of business in year $t$;[11]

$Loss_{i,t} =$ A binary variable equal to one if firm $i$'s return on assets is in the bottom 90 percent of the negative earnings distribution in year $t$ and zero otherwise;

$Small\ Profit_{i,t} =$ A binary variable equal to one if firm $i$'s return on assets is in the bottom 5 percent of the positive earnings distribution in year $t$ and zero otherwise;

$Profit_{i,t} =$ A binary variable equal to one if firm $i$'s return on assets is in the top 90 percent of the positive earnings distribution in year $t$ and zero otherwise;

$Reinsurance_{i,t} =$ Firm $i$'s reinsurance ceded divided by the sum of reinsurance assumed and direct premiums written in year $t$;

$Product\ Herf_{i,t} =$ A Herfindal index of firm $i$'s net premiums written across 24 lines of business in year $t$;

[10] Prior studies examining the determinants of insurer loss reserve errors have included *Over*Length* and *Under*Length* to control for product mix (e.g., Petroni and Beasley, 1996; Gaver and Paterson, 2007; Gaver, Paterson, and Pacini, 2012).

[11] Consistent with Eckles and Halek (2010), I define the following lines as long-tailed: farm multi peril, homeowners' multi peril, commerical multi peril, medical malpractice, workers' compensation, products liability, automobile liability, and "other" liability. Additionally, I consider an alternative definition of *Longtail* as defined by Phillips, Cummins, and Allen (1998) and used by Grace and Leverty (2010). My results are robust to this different definition of long-tailed lines.

$ln(Capital/Assets)_{i,t}$ = The natural log of firm $i$'s surplus divided by total assets in year $t$;[12]

$Other\ Comp_{i,t}$ = The percentage of total executive compensation that is not reported as salary or a bonus in year $t$;

$\epsilon_{i,t}$ = A random error term.

I apply separate regression models for all executives, CEOs, and Actuaries. I then perform Wald tests to examine the overall effect of *Bonus* on reserve errors (i.e., *Bonus+Bonus*Public* = 0 and *Bonus+Bonus*Mutual* = 0). Additionally, I apply separate regressions for mutual, public, and private insurers to better isolate the differences in reserving behavior between executives of different ownership structures.[13]

My data do not provide detailed information on the structure of insurers' bonus compensation in the sense that I do not know where bonus payments are capped relative to firm performance. Therefore, I include *Bonus* as a percentage of total compensation, and look for positive or negative significance as an indication of reserve management (e.g., Eckles and Halek, 2010; Eckles et al., 2011).

My primary variables of interest are the compensation variables and their interactions with firm ownership structure. A positive coefficient in equation (3.1) suggests underreserving while a negative coefficient represents overreserving for the ownership structure binary variables (*Mutual* and *Public*). A positive coefficient for *Bonus* indicates that a larger percentage of total compensation paid in bonus is associated with increased underreserving. A

[12]Prior studies have found evidence that financial weakness is one potential reason firms manage reserves (e.g., Petroni, 1992; Gaver and Paterson, 2004). These studies have generally measured financial weakness using the IRIS ratios. Since my analysis is performed at the group level, I cannot use IRIS ratios to measure financial weakness, as these ratios are not assessed at the group level. I, therefore, include the natural log of an insurer's surplus to assets as a general proxy for an insurer's financial position.

[13]These regressions are specified as equation (3.1) when possible. The interactions are excluded as they are no longer necessary.

negative coefficient for *Bonus* indicates that a larger percentage of total compensation paid in bonus is associated with increased overreserving.

Table 3.1 summarizes the relationships between my hypotheses and potential results estimated by my regression model. A positive (negative) significant coefficient estimate of $\beta_1$ would provide support for *H1(a)* (*H1(b)*). A a non-significant coefficient estimate of $\beta_3$ would provide support for my *H5* while a positive or negative significant estimate would provide support for *H6*. For the regressions on only CEOs a significant estimated coefficient for *Bonus* provides support for *H2*. For the actuary only regression, a positive (negative) significant estimated coefficient for *Bonus* provides support for *H3(a)* (*H3(b)*), while a non-significant coefficient provides support for *H4*. The other variables control for discretionary and non-discretionary determinants of reserve errors. Grace and Leverty (2012) suggest that omitting potential incentives can influence econometric inference. In order to better isolate discretionary loss reserve decisions, I control for additional factors, such as the use of reinsurance and the business mix of each insurer.

I also estimate models that include controls for a firm's external monitoring in the form of audit firms and actuarial firms (to test *H7*). Specifically, I include a binary variable, *Big 4*, which is equal to one if a firm employs both a Big 4 audit firm and a Big 4 actuarial firm, and zero otherwise. Gaver and Paterson (2004) find empirical evidence suggesting that high-quality, external monitoring can mitigate the ability of insurers to manipulate reserves, but the expertise of an affiliated actuary is necessary. I interact *Big 4* with *Bonus* and perform a Wald test to see if high-quality, external monitors can mitigate the ability of managers to manipulate reserves to achieve more bonus compensation (i.e., a tests of the hypothesis that *Bonus* + *Bonus*Big 4* = 0).

Beaver and McNichols (1998) and Grace and Leverty (2012) note that reserve errors are positively serially correlated. Tests indicate that autocorrelation is also present in my data (*p*-value$<0.001$) (Wooldridge, 2002). In addition, modified Wald tests reject the null hypothesis of a common variance of residuals across panels ($p$-value$<0.0001$). Grace and Leverty (2012) suggest that estimating a fixed-effects model when estimating the determinants of reserve errors is troublesome due to the simultaneous existence of serially correlated errors and heteroskedasticity. Accordingly, since my data exhibit these same characteristics, I specify the feasible generalized least squares (FGLS) model, which allows me to correct standard errors for autocorrelation and heteroskedasticity (Grace and Leverty, 2012). I specify an autoregressive AR(1) autocorrelation structure. In these models I must exclude observations for which there is only one firm-year observation in the sample. Standard errors also account for panel-specific heteroskedasticity.

## 3.4 Data

My executive compensation data come from the Supplemental Compensation Exhibits filed with the Nebraska Department of Insurance between 2003 and 2005, and includes all insurers licensed in Nebraska.[14] Compensation information is required to be reported in Nebraska for the chief executive officer, the four most highly paid other executive officers, as well as the next five most highly compensated employees whose total compensation exceeds \$100,000. For each executive, compensation is provided in terms of "salary," "bonus," and "all other compensation."

I aggregate the compensation data to the organization's group level, when possible, so that the final sample consists of groups and unaffiliated insurers.[15] For groups, affiliated firms have the option to report executive compensation in total across the entire group, or only the portion of the executive's compensation that an affiliated firm pays. For consistency,

[14] My final sample represents approximately 50% of net premiums written in the U.S. property-liability insurance industry.

[15] Eckles and Halek (2010) and Eckles et al. (2011) conduct their analysis on groups and unaffiliated single insurers. Grace and Leverty (2010, 2012) conduct their analysis at the affiliated and unaffiliated single insurer level, but report that their results are robust to conducting analysis at the group and unaffiliated insurer level.

compensation is added when each affiliate reports their own contribution to an executive's compensation.

Data on insurers come from the annual statutory statements filed with the National Association of Insurance Commissioners (NAIC) from 2003 to 2010.[16] I limit my sample to property-liability insurers domiciled in the United States. Life and Health insurers are excluded, as their managers have less discretion in reserving practices due to the existence of well-established actuarial tables (Petroni, 1992).[17] I also eliminate from my sample firms with reported salaries of zero. Values of variables are set to be equal to their theoretically possible maximum and minimum if they are outside of that range (e.g., *Product Herf* is set to equal one if it is greater than one).[18] Unlike previous studies involving executive compensation in the insurance industry, I do not rely exclusively on data from publicly traded firms (e.g., Grace, 2004; Eckles and Halek, 2010; Eckles et al., 2011). This allows me to capture a broader and more complete representative sample of the P/C insurance industry. Specifically, I are able to include mutual insurers and privately-held stock insurers in my sample. Additionally, the executives in my sample are managers of the insurance firm directly. Data on publicly traded firms generally relies on Compustat North America's Executive Compensation Database (ExecuComp), which provides compensation data on executives who may manage numerous firms in different industries, and thus may not directly make decisions related to loss reserving.

Data on firm ownership structure are from A.M. Best's Insurance Reports (Best). In addition to providing information on the organizational form of each affiliated and non-affiliated single insurer, Best provides a group organization structure variable, which differentiates

[16]Though my primary sample is from 2003-2005, I require data through five additional years (2010) in order to calculate insurer reserve errors.

[17]The reserve data reported for life-health insurers is also limited and does not allow for the calculation of reserve errors.

[18]I also run robustness tests on the sensitivity of my results to these exclusions. My results are generally not sensitive to (1) including values that are outside the theoretically possible range at their reported values, and (2) dropping these observations.

whether a group is organized as a stock or mutual. Best also reports whether or not a firm is publicly traded. I use Best as my source of a firm's auditor and actuary.[19] My final sample consists of 168 unique insurers and 455 firm-year observations over a three year period where each firm-year observation reflects the aggregate compensation of managers for that firm along with other firm-specific characteristics.

Table 3.2 displays descriptive statistics for my cross sectional sample of 455 firm-year observations.[20] The average magnitude of $RE$ is -1.03 percent of assets. The majority of firms in the sample overreserve, as the median value for $RE$ is negative. Over-reserving estimation errors occur in 62 percent of my sample. The largest underreserving error in the sample is 42 percent of assets while the largest overreserving error is 34 percent of assets.

On average, all executives in my sample received 22 percent of their total compensation as a bonus. CEOs received a higher amount of compensation in bonus payments, 26 percent, relative to all executives. Actuaries received a lower proportion of bonus payments at 20 percent. The $10^{\text{th}}$ percentile for CEOs is zero, indicating that at least some executives in my sample have contracts with zero as a lower bound for bonus compensation. While the $10^{\text{th}}$ percentile for CEOs and actuaries is greater than zero, it is still relatively low (1 percent and 3 percent, respectively). Additionally, the minimum for CEOs and actuaries is also zero, indicating that some executives receive a bonus of zero in some years. CEOs receive more payments classified as "other" compared to both the pool of all executives and actuaries. CEOs receive 15 percent compared to 14 percent for all executives and 9 percent for actuaries.

[19] Best does not report a group-level auditor or actuary. So for groups in my sample, I examine the auditor and actuary for each of the affiliates. In all cases aside from one, the auditor and actuary were the same for all group members. The one firm with different auditors and actuaries is excluded from models including *Big 4*.

[20] Since computation of my standard errors requires the elimination of firms that are only observed once in my panel, 14 firms are excluded from my empirical analysis. The summary statistics when excluding these firms are not substantially altered.

Mutuals comprise approximately 31 percent of my sample, and 31 percent are publicly traded stock insurers, providing variation among ownership structures.

Table 3.3 provides summary statistics on the executive compensation of managers in my sample based on ownership structure. I provide the raw compensation variables (*Total Compensation*, *Salary*, *Bonus*, and *Other Comp.*) and percentages of each (*Percent Salary*, *Percent Bonus*, and *Percent Other Comp.*). In addition, I provide $t$-tests for differences in means and nonparametric $k$-sample tests for differences in medians between private, public, and mutual firms. Managers of public stock firms appear to receive a higher amount of compensation in all areas compared to managers at private and mutual firms. Private and mutual firms, however, appear to have similar magnitudes of compensation. Notably, *Percent Bonus* is not significantly different in means or medians for any combination of two ownership structures.

Table 3.4 provides Pearson and Spearman correlations. My measure of loss reserve error, *RE*, is not significantly—at the 0.05 level—correlated to the percent of bonus compensation (*Bonus*). While this indicates that there is no univariate relation between loss reserve errors and *Bonus*, this univariate relationship is not the most accurate way to capture the possible relation between the two variables since they do not consider or control for other incentives to manage loss reserves (Grace and Leverty, 2010). In the next section I, therefore, control for other incentives in order to better assess the association between manager compensation and loss reserve errors.

## 3.5 Results

### 3.5.1 All Executives

Results from feasible generalized least squares (FGLS) estimation of equation (3.1) on the pooled sample of all managers appear in Table 3.5.[21] The dependent variable of each model is insurer reserve error scaled by assets ($RE$). Column (1) includes all firms in my sample and controls for ownership structure with indicator variables and interaction terms. Columns (2), (3), and (4) are restricted to specific ownership structures. Column (2) includes only mutuals. Columns (3) and (4) present results for private stock and public stock firms, respectively.

Recall that a positive reserve error (the dependent variable) indicates that incurred losses were higher than the initial reserve estimates or, in other words, indicates underreserving. Therefore, a positive coefficient of an independent variable suggests an association with underreserving, while a negative coefficient would suggest overreserving. Standard errors are corrected for autocorrelation and panel-specific heteroskedasticity. $t$-statistics are presented in parentheses beneath each coefficient estimate.

The results for the sample including all executives are presented in column (1) of Table 3.5. The estimated coefficient of *Bonus* is negative and significant at the one percent level, indicating that firms tend to overreserve as their overall compensation becomes more bonus-laden. The estimated coefficients on the interaction term *Bonus**Public* is also significant. This provides some evidence that stock firms manage reserves as the proportion of bonus compensation increases. The estimated coefficient of the interaction term *Bonus**Mutual*, however, is not significantly different from zero. This provides evidence for my hypotheses that stock firms manage earnings, while mutual firms do not. However, to get a cleaner

[21] Due to the reporting requirements, it is likely that smaller firms will have fewer executives in their compensation report since the requirements are that an executive receive more than $100,000 in compensation. However, since my compensation variables are percentages, this should not impact my results.

test of whether executives manage reserves across ownership structures, I provide tests on different subsamples of firms.

Column (2) of Table 3.5 examines only mutual firms. Here, I do not find a significant relationship between *Bonus* and insurer loss reserve errors. This is consistent with my hypothesis that mutual managers are less likely (or less able) to manage reserves in an effort to increase their overall compensation. The results in columns (3) and (4) of Table 3.5 provide results consistent with the results in column (1) that provide evidence of earnings management for stock firms (both private and public). Specifically, the estimated coefficients on *Bonus* are statistically significant and negative (indicating overreserving) for regressions including only private (column (3)) and public (column (4)) firms. Overall, the results in Table 3.5 provide empirical evidence that managers of stock firms (public and private) manipulate reserves to increase their overall compensation, while managers of mutual firms do not appear to manipulate reserves in order to maximize their overall compensation.

### 3.5.2 CEOs

To further examine how the relation between reserve manipulation and executive compensation is affected by ownership structure I provide in Table 3.6 separate regressions based on ownership structure specifically for CEOs. As the top decision-maker at the firm, the CEO may have more ability to manipulate reserves compared to other top executives.

Table 3.6 presents results from the FGLS regression for all executives separately for stock and mutual firms. The dependent variable of each model is insurer reserve error scaled by assets (*RE*). Column (1) includes all firms in my sample and controls for ownership structure with indicator variables and interaction terms. Columns (2), (3), and (4) are restricted to specific ownership structures. Column (2) includes only mutuals. Columns (3) and (4) present results for public and private firms, respectively.

The estimated coefficient of *Bonus* in column (1) of Table 3.6 is not statistically different from zero. Additionally, neither of the interaction terms (*Bonus*Public* and *Bonus*Mutual*) are significantly different from zero. However, as with my analysis of all executives, I estimated models separately for each ownership structure to provide a cleaner test of incentives to manipulate reserves based on ownership structure.

The results in column (2) of Table 3.6 provide further evidence to suggest that CEOs of mutual firms do not manage reserves as they receive a higher proportion of their compensation as a bonus. The estimated coefficient of *Bonus* is not significantly different from zero. The results in column (3) for private stock firms only provide evidence of underreserving for CEOs of private firms (positive estimated coefficient of *Bonus*). This provides further evidence of reserve management for managers of private firms. The estimated coefficient of *Bonus* is negative and significant when only examining publicly traded firms. Overall, these results are consistent with those presented in Table 3.5, where I find evidence of reserve management related to bonus compensation for managers of stock firms (both private and public), but I do not find evidence of reserve management for executives of mutual firms.

Overall, the results presented in Table 3.6 provide evidence that CEOs specifically manage reserves in privately-held firms and in publicly traded firms, but I do not find evidence suggesting the same for mutual firms.

### 3.5.3 Actuaries

I also test empirically if actuaries manage loss reserves to maximize their compensation. Since establishing loss reserves is a complex process and actuaries have an expertise in this area, I examine actuaries specifically as this may provide an opportunity to manage reserves.

Table 3.7 provides my results from an FGLS model examining the determinants of loss reserve error. The dependent variable is insurer reserve error scaled by assets ($RE$). Unlike my previous analysis, I only present the model including the interaction terms with *Bonus* and *Public* and *Mutual* instead of running separate models for each ownership structure, since there are insufficient observations to separately estimate each model.

The results in Table 3.7 provide some evidence that actuaries of public stock firms manage reserves, while there is less evidence supporting this conclusion for actuaries of private or mutual firms. The estimated coefficient of *Public*Bonus* is positive and significant, indicating that actuaries in public stock firms manage reserves as their bonus pay comprises a greater proportion of their overall compensation. The estimated coefficient of the interaction term *Bonus*Mutual* is not significant. The estimated coefficient of *Bonus* also does not achieve significance. These results suggest that actuaries of private and mutual firms do not manage reserves. However, consistent with my prior results, I find evidence of reserve management for actuaries of publicly traded firms related to their incentive-based bonus compensation.

### 3.5.4 External Monitoring

The results from my analysis of external monitor quality are presented in Table 3.8. The dependent variable is insurer reserve error scaled by assets ($RE$). The results in columns (1), (2), and (3) include all executives at each firm while the results in columns (4), (5), and (6) are for CEOs only. Each column reports results for the subsample of observations representing a single ownership structure. Specifically, columns (1) and (4) are for mutual firms, columns (2) and (5) are for private stock firms, and columns (3) and (6) are for publicly traded stock firms. The variable of interest, *Big 4*, is a binary variable equal to one if a firm employed both a Big 4 audit firm and a Big 4 actuarial firm, and zero otherwise. I report $p$-values from Wald tests of the hypothesis *Bonus* + *Bonus*Big 4* = 0 at the bottom of Table 3.8 to specifically examine the interaction between reserve management to increase overall compensation and external monitoring.

As with my prior results, I find no evidence of reserve management for executives of mutual firms. The estimated coefficient of *Bonus* is not statistically significant in either column (1) or column (4), providing further evidence that managers of mutual firms do not manage reserves to increase their incentive based bonus compensation.[22] Since I do not find evidence of reserve management for mutuals, there is no behavior for external monitoring to mitigate specific to executive compensation. However, the estimated coefficient of *Big 4* is negative and significant in both columns (1) and (4), indicating that high-quality, external monitoring results in more overreserving, consistent with the findings of Gaver and Paterson (2001).

The evidence on whether high-quality, external monitoring impacts the ability of managers to manipulate reserves is mixed for managers of private firms. In column (2) of Table 3.8, the estimated coefficient of *Bonus* is not significant. However, the estimated coefficient of the interaction term *Bonus*Big 4* is negative and significant. In addition, a Wald test of the null hypothesis *Bonus+Bonus*Big 4* $= 0$ fails to reject the null, indicating that high-quality, external monitoring does not completely mitigate reserve management. However, in column (5) of Table 3.8, I find that while the coefficient estimate of *Bonus* is positive and significant, the estimated coefficient of the interaction term *Bonus*Big 4* is negative and significant. In this case, the Wald test indicates that the sum of these two coefficient estimates is not statistically different from zero ($p$-value = 0.1822). Taken together, these results suggest that external monitors can prevent reserve management related to bonus compensation for CEOs, but not overall for top managers.

The results related to publicly traded firms are presented in columns (3) and (6) of Table 3.8. The estimated coefficient of the interaction term *Bonus*Big 4* is not statistically different from zero in either model. However, the associated Wald tests of the hypothesis *Bonus+Bonus*Big 4* $= 0$ fails to reject the null in both cases. ($p$-values = 0.1470 and 0.1408 for columns (3) and (6), respectively). This provides evidence that high-quality, external

[22]I report the Wald tests for all the regression models in Table 3.8, but discuss implications of only select models.

monitoring can temper the ability of publicly traded stock insurers from managing reserves to increase their overall compensation. In this case, the result is driven by the affiliated Big 4 actuaries, as every publicly traded firm in my sample employs a Big 4 auditor. This result is consistent with the findings of Gaver and Paterson (2001), who document that high-quality, actuarial monitoring is necessary to induce conservative loss reserve estimates.

Overall, the results in Table 3.8 provide evidence that external monitoring can prevent reserves management related to executive compensation incentives. This is particularly true for CEOs of private firms and all managers of publicly traded stock firms.

## 3.6 Conclusion

A vast literature indicates that managers manipulate earnings to maximize their own compensation (Healy, 1985; Gaver, Gaver, and Austin, 1995; Holthausen, Larcker, and Sloan, 1995). I extend the literature by testing for differences in such behavior by executives across property-casualty insurance firms with three types of ownership structure: publicly traded stock firms, privately-held stock firms, and mutual firms, which are owned by their policyholders. I also test for differences across types of executives and degrees of external monitor quality.

My targeted sample industry is well-suited to this analysis for at least three reasons. First, insurance firms in my sample are distributed somewhat evenly across the three organizational forms. Second, I can observe compensation for a broad selection of firms and are not limited to executive compensation data for a subset of the firms (publicly traded firms). Third, insurance company statutory reports include loss reserve development, a very direct and accurate measure of earnings manipulation.

Though I significantly augment the literature, the results of my analysis are generally consistent with prior literature (from an empirical and theoretical perspective). I find that executives with a greater amount of compensation in the form of a bonus undertake reserve management to a greater degree. Such consistency with extant studies bolsters my confidence in the specification of the empirical model.

My primary contribution to the literature comes from my comparison of earnings management across firms of different organizational form. I find that, unlike their counterparts in stock firms, managers of mutual firms do not appear to manipulate earnings to maximize their own compensation. This result holds across several specifications of my model controlling for executive title, expertise, and quality of external monitors. I propose two potential explanations of this result. First, mutual managers receive a smaller portion of their total compensation in the form of a bonus. Therefore, they may have less incentive to manage earnings. Alternatively, bonuses for mutual managers may be tied to performance measures that are not affected by under or overreserving. For example, because mutual companies are owned by, and operated to the benefit of policyholders, they may be concerned with metrics such as policyholder retention and satisfaction. This would be consistent with the finding of Ke, Petroni, and Safieddine (1999) that compensation of private firm managers is less responsive to accounting measures relative to publicly traded firms. Nonetheless, further research is necessary to confirm the cause of this difference for mutual versus stock firms.

I also find that both CEOs and actuaries whose compensation packages are more bonus-laden are associated with larger reserve errors. This is consistent with the idea that both of these positions possess the power to influence reserving decisions and that they do so in such a way to potentially increase their own compensation. I also find, consistent with my result for all executives, that CEOs of stock firms undertake more reserve manipulation compared to mutual CEOs in relation to the amount of bonus compensation. Finally, I find evidence that high-quality, external monitoring can mitigate managers' reserve manipulation related to their incentive based bonus compensation.

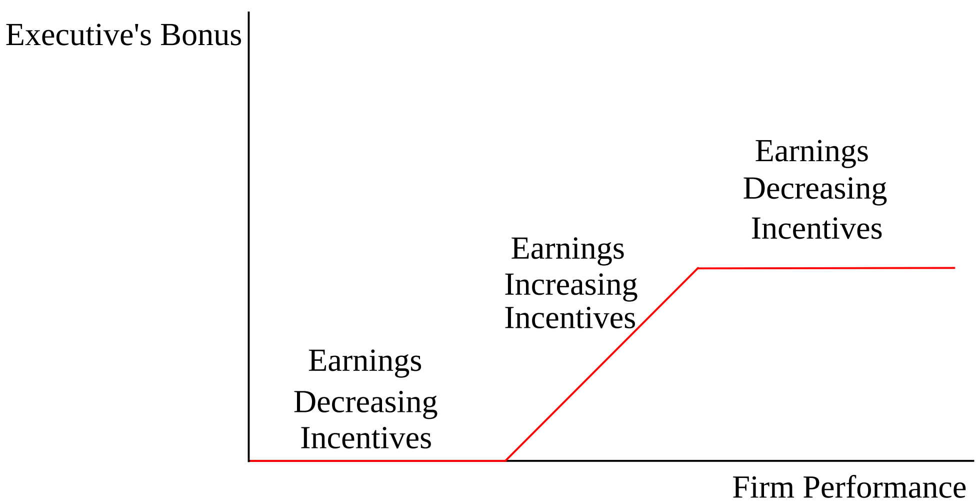


Figure 3.1: Bonus Call Spread

Table 3.1: Hypothesis Summary

| Hypothesis | Variable of Interest | Result | Interpretation |
|---|---|---|---|
| *H1(a)* | *Bonus* | Positive | Managers underreserve |
| *H1(b)* | | Negative | Managers overreserve |
| *H2(a)* | *Bonus* | Positive | CEOs underreserve |
| *H2(b)* | | Negative | CEOs overreserve |
| *H3(a)* | | Positive | Actuaries underreserve |
| *H3(b)* | *Bonus* | Negative | Actuaries overreserve |
| *H4* | | Zero | Actuaries do not manage reserves |
| *H5* | *Bonus+Bonus*Mutual* | Zero | Mutual managers do not manage reserves |
| *H6* | | Positive/Negative | Mutual managers manage reserves |
| *H7* | *Bonus+Bonus*Big 4* | Zero | External monitoring mitigates reserves management |

Table 3.2: Descriptive Statistics

| | | | | Percentiles | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | Mean | Std. | Min | $10^{th}$ | $25^{th}$ | $50^{th}$ | $75^{th}$ | $90^{th}$ | Max |
| *RE* | -0.0103 | 0.0737 | -0.3356 | -0.0744 | -0.0471 | -0.0131 | 0.0143 | 0.0592 | 0.4175 |
| *Bonus* | 0.2211 | 0.1643 | 0.0000 | 0.0113 | 0.0903 | 0.2099 | 0.3128 | 0.4217 | 0.8032 |
| *Percent Other* | 0.1383 | 0.1928 | 0.0000 | 0.0000 | 0.0055 | 0.0577 | 0.1880 | 0.4292 | 0.8849 |
| *Bonus (CEO)* | 0.2586 | 0.2104 | 0.0000 | 0.0000 | 0.0869 | 0.2462 | 0.3918 | 0.5403 | 0.8608 |
| *Other Comp (CEO)* | 0.1467 | 0.2220 | 0.0000 | 0.0000 | 0.0066 | 0.0329 | 0.2046 | 0.5136 | 0.8871 |
| *Bonus (Actuary)* | 0.1994 | 0.1622 | 0.0000 | 0.0270 | 0.0865 | 0.1746 | 0.2940 | 0.3687 | 0.9470 |
| *Other Comp (Actuary)* | 0.0868 | 0.1316 | 0.0000 | 0.0000 | 0.0000 | 0.0296 | 0.1013 | 0.2925 | 0.4857 |
| *Public* | 0.3077 | 0.4620 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 |
| *Private* | 0.3802 | 0.4860 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 |
| *Mutual* | 0.3121 | 0.4639 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 |
| *Over*Length* | 0.2561 | 0.2333 | 0.0000 | 0.0000 | 0.0000 | 0.2874 | 0.4553 | 0.5546 | 0.7942 |
| *Under*Length* | 0.1673 | 0.2455 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.3914 | 0.5483 | 0.8644 |
| *Size* | 20.6474 | 1.9031 | 16.5935 | 18.0117 | 19.2642 | 20.6211 | 21.9272 | 23.0202 | 25.4640 |
| *Tax Shield* | 0.0282 | 0.0428 | -0.2450 | -0.0157 | 0.0122 | 0.0306 | 0.0496 | 0.0695 | 0.1982 |
| *Longtail* | 0.6214 | 0.3044 | 0.0000 | 0.0000 | 0.5199 | 0.6828 | 0.8231 | 0.9721 | 1.0000 |
| *Loss* | 0.1495 | 0.3569 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 |
| *Small Profit* | 0.0264 | 0.1604 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| *Profit* | 0.7670 | 0.4232 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| *Reinsurance* | 0.2288 | 0.2109 | 0.0000 | 0.0309 | 0.0687 | 0.1675 | 0.3196 | 0.5312 | 1.0000 |
| *Product Herf* | 0.5493 | 0.3084 | 0.0000 | 0.0001 | 0.3813 | 0.6443 | 0.7669 | 0.8453 | 1.0000 |
| *ln(Capital/Assets)* | -1.1826 | 0.4468 | -3.6976 | -1.6036 | -1.3902 | -1.1630 | -0.9152 | -0.7158 | -0.1243 |
| *Big 4* | 0.3170 | 0.4658 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 |

Note: This table reports descriptive statistics for the years 2003 to 2005. The full sample is 455 firm-years and 168 unique firms. The CEO sample is 350 firm-years and 135 unique firms. The actuary sample is 78 firm-years and 34 unique firms. *RE* is the five-year loss reserve error scaled by total assets. Positive errors indicate underreserving while negative errors indicate overreserving. *Bonus* is the percent of total compensation in the form of a bonus. *Other Comp* is the percentage of total compensation reported as "All other compensation." These compensation variables are reported for the sum of all executives at each firm, the chief executive officer, and if any actuary is listed. *Public* is a binary variable equal to 1 if a firm is publicly traded and 0 otherwise. *Private* is a binary variable equal to 1 if a firm is a private stock firm and 0 otherwise. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Over* (*Under*) is a binary variable equal to 1 if a firm over (under) reserved and 0 otherwise. *Length* is a firm's total loss reserve scaled by total liabilities. *Size* is the natural log of total assets. *Tax Shield* is the sum of net income and the estimated reserve divided by total assets. *Longtail* is the proportion of premiums written in longtailed lines. *Loss* is a binary variable equal to 1 if a firm is in the bottom 90 percent of the negative earnings distribution and 0 otherwise. *Small Profit* is a binary variable equal to 1 if a firm is in the bottom 5 percent of the positive earnings distribution and 0 otherwise. *Profit* is a binary variable equal to 1 if a firm is in the top 90 percent of the positive earnings distribution and 0 otherwise. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Product Herf* is a firm's line of business Herfindahl index. *ln(Capital/Assets)* is the natural log of surplus divided by assets. *Big 4* is a binary variable equal to 1 if a firm has both a Big 4 audit firm and a Big 4 actuarial firm.

Table 3.3: Executive Compensation by Ownership Structure

| | Private | | Public | | Mutual | | Private-Public | | Public-Mutual | | Private-Mutual | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Mean | Median | Mean | Median | Mean | Median | Mean | Median | Mean | Median | Mean | Median |
| *Total Compensation* | 5.3964 | 1.9867 | 8.0208 | 4.4941 | 4.4575 | 2.0754 | -2.6244** | -2.5074*** | 3.5633*** | 2.4187*** | 0.9389 | -0.0887 |
| *Salary* | 1.9758 | 1.5508 | 3.0118 | 2.4528 | 1.8880 | 1.4050 | -1.0360*** | -0.9020*** | 1.1238*** | 1.0478*** | 0.0878 | 0.1458 |
| *Bonus* | 1.7520 | 0.2633 | 1.9206 | 1.1731 | 1.7270 | 0.3407 | -0.1686 | -0.9098*** | 0.1936 | 0.8324*** | 0.0250 | -0.0774 |
| *Other Comp.* | 1.6687 | 0.0796 | 3.0884 | 0.4606 | 0.8425 | 0.0306 | -1.4197** | -0.3810*** | 2.2459*** | 0.4300*** | 0.8262 | 0.0490** |
| *Percent Salary* | 0.6717 | 0.7290 | 0.5671 | 0.6092 | 0.6736 | 0.7182 | 0.1046*** | 0.1198*** | -0.1065*** | -0.1090*** | -0.0019 | 0.0108 |
| *Percent Bonus* | 0.2150 | 0.2054 | 0.2250 | 0.2179 | 0.2233 | 0.2040 | -0.0100 | -0.0125 | 0.0017 | 0.0139 | -0.0083 | 0.0014 |
| *Percent Other Comp.* | 0.1133 | 0.0470 | 0.2079 | 0.0978 | 0.1031 | 0.0247 | -0.0946*** | -0.0508*** | 0.1048*** | 0.0731*** | 0.0102 | 0.0223** |

Note: This table reports means and medians for different ownership structures in the sample for the years 2003 to 2005. The full sample is 441 firm-years and 154 unique firms. The first 6 columns present present statistics for privately-held firms, publicly traded firms, and mutual firms. The last 6 columns present $t$-tests for difference in means and nonparametric $k$-sample tests for differences in medians. *Total Compensation* is a CEO's total compensation in millions. *Salary* is a CEO's annual fixed salary in millions. *Bonus* is a CEO's annual bonus in millions. *Other Comp.* is a CEO's compensation that is not included in *Salary* or *Bonus*. *Percent Salary*, *Percent Bonus*, and *Percent Other* are the percentage of *Total Compensation* comprised of *Salary*, *Bonus*, and *Other Comp*, respectively. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table 3.4: Correlation Matrix

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) *RE* | | 0.0002 | -0.0184 | 0.0058 | 0.0123 | *-0.7971* | *0.8264* | *0.1179* | *-0.2049* | -0.0142 | *0.2113* | -0.0179 | *-0.2120* | *0.1407* | 0.0295 | *-0.2459* | 0.0484 |
| (2) *Bonus* | -0.0127 | | 0.0574 | -0.0552 | 0.0006 | -0.0183 | 0.0054 | *0.4258* | *0.1439* | -0.0728 | *-0.1590* | -0.0608 | *0.1546* | -0.0455 | *0.1128* | -0.0279 | *0.1454* |
| (3) *Public* | 0.0416 | 0.0180 | | *-0.5222* | *-0.4490* | -0.0017 | 0.0071 | *0.2941* | 0.0128 | -0.0636 | 0.0144 | 0.0091 | -0.0607 | *0.1657* | *0.0932* | *-0.2506* | *0.2434* |
| (4) *Private* | -0.0094 | -0.0304 | *-0.5222* | | *-0.5276* | 0.0072 | -0.0212 | *-0.2218* | -0.0734 | *-0.1103* | 0.0907 | 0.0124 | -0.0717 | 0.0653 | *-0.1507* | 0.0698 | -0.0887 |
| (5) *Mutual* | -0.0316 | 0.0139 | *-0.4490* | *-0.5276* | | -0.0058 | 0.0151 | -0.0606 | 0.0641 | *0.1789* | *-0.1094* | -0.0221 | *0.1356* | *-0.2334* | 0.0650 | *0.1765* | *-0.1495* |
| (6) *Over*Length* | *-0.6139* | -0.0133 | -0.0030 | -0.0098 | 0.0133 | | *-0.8279* | -0.0223 | 0.0763 | *0.1152* | *-0.1132* | 0.0429 | *0.1097* | *-0.0990* | 0.0427 | *0.1267* | -0.0208 |
| (7) *Under*Length* | *0.6122* | -0.0299 | -0.0293 | -0.0027 | 0.0320 | *-0.7500* | | *0.1220* | *-0.2692* | 0.0773 | *0.2304* | -0.0138 | *-0.2302* | *0.1358* | 0.0387 | *-0.3092* | 0.0388 |
| (8) *Size* | *0.0935* | *0.4547* | *0.2722* | *-0.2143* | -0.0467 | -0.0333 | *0.1234* | | 0.0636 | -0.0763 | *-0.1184* | -0.0889 | *0.1379* | *-0.1212* | *0.3545* | *-0.3099* | *0.4646* |
| (9) *Tax Shield* | *-0.1994* | *0.1260* | 0.0365 | -0.0853 | 0.0530 | 0.0788 | *-0.3033* | 0.0829 | | *-0.3848* | *-0.6175* | *-0.1746* | *0.7318* | *-0.2794* | -0.0332 | *0.3797* | *0.0928* |
| (10) *Longtail* | -0.0380 | -0.0227 | -0.0254 | *-0.1692* | *0.2026* | *0.1849* | *0.1073* | 0.0030 | *-0.3742* | | *0.1306* | *0.1031* | *-0.1859* | 0.0918 | 0.0409 | *-0.2673* | -0.0863 |
| (11) *Loss* | *0.2107* | *-0.1408* | 0.0144 | 0.0907 | *-0.1094* | *-0.1116* | *0.2551* | *-0.1265* | *-0.6849* | *0.1207* | | -0.0690 | *-0.7606* | *0.1805* | *-0.1090* | *-0.2608* | -0.0800 |
| (12) *Small Profit* | 0.0017 | -0.0656 | 0.0091 | 0.0124 | -0.0221 | 0.0293 | -0.0092 | -0.0837 | *-0.0940* | 0.0876 | -0.0690 | | *-0.2986* | 0.0550 | 0.0720 | -0.0583 | 0.0070 |
| (13) *Profit* | *-0.2102* | *0.1504* | -0.0607 | -0.0717 | *0.1356* | *0.1153* | *-0.2487* | *0.1382* | *0.6917* | *-0.1747* | *-0.7606* | *-0.2986* | | *-0.2205* | 0.0826 | *0.3029* | 0.0616 |
| (14) *Reinsurance* | *0.1400* | -0.0335 | *0.1665* | 0.0745 | *-0.2438* | *-0.1088* | *0.0980* | *-0.1029* | *-0.2551* | 0.0751 | *0.1710* | 0.0335 | *-0.2262* | | 0.0657 | *-0.2424* | -0.0403 |
| (15) *Product Herf* | -0.0221 | *0.1363* | 0.0324 | *-0.1830* | *0.1594* | 0.0537 | -0.0097 | *0.3506* | -0.0279 | *0.1444* | *-0.1049* | 0.0464 | 0.0855 | -0.0370 | | *-0.3318* | *0.2358* |
| (16) *ln(Capital/Assets)* | *-0.1494* | -0.0056 | *-0.1500* | 0.0064 | *0.1427* | *0.1533* | *-0.2976* | *-0.2732* | *0.3167* | *-0.1279* | *-0.3227* | -0.0255 | *0.3177* | *-0.1508* | *-0.2267* | | -0.2337 |
| (17) *Percent Other* | -0.0076 | -0.0243 | *0.2231* | *-0.0997* | *-0.1178* | -0.0012 | -0.0619 | *0.4065* | *0.1518* | *-0.1225* | *-0.1194* | -0.0461 | *0.1382* | -0.0344 | *0.1180* | -0.0849 | |

Note: This table pairwise correlations years 2003 to 2005. Pearson correlations are shown below the diagonal and Spearmen correlations shown above the diagonal. *RE* is the five-year loss reserve error scaled by total assets. Positive errors indicate underreserving while negative errors indicate overreserving. *Bonus* is the percent of total compensation in the form of a bonus. *Public* is a binary variable equal to 1 if a firm is publicly traded and 0 otherwise. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Over* (*Under*) is a binary variable equal to 1 if a firm over (under) reserved and 0 otherwise. *Length* is a firm's total loss reserve scaled by total liabilities. *Size* is the natural log of total assets. *Tax Shield* is the sum of net income and the estimated reserve divided by total assets. *Longtail* is the proportion of premiums written in longtailed lines. *Loss* is a binary variable equal to 1 if a firm is in the bottom 90 percent of the negative earnings distribution and 0 otherwise. *Small Profit* is a binary variable equal to 1 if a firm is in the bottom 5 percent of the positive earnings distribution and 0 otherwise. *Profit* is a binary variable equal to 1 if a firm is in the top 90 percent of the positive earnings distribution and 0 otherwise. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Product Herf* is a firm's line of business Herfindahl index. *ln(Capital/Assets)* is the natural log of surplus divided by assets. *Other Comp* is the percentage of total compensation reported as "All other compensation." Coefficients in italics indicate significance at the 0.05 level.

## Table 3.5: Results by Ownership Structure—All Executives

| Dependent Variable: *RE* | | | | |
|---|---|---|---|---|
| | All | Mutual | Private | Public |
| | (1) | (2) | (3) | (4) |
| *Bonus* | -0.0431*** | -0.0044 | -0.0425*** | -0.0411*** |
| | (-3.7442) | (-0.3355) | (-2.9131) | (-3.1376) |
| *Bonus*Public* | 0.0342** | | | |
| | (1.9989) | | | |
| *Bonus*Mutual* | 0.0227 | | | |
| | (1.4926) | | | |
| *Mutual* | -0.0022 | | | |
| | (-0.5124) | | | |
| *Public* | -0.0078 | | | |
| | (-1.5245) | | | |
| *Over*Length* | -0.0781*** | -0.0649*** | -0.0793*** | -0.1187*** |
| | (-9.7587) | (-3.5049) | (-5.0830) | (-6.7068) |
| *Under*Length* | 0.0629*** | 0.0394** | 0.0697*** | 0.0696*** |
| | (7.3073) | (2.1796) | (3.8678) | (3.5536) |
| *Size* | 0.0051*** | 0.0037*** | 0.0048** | 0.0110*** |
| | (6.0098) | (2.6727) | (2.0548) | (5.5144) |
| *Tax Shield* | -0.0209 | -0.1576** | -0.0012 | 0.3169*** |
| | (-0.5995) | (-2.3653) | (-0.0199) | (2.7996) |
| *Longtail* | -0.0157*** | -0.0166* | -0.0236** | -0.0048 |
| | (-3.0091) | (-1.7041) | (-2.5347) | (-0.4464) |
| *Loss* | 0.0104** | 0.0104 | 0.0023 | 0.0131 |
| | (2.1598) | (0.9109) | (0.2802) | (1.3419) |
| *Small Profit* | -0.0042 | -0.0112 | -0.0279* | 0.0097 |
| | (-0.4528) | (-0.3649) | (-1.9038) | (0.7760) |
| *Profit* | -0.0069 | 0.0127 | -0.0166*** | -0.0190** |
| | (-1.5696) | (1.1849) | (-3.1875) | (-2.0403) |
| *Reinsurance* | 0.0184*** | 0.0459*** | 0.0018 | 0.0266** |
| | (2.8056) | (3.6870) | (0.1551) | (2.4233) |
| *Product Herf* | -0.0011 | -0.0206* | 0.0104 | -0.0133* |
| | (-0.2478) | (-1.7226) | (1.0563) | (-1.9543) |
| *ln(Capital/Assets)* | 0.0112*** | -0.0208*** | 0.0195*** | -0.0155 |
| | (4.2638) | (-2.7432) | (4.0512) | (-1.5954) |
| *Other Comp* | -0.0159*** | 0.0024 | -0.0308* | -0.0449*** |
| | (-2.8904) | (0.2495) | (-1.9016) | (-4.4330) |
| Intercept | -0.0647*** | -0.0830*** | -0.0393 | -0.2099*** |
| | (-3.8766) | (-3.2148) | (-0.9598) | (-5.0568) |
| Year FE | Yes | Yes | Yes | Yes |
| *Bonus+Bonus*Public* = 0 | 0.4761 | | | |
| *Bonus+Bonus*Mutual* = 0 | 0.0712 | | | |
| Wald $\chi^2$ | 1,195.72 | 912.39 | 419.70 | 595.11 |
| Observations | 441 | 140 | 168 | 133 |

Note: This table reports results from feasible generalized least squares regressions. Results in column (1) are for the full sample of firms. Results in columns (2), (3), and (4) are results on subsamples of firms with ownership structures of mutual, private, and public, respectively. The dependent variable (*RE*) is loss reserve error scaled by total assets. *Bonus* is the percent of total compensation in the form of a bonus. *Public* is a binary variable equal to 1 if a firm is publicly traded and 0 otherwise. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Over* (*Under*) is a binary variable equal to 1 if a firm over (under) reserved and 0 otherwise. *Length* is a firm's total loss reserve scaled by total liabilities. *Size* is the natural log of total assets. *Tax Shield* is the sum of net income and the estimated reserve divided by total assets. *Longtail* is the proportion of premiums written in longtailed lines. *Loss* is a binary variable equal to 1 if a firm is in the bottom 90 percent of the negative earnings distribution and 0 otherwise. *Small Profit* is a binary variable equal to 1 if a firm is in the bottom 5 percent of the positive earnings distribution and 0 otherwise. *Profit* is a binary variable equal to 1 if a firm is in the top 90 percent of the positive earnings distribution and 0 otherwise. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Product Herf* is a firm's line of business Herfindahl index. *ln(Capital/Assets)* is the natural log of surplus divided by assets. *Other Comp* is the percentage of total compensation reported as "All other compensation." All models include year fixed effects. Standard errors account for heteroskedasticity and autocorrelation. *t*-statistics are presented in parentheses beneath each coefficient estimate. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table 3.6: Results by Ownership Structure—CEO Only

| Dependent Variable: *RE* | All (1) | Mutual (2) | Private (3) | Public (4) |
|---|---|---|---|---|
| *Bonus* | -0.0120 | 0.0112 | 0.0527*** | -0.0272** |
| | (-1.1037) | (0.8106) | (4.6195) | (-2.1079) |
| *Bonus*Public* | 0.0112 | | | |
| | (0.8025) | | | |
| *Bonus*Mutual* | 0.0112 | | | |
| | (0.7994) | | | |
| *Mutual* | 0.0093* | | | |
| | (1.8013) | | | |
| *Public* | -0.0005 | | | |
| | (-0.0875) | | | |
| *Over*Length* | -0.0805*** | -0.0473** | -0.1154*** | -0.0982*** |
| | (-7.2578) | (-2.3835) | (-6.3401) | (-3.9420) |
| *Under*Length* | 0.0615*** | 0.0567*** | 0.1017*** | 0.0701*** |
| | (5.3191) | (2.8882) | (3.6931) | (2.7687) |
| *Size* | 0.0047*** | 0.0013 | -0.0008 | 0.0115*** |
| | (4.4826) | (0.9338) | (-0.4988) | (4.2998) |
| *Tax Shield* | -0.0755 | -0.1332 | -0.0058 | -0.1363 |
| | (-1.5317) | (-1.6399) | (-0.0605) | (-1.0331) |
| *Longtail* | -0.0115 | -0.0069 | -0.0030 | -0.0264* |
| | (-1.5793) | (-0.5726) | (-0.2346) | (-1.6737) |
| *Loss* | 0.0133** | 0.0097 | 0.0026 | 0.0007 |
| | (2.2051) | (1.0141) | (0.1933) | (0.0657) |
| *Small Profit* | 0.0117 | -0.0073 | -0.0005 | 0.0063 |
| | (1.3186) | (-0.4441) | (-0.0287) | (0.4448) |
| *Profit* | -0.0038 | 0.0103 | -0.0139* | -0.0194* |
| | (-0.7710) | (1.2977) | (-1.7597) | (-1.8754) |
| *Reinsurance* | 0.0353*** | 0.0361** | 0.0110 | 0.0206 |
| | (3.8244) | (2.3538) | (0.9946) | (1.3116) |
| *Product Herf* | -0.0013 | -0.0045 | 0.0254*** | -0.0173* |
| | (-0.2289) | (-0.3354) | (2.6466) | (-1.7597) |
| *ln(Capital/Assets)* | 0.0074* | -0.0177 | 0.0060 | -0.0098 |
| | (1.7718) | (-1.6327) | (0.8552) | (-0.9074) |
| *Other Comp* | -0.0054 | -0.0051 | 0.0426*** | -0.0278*** |
| | (-0.9180) | (-0.4535) | (3.1068) | (-2.8844) |
| Intercept | -0.0785*** | -0.0546* | 0.0033 | -0.1953*** |
| | (-3.5539) | (-1.7670) | (0.1013) | (-3.6413) |
| Year FE | Yes | Yes | Yes | Yes |
| *Bonus*+*Bonus*Public* = 0 | 0.9404 | | | |
| *Bonus*+*Bonus*Mutual* = 0 | 0.9399 | | | |
| Wald $\chi^2$ | 1,328.74 | 322.59 | 460.76 | 540.00 |
| Observations | 332 | 116 | 106 | 110 |

Note: This table reports results from feasible generalized least squares regressions. Results in column (1) are for the full sample of firms. Results in columns (2), (3), and (4) are results on subsamples of firms with ownership structures of mutual, private, and public, respectively. The dependent variable (*RE*) is loss reserve error scaled by total assets. *Bonus* is the percent of total compensation in the form of a bonus. *Public* is a binary variable equal to 1 if a firm is publicly traded and 0 otherwise. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Over* (*Under*) is a binary variable equal to 1 if a firm over (under) reserved and 0 otherwise. *Length* is a firm's total loss reserve scaled by total liabilities. *Size* is the natural log of total assets. *Tax Shield* is the sum of net income and the estimated reserve divided by total assets. *Longtail* is the proportion of premiums written in longtailed lines. *Loss* is a binary variable equal to 1 if a firm is in the bottom 90 percent of the negative earnings distribution and 0 otherwise. *Small Profit* is a binary variable equal to 1 if a firm is in the bottom 5 percent of the positive earnings distribution and 0 otherwise. *Profit* is a binary variable equal to 1 if a firm is in the top 90 percent of the positive earnings distribution and 0 otherwise. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Product Herf* is a firm's line of business Herfindahl index. *ln(Capital/Assets)* is the natural log of surplus divided by assets. *Other Comp* is the percentage of total compensation reported as "All other compensation." All models include year fixed effects. Standard errors account for heteroskedasticity and autocorrelation. *t*-statistics are presented in parentheses beneath each coefficient estimate. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table 3.7: Results by Ownership Structure—Actuary Only

| | Dependent Variable: *RE* |
|---|---|
| *Bonus* | -0.0496 |
| | (-0.6449) |
| *Bonus*Public* | 0.3242** |
| | (2.0934) |
| *Bonus*Mutual* | -0.1113 |
| | (-0.8581) |
| *Mutual* | 0.0188 |
| | (0.6326) |
| *Public* | -0.0487 |
| | (-1.6441) |
| *Over*Length* | -0.2540*** |
| | (-3.9470) |
| *Under*Length* | -0.0586 |
| | (-0.8665) |
| *Size* | 0.0112** |
| | (2.0489) |
| *Tax Shield* | 0.0875 |
| | (0.3493) |
| *Longtail* | 0.0422 |
| | (1.2303) |
| *Loss* | 0.1188*** |
| | (2.7927) |
| *Small Profit* | -0.0928 |
| | (-1.3819) |
| *Profit* | 0.0279 |
| | (0.8710) |
| *Reinsurance* | 0.1334*** |
| | (2.8279) |
| *Product Herf* | -0.0148 |
| | (-0.4805) |
| *ln(Capital/Assets)* | 0.0323* |
| | (1.8378) |
| *Other Comp* | -0.0384 |
| | (-0.8142) |
| Intercept | -0.1830* |
| | (-1.6495) |
| Year FE | Yes |
| *Bonus*+*Bonus*Public* = 0 | 0.0310 |
| *Bonus*+*Bonus*Mutual* = 0 | 0.0769 |
| Wald $\chi^2$ | 118.95 |
| Observations | 70 |

Note: This table reports results from a feasible generalized least squares regression. The dependent variable (*RE*) is the five-year loss reserve error scaled by total assets. Standard errors account for heteroskedasticity and autocorrelation. *t*-statistics are presented in parentheses beneath each coefficient estimate. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

## Table 3.8: External Monitoring Results

Dependent Variable: *RE*

| | All Executives | | | CEOs | | |
|---|---|---|---|---|---|---|
| | Mutual | Private | Public | Mutual | Private | Public |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Bonus* | -0.0044 | 0.0151 | -0.0407*** | -0.0001 | 0.0555*** | -0.0096 |
| | (-0.3006) | (1.0102) | (-3.0619) | (-0.0096) | (3.3400) | (-0.5523) |
| *Bonus*Big 4* | 0.0477** | -0.1796*** | -0.0050 | 0.0377* | -0.1180** | -0.0222 |
| | (2.0436) | (-5.7802) | (-0.1483) | (1.9014) | (-2.3594) | (-0.9239) |
| *Big 4* | -0.0254*** | 0.0286*** | -0.0048 | -0.0233*** | 0.0171 | -0.0046 |
| | (-3.7941) | (4.1161) | (-0.5328) | (-3.4750) | (1.1684) | (-0.4545) |
| *Over*Length* | -0.0460*** | -0.0681*** | -0.1184*** | -0.0603*** | -0.0953*** | -0.0725** |
| | (-2.7339) | (-4.7286) | (-6.7267) | (-2.6234) | (-3.7399) | (-2.4672) |
| *Under*Length* | 0.0606*** | 0.1044*** | 0.0692*** | 0.0688*** | 0.0958*** | 0.0753*** |
| | (3.7960) | (6.5308) | (3.6780) | (3.1879) | (3.0360) | (2.6552) |
| *Size* | 0.0025* | 0.0010 | 0.0109*** | 0.0016 | -0.0008 | 0.0086** |
| | (1.8241) | (0.5307) | (5.4706) | (1.2238) | (-0.3819) | (2.5145) |
| *Tax Shield* | -0.1619** | 0.0669 | 0.3255*** | -0.2021** | 0.0625 | -0.2013 |
| | (-2.0764) | (1.0224) | (3.3202) | (-1.9618) | (0.5580) | (-1.4481) |
| *Longtail* | -0.0155* | -0.0131 | -0.0090 | -0.0146 | -0.0057 | -0.0367* |
| | (-1.8405) | (-1.6092) | (-0.8799) | (-1.6201) | (-0.3398) | (-1.8498) |
| *Loss* | -0.0113 | 0.0007 | 0.0148 | -0.0145 | 0.0003 | -0.0048 |
| | (-0.7570) | (0.0846) | (1.5917) | (-1.0324) | (0.0181) | (-0.4321) |
| *Small Profit* | -0.0591 | -0.0114 | 0.0084 | -0.0365** | 0.0056 | 0.0096 |
| | (-1.1814) | (-0.6655) | (0.7376) | (-2.4256) | (0.2620) | (0.7508) |
| *Profit* | -0.0064 | -0.0142** | -0.0201** | -0.0174** | -0.0097 | -0.0162* |
| | (-0.4781) | (-2.1339) | (-2.3468) | (-2.0743) | (-0.8965) | (-1.6486) |
| *Reinsurance* | 0.0432*** | 0.0187* | 0.0266** | 0.0218 | 0.0247* | 0.0243 |
| | (3.4407) | (1.8695) | (2.4799) | (1.6194) | (1.7794) | (1.3266) |
| *Product Herf* | -0.0229** | 0.0087 | -0.0145** | 0.0062 | 0.0321** | -0.0239** |
| | (-2.1101) | (1.0672) | (-2.2299) | (0.5343) | (2.4352) | (-2.0766) |
| *ln(Capital/Assets)* | -0.0146* | 0.0113** | -0.0152 | -0.0120 | 0.0083 | -0.0096 |
| | (-1.7807) | (2.2575) | (-1.6111) | (-1.2632) | (1.0564) | (-0.7069) |
| *Other Comp* | 0.0141 | 0.0216 | -0.0459*** | -0.0087 | 0.0510*** | -0.0228* |
| | (1.3144) | (1.3448) | (-5.0297) | (-0.6891) | (3.0353) | (-1.8964) |
| Constant | -0.0367 | -0.0095 | -0.2024*** | -0.0155 | -0.0069 | -0.1334* |
| | (-1.2690) | (-0.3010) | (-4.8448) | (-0.5625) | (-0.1774) | (-1.9213) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| *Bonus+Bonus*Big 4* = 0 | 0.0592 | >0.0001 | 0.1470 | 0.0495 | 0.1822 | 0.1408 |
| Wald $\chi^2$ | 484.65 | 459.22 | 663.67 | 462.43 | 273.96 | 379.30 |
| Observations | 140 | 168 | 133 | 116 | 106 | 110 |

Note: This table reports results from feasible generalized least squares regressions. Results in columns (1), (2), and (3) are for all executives for mutual, private, and public firms, respectively. Results in columns (4), (5), and (6) are are for CEOs only for mutual, private, and public firms, respectively. The dependent variable (*RE*) is loss reserve error scaled by total assets. *Bonus* is the percent of total compensation in the form of a bonus. *Big 4* is a binary variable equal to 1 if a firm has a Big 4 auditor and a Big 4 actuarial firm and 0 otherwise. *Over* (*Under*) is a binary variable equal to 1 if a firm over (under) reserved and 0 otherwise. *Length* is a firm's total loss reserve scaled by total liabilities. *Size* is the natural log of total assets. *Tax Shield* is the sum of net income and the estimated reserve divided by total assets. *Longtail* is the proportion of premiums written in longtailed lines. *Loss* is a binary variable equal to 1 if a firm is in the bottom 90 percent of the negative earnings distribution and 0 otherwise. *Small Profit* is a binary variable equal to 1 if a firm is in the bottom 5 percent of the positive earnings distribution and 0 otherwise. *Profit* is a binary variable equal to 1 if a firm is in the top 90 percent of the positive earnings distribution and 0 otherwise. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Product Herf* is a firm's line of business Herfindahl index. *ln(Capital/Assets)* is the natural log of surplus divided by assets. *Other Comp* is the percentage of total compensation reported as "All other compensation." All models include year fixed effects. Standard errors account for heteroskedasticity and autocorrelation. *t*-statistics are presented in parentheses beneath each coefficient estimate. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

# Chapter 4
# Managerial Style

## 4.1 Introduction

This study investigates whether individual executives impact their firm's discretionary accounting decisions beyond what can be explained by firm characteristics. Specifically, I examine whether executives influence the loss reserving behavior of property-liability (P/L) insurance firms. Numerous studies have examined how insurers can use their discretion over loss reserves in response to various incentives, such as regulation (Gaver and Paterson, 2004) or earnings smoothing (Beaver, McNichols, and Nelson, 2003), but studies have largely not considered the role of individual managers in establishing loss reserves. I am interested in whether a firm's loss reserving will differ depending on which executive leads the firm.

In this paper, I examine whether chief executive officers (CEOs) of insurance firms influence loss reserving. Specifically, I examine whether managerial fixed effects provide incremental explanatory power in estimating the determinants of loss reserve errors. Even if a CEO is not directly responsible for establishing loss reserves, it is likely that they set a "tone at the top" with regard to the firm's operations (Dyreng, Hanlon, and Maydew, 2010).

The property-liability insurance industry provides an excellent laboratory to examine the issue of whether managerial style influences firm policies. Insurers are required to report initial annual estimates of losses. Higher (lower) loss estimates can serve to reduce (increase) the net income of an insurer. Insurers, unlike other firms, are required to show how these estimated expenses (the losses) develop over time. Each year, insurers are required to re-estimate prior years' loss estimates to reflect actual payments made, as well as changes in estimates. Over time, these estimates converge to the actual loss amount incurred.[1] This allows for the observability of the actual error made in the original accounting estimate, called loss reserve errors.

Using ordinary least squares (OLS), I regress loss reserve errors on managerial fixed effects and control for other factors that have been found to be related to reserve errors in prior literature. The sample consists of P/L insurance firms from 1992 to 2006. I construct the sample to include only CEOs who have managed at least two firms in the sample, consistent with prior studies investigating manager fixed effects (e.g., Bertrand and Schoar, 2003; Bamber, Jiang, and Wang, 2010; Dyreng, Hanlon, and Maydew, 2010; Ge, Matsumoto, and Zhang, 2011; Yang, 2012). These data are from statutory annual filings P/L insurers are required to make to the National Association of Insurance Commissioners (NAIC).

I make several contributions to the literature. First, I contribute to the managerial style literature by investigating whether CEOs of insurance firms have an impact on insurer loss reserve errors. Second, I contribute to the literature on the discretionary determinants of insurer loss reserve errors. Prior studies have, generally, not examined how individual executives impact reserving decisions.[2]

The rest of the paper proceeds as follows. In the next section, I provide background and a brief literature review on insurer loss reserve errors and managerial fixed effects. In the following section, I describe my empirical strategy and my data. I then provide my results and, in the final section, give a brief conclusion.

[1] Certain lines of business will converge more quickly than others. Long-tailed lines, such as liability lines, take longer to resolve compared to short-tailed lines, such as personal auto policies.

[2] Several studies have examined how executive compensation contracts can incentivize managers to over or underreserve to increase their compensation (e.g., Eckles and Halek, 2010; Eckles et al., 2011). However, these papers provide evidence of executives responding to economic incentives, whereas the managerial style literature is focused on personality traits. The only other study, to my knowledge, to investigate how an individual manager can impact reserving is Berry-Stölzle, Eastman, and Xu (2016), who find evidence that CEO overconfidence can influence reserving.

# 4.2 Background

## 4.2.1 Manager Impact on Firm Policies

The impact of top executives on firm policies has attracted recent interest in the finance and accounting literature. While several studies have found evidence of negative market reactions to CEO turnover (e.g., Johnson et al., 1985; Hayes and Schaefer, 1999)—suggesting that managers are important to firms—recent studies have began to focus on how individual managers impact firm policies. Notably, Bertrand and Schoar (2003) construct a sample of executives who managed at least two firms, which allows them to differentiate between firm fixed effects and executive fixed effects. They find evidence that managerial fixed effects are significantly related to managerial practices, such as investment. Subsequent studies have used the Bertrand and Schoar (2003) methodology to investigate disclosure policy (Bamber, Jiang, and Wang, 2010; Yang, 2012), tax avoidance (Dyreng, Hanlon, and Maydew, 2010), and firm efficiency (Leverty and Grace, 2012). Ge, Matsumoto, and Zhang (2011) find evidence that chief financial officers (CFOs) have a style that translates to accounting choices, including discretionary accruals, earnings smoothing, and accounting misstatements.

Several other studies have investigated how managerial personality traits impact firm policies. Malmendier and Tate (2005) suggest that overconfident managers may impact firm policies, since overconfidence is associated with overestimating the potential for success. They proxy for overconfidence by examining a CEO's option exercising behavior and their portrayal in the media to construct measure of CEO overconfidence. Their empirical evidence suggests that overconfident managers tend to over-invest when they have abundant internal funds. Subsequent studies in finance and accounting have linked CEO overconfidence to mergers and acquisitions (Malmendier and Tate, 2008), innovation (Hirshleifer, Low, and Teoh, 2012), accounting fraud (Schrand and Zechman, 2012), and conservatism

(Ahmed and Duellman, 2013). Additionally, Berry-Stölzle, Eastman, and Xu (2016) find evidence linking CEO overconfidence to insurer loss reserve errors. Using an options-based measure of overconfidence, they find that overconfident CEOs tend to underreserve relative to non-overconfident CEOs. This suggests that overconfident CEOs under-estimate the loss exposure of the firm when the initially estimate reserves, and then must increase reserves in subsequent periods.

Studies on managerial personality traits or personal behaviors are not limited to CEO overconfidence. Dhaliwal, Erickson, and Heitzman (2009) find evidence that executives suspected of option exercise backdating are driven to backdate by personal tax considerations. Malmendier and Tate (2009) find evidence that "superstar" CEOs—those who have won awards—extract greater pay, but also tend to under-perform relative to non-award-winning CEOs. Malmendier, Tate, and Yan (2011) find evidence that CEOs who lived through the Great Depression are less likely to use debt in their firm's capital structure while CEOs with military and combat experience are more likely to have an aggressive capital structure. Chyz (2013) documents a positive relationship between CEOs with a history of personal tax evasion and corporate tax sheltering for the firm that they manage.

## 4.3 Hypothesis Development

Theory has traditionally allowed no role for individual managers to influence firm policies. In neoclassical economic theory, managers are considered to be "homogenous and selfless inputs into the production process" (Bertrand and Schoar, 2003). Agency theory allows for differences between certain managerial attributes, such as risk aversion, but tends to focus on representative agents in situations where incentives will cause managers to act in a similar way.

Recent work, however, has proposed that individual managers might play a role in firm policies. Notably, Bertrand and Schoar (2003) develop an empirical methodology that isolates managerial fixed-effects. They find evidence that managers do have a distinct style and that this style impacts corporate policies, such as the number of acquisitions, R&D expenditures, and advertising expenditures. Subsequent work has applied Bertrand and Schoar's (2003) methodology to accounting decisions, such as voluntary disclosure (Bamber, Jiang, and Wang, 2010; Yang, 2012) and tax avoidance (Dyreng, Hanlon, and Maydew, 2010).

I am particularly interested in examining whether managerial style has an influence on reserving decisions. Establishing reserves is a major concern for insurers, as they are the largest liability on their balance sheet. In practice, loss reserves are generally set by top management after a firm's internal actuaries establish a range of acceptable loss reserves. My analysis is primarily concerned with chief executive officer style in setting reserves. CEOs are likely to have the opportunity to play a role in reserving when a firm's actuaries recommend a range.

However, establishing loss reserves is a complex process.[3] A typical CEO of an insurance firm is unlikely to have an expertise in setting loss reserves. It is possible, then, that CEOs have a style that impacts other aspects of a firm's operations, but not reserving.

Dyreng, Hanlon, and Maydew (2010) note, however, that managers could also impose their style by setting the "tone at the top." Even if CEOs do not directly influence reserving, they have the ability to allocate resources to different areas of the firm or to place emphasis on certain corporate goals. For example, a CEO could emphasize solvency over other financial outcomes, such as firm performance. A CEO could also allocate proportionally more resources to their actuarial department compared to other departments. CEOs are also likely to play a role in designing the compensation contracts to other individuals in the firm, and could incentivize adequate reserving.

[3]Prior work on external monitoring suggests that actuarial expertise is an important component of establishing adequate reserves. Gaver and Paterson (2001) find evidence that Big Six auditors only prevent underreserving by weak insurers when they are matched with a Big Six actuary. Grace and Leverty (2013) find evidence that the technical knowledge of an external actuary is important in preventing discretionary management of loss reserves.

My main hypothesis is that CEOs have a style that will influence how the initially set reserves. This "style" will mean that CEOs will reserve differently, all else equal. Formally, I offer the following hypothesis:

**H1**: CEO fixed-effects will have a statistical significant impact on loss reserve errors.

## 4.4 Sample

My data are from annual property-casualty statutory filings with the National Association of Insurance Commissioners from 1991 to 2011. These data are used for construction of the reserve error variable. This calculation requires five years of lead data (e.g., the 2006 reserve error is calculated using the 2011 statement), so analysis is for 1991 to 2006. Data are also required to control for other discretionary and non-discretionary determinants of loss reserve errors, as failing to control for firm-specific effects could result in misattributing firm effects to managers (Bamber, Jiang, and Wang, 2010).

The statutory filings also contain the identity of a firm's CEO. Following Bertrand and Schoar's (2003) design, I create a dataset that tracks managers across firms over time. Specifically, to be included in the sample, a CEO must work for at least two firms over the sample period. This allows me to measure the impact of managerial style on insurer loss reserve errors after controlling for other determinants of loss reserve errors, as well as any time trends. The manager fixed-effect is interpreted as each manager's "style."

Table 4.1 provides summary statistics for sample firms. Following the restriction that a CEO must be at the head of two different sample periods, this sample is restricted to 1,795 firm-year observations and 221 unique-firms. The average reserve error (*Error*) is

0.0026, indicating that on average firms overreserved. The majority of firms in the sample overreserved, as the median value is 0.0072.

## Research Design

To test whether individual managers have a style that influences how they reserve, I estimate the following model:

$$\begin{aligned}
Error_{i,t} = {} & \beta_0 + \beta_1 Longtail_{i,t} + \beta_2 Product\ Diverse_{i,t} + \beta_3 Geo\ Herf_{i,t} + \beta_4 Small\ Profit_{i,t} \\
& + \beta_5 Small\ Loss_{i,t} + \beta_6 Profit_{i,t} + \beta_7 Reinsurance_{i,t} + \beta_8 Size_{i,t} \\
& + \beta_9 Tax\ Shield_{i,t} + \beta_{10} Insolvent_{i,t} + \beta_{11} Mutual_{i,t} + \beta_{12} Group_{i,t} + \lambda_{Year} \\
& + \lambda_{CEO} + \lambda_{Firm} + \lambda_{Group} + \epsilon_{i,t}
\end{aligned} \tag{4.1}$$

where:

| | |
|---|---|
| $i,t$ = | Firm $i$ in year $t$; |
| $Error_{i,t}$ = | A firm's incurred losses in year $t+5$ minus incurred losses in year $t$, scaled by total assets; |
| $Longtail_{i,t}$ = | The proportion of a firm's net premiums written in long-tailed lines of business in year $t$;[4] |
| $Product\ Diverse_{i,t}$ = | One minus a Herfindal index of a firm's net premiums written across 24 lines of business in year $t$;[5] |

[4]Consistent with Eckles and Halek (2010), I define the following lines as long-tailed: farm multi peril, homeowners' multi peril, commerical multi peril, medical malpractice, workers' compensation, products liability, automobile liability, and "other" liability.

[5]Using net premiums written data from the Underwriting and Investment Exhibit (Part 1B-Premiums Written) in the annual statutory filings, I make the following adjustments as described in Berry-Stölzle et al. (2012). Fire and Allied Lines is defined as the sum of "Fire" and "Allied Lines." Accident and Health is defined as the sum of "Group Accident and Health," "Credit Accident and Health," and "Other Accident and Health." Medical Malpractice is defined as the sum of "Medical Malpractice—Occurrence" and "Medical Malpractice—Claims Made." Products Liability is defined as the sum of "Products Liability—Occurrence" and "Products Liability—Claims Made." Auto is defined as the sum of "Private Passenger Auto Liability," "Commercial Auto Liability," and "Auto Physical Damage." Reinsurance is defined as the

$Geo\ Herf_{i,t}$ = A Herfindahl index of a firm's direct premiums written in each of the 50 U.S. states and Washington D.C. in year $t$;

$Small\ Profit_{i,t}$ = A binary variable equal to one if a firm has earnings in the bottom 5 percent of the earnings distribution in year $t$ and zero otherwise;

$Small\ Loss_{i,t}$ = A binary variable equal to one if a firm has earnings in the top 5 percent of the negative earnings distribution in year $t$ and zero otherwise;

$Profit_{i,t}$ = A binary variable equal to one if a firm has earnings in the top 90 percent of the positive earnings distribution in year $t$ and zero otherwise;

$Reinsurance_{i,t}$ = A firm's reinsurance ceded divided by the sum of reinsurance assumed and direct premiums written in year $t$;

$Size_{i,t}$ = The natural log of year $t$ total assets;

$Tax\ Shield_{i,t}$ = The sum of firm $i$'s net income plus estimated reserves divided by total assets in year $t$;

$Insolvent_{i,t}$ = Firm $i$'s predicted probability of insolvency in year $t$;[6]

$Mutual_{i,t}$ = A binary variable equal to one if a firm is a mutual firm in year $t$ and zero otherwise;

$Group_{i,t}$= A binary variable equal to one if a firm is a member of a group in year $t$ and zero otherwise;[7]

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sum of "Nonproportional Assumed Property," "Nonproportional Assumed Liability," and "Nonproportional Assumed Financial Lines." After these combinations I are left with 24 lines of business from which I construct the Herfindahl Index: Accident and Health, Aircraft, Auto, Boiler and Machinery, Burglary and Theft, Commercial Multi Peril, Credit, Earthquake, Farmowners', Financial Guaranty, Fidelity, Fire and Allied lines, Homeowners, Inland Marine, International, Medical Malpractice, Mortgage Guaranty, Ocean Marine, Other, Other Liability, Products Liability, Reinsurance, Surety, and Workers' Compensation.

[6] As in Grace and Leverty (2010, 2012), I estimate a probability of insolvency using the IRIS ratios to predict a probability of failure using a logit model.

[7] Some insurers are organized as a group, where they operate under common ownership with other insurance firms. For example, as of 2011, the Allstate Insurance Group is comprised of numerous subsidiaries, such as Allstate Fire and Casualty Insurance Company, Encompass Insurance Company, and Esurance In-

$\lambda_{Year} =$ Estimated coefficients for indicator variables corresponding to each year;

$\lambda_{CEO} =$ Estimated coefficients for indicator variables corresponding to each CEO;

$\lambda_{Firm} =$ Estimated coefficients for indicator variables corresponding to each Firm;

$\lambda_{Group} =$ Estimated coefficients for indicator variables corresponding to each Group;

I estimate this model using ordinary least squares (OLS). I estimate separate models including various fixed effects. In models including firm fixed effects, I exclude time invariant control variables ($Mutual_{i,t}$ and $Group_{i,t}$). I use Wald tests to test for joint significance of the CEO fixed effects to examine if they provide incremental explanatory power beyond the other firm-level control variables.

I also estimate equation (4.1) with the absolute value of $Error_{i,t}$ as the dependent variable. These models will examine whether CEO fixed effects play a role in determining reserve estimation accuracy in opposed to magnitude. Certain hypothesized incentives for reserve manipulation have a directional prediction regarding how the incentive changes insurer reserving. For example, firms will be incentivized to overreserve to minimize their tax burden (e.g., Grace, 1990). Another example would be firms underreserving to increase reported earnings (e.g., Beaver, McNichols, and Nelson, 2003). However, since I have no directional prediction regarding managerial style, I also examine the absolute value of insurer loss reserve errors. This provides insight into the accuracy of reserve estimation. Petroni and Beasley (1996), for example, use the absolute value of reserve error ("unsigned" reserve error) in their examination of the impact of external monitoring on insurer reserve errors.

surances Services. The NAIC statements provide financial information consolidated at the group level and also for each subsidiary.

In addition to managerial fixed effects, it is important to control for other discretionary and non-discretionary determinants of insurer loss reserve errors to attempt to isolate the marginal impact of managerial style on reserving direction and magnitude. Accordingly, I control for these factors in my empirical analysis.[8]

Business mix and geographic diversification can have an influence on insurer reserving. Long-tailed lines of business (i.e., lines of business where there is a long period of time between the initial claim and the claim payment), in particular, can increase the difficulty of accurately reserving. This generally includes liability lines such as medical malpractice (Nelson, 2000). I control for this by including the proportion of net premiums in long-tailed lines (*Longtail*). I also control for the degree of line-of-business and geographic diversification of an insurers business. Writing more lines of business can increase business complexity and make reserving more difficult. I control for this using one minus a line-of-business Herfindahl index (*Product Diverse*). Similarly, writing business across more markets can make reserving more complex. I control for this using a Herfindahl index based on direct premiums written across the 50 U.S. states as well as Washington D.C. (*Geo Herf*).

I also control for incentives related to earnings smoothing. Beaver, McNichols, and Nelson (2003) find evidence that firms manage reserves across the earnings distribution. Therefore, I control for small loss firms, small profit firms, and profit firms using indicator variables.[9] I also include a variable to control for incentives related to an insurer's tax liability. Specifically, I include *Tax Shield*, which is defined as the sum of net income and

[8]There are two incentives that are not included in these models due to data limitations. First, I do not control for executive compensation incentives, as data on executive bonus payments are generally not available for the entire insurance industry. Prior studies examining these incentives rely on samples of publicly traded firms (e.g., Eckles and Halek, 2010; Eckles et al., 2011) or on hand-collected data from individual states (e.g., Ke, Petroni, and Safieddine, 1999). The second incentive that I do not account for is ratings. While a large proportion of the insurance industry receives a rating, not every firm does so. In addition, data may be needed to estimate, for example, a "target rating" that places additional sample restrictions (Alissa et al., 2013). Given the reduced sample necessary to construct CEO fixed effects, this becomes impractical.

[9]An indicator for loss firms is omitted to avoid multicollinearity issues.

estimated reserves divided by total assets (Grace, 1990). This variable is intended to capture a firm's incentive to overreserve to minimize taxes.

Harrington and Danzon (1994) suggest that firms can use reinsurance to hide under-reserving associated with growth. To control for this discretionary incentive, I include a variable that accounts for a firm's reinsurance use (*Reinsurance*). A firm's size could also potentially influence reserving decisions. Larger firms could have advantages associated with the law of large numbers and larger actuarial departments, which would lead to more accurate reserving. (Aiuppa and Trieschmann, 1987). Smaller firms could also be expected to build in a larger "safety loading" into their reserve estimates. In other words, the probability of default associated with under-estimating reserves could be greater for smaller firms, so they are more conservative in their reserve estimates.

Prior studies have also documented underreserving by financially weak firms (Petroni, 1992; Gaver and Paterson, 2004; Grace and Leverty, 2012). Firms that are performing poorly financially or are in danger of regulatory intervention could underreserve to attempt to "mask" solvency issues from regulators or poor financial results from investors. Accordingly, I include a control for a firm's probability of insolvency (*Insolvent*), measured as the fitted probability of insolvency using a hazard model.[10]

I also control for a firm's ownership structure. Prior studies have documented that stock and mutual firms (customer-owned firms) reserve differently (e.g., Grace and Leverty, 2012). In addition, I include a control for whether a firm is a member of a group.

## 4.5 Results

Table 4.2 provides results from ordinary least squares regressions. The dependent variable in column (1) is loss reserve error scaled by total assets and the dependent variable in column (2) is the absolute value of loss reserve error scaled by assets. *t*-statistics are presented

[10] I estimate a firm's probability of insolvency using each firm's IRIS ratios.

beneath each coefficient estimate in parentheses. Both models include year fixed-effects. These models are presented as a baseline. Neither includes CEO, firm, or group fixed effects.

The estimated coefficient of *Longtail* is positive and significant in both specifications, indicating that firms tend to overreserve as they write more premiums in long-tailed lines of business. They also tend to reserve less accurately. *Reinsurance* has a negative and significant coefficient estimate in column (1), suggesting that firms tend to underreserve as they use more reinsurance. The coefficient estimate of *Size* is negative and significant. This is consistent with smaller firms having a safety loading. *Tax Shield* has a positive and significant coefficient estimate in column (1), suggesting that firms use reserves as a means to lower their tax liability. *Mutual* has a positive coefficient estimate in column (1), which provides evidence that mutual firms reserve more conservatively. The coefficient estimate for *Mutual* is negative in column (2), which would indicate that mutual firms reserve more accurately compared to stock firms.

The results of Wald tests of joint significance of fixed effects are presented in Table 4.3. The results in the top panel are from OLS regressions where $Error_{i,t}$ is the dependent variable, while results in the bottom panel are from models where the absolute value of $Error_{i,t}$ are the dependent variable. $F$-statistics are presented with corresponding $p$-values in parentheses below. The adjusted $\mathrm{R}^2$ from each model is also given to provide some measure of additional explanatory power as fixed effects are added.

The results in the top panel of Table 4.3 provide support for the presence of managerial style in reserve error magnitude. CEO fixed effects are jointly significant at the one percent level in models without and with firm and group fixed effects. Adding manager fixed effects increases the adjusted $\mathrm{R}^2$ by approximately eight percentage points. These results provide support for my hypothesis and suggest that managers play a role in determining reserve error magnitude.

The results in the bottom panel of Table 4.3 also support the hypothesis that managers play a role in determining loss reserve errors. In this case, however, the results provide evidence that managers play a role in reserve error accuracy. Again, CEO fixed effects are jointly significant at the one percent level in models without and with firm and group fixed effects. The adjusted $R^2$ increases to approximately 13 percent when manager fixed effects are included, from 4.5 percent without any fixed effects. Overall, these results suggest that managerial style plays a role in determining loss reserve estimation accuracy.

## 4.6 Conclusion

In this paper, I provide evidence that managerial style plays a role in determining insurer loss reserve errors. Specifically, CEO fixed-effects provide statistically significant explanatory power in explaining loss reserve error magnitude and accuracy when controlling for firm-specific determinants of loss reserve errors. The findings in this paper contribute to the literature examining the role of managerial style on firm financial and accounting policies (Bertrand and Schoar, 2003; Bamber, Jiang, and Wang, 2010; Dyreng, Hanlon, and Maydew, 2010). It also contributes to the literature examining the determinants of loss reserve errors (e.g., Petroni, 1992; Gaver and Paterson, 2004; Grace and Leverty, 2010; Eckles and Halek, 2010) and provides evidence that loss reserve errors are determined not only by firm-level incentives, but also by the style of individual managers.

Table 4.1: Descriptive Statistics

| | | | | Percentiles | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | Mean | Std. | Min | $10^{th}$ | $25^{th}$ | $50^{th}$ | $75^{th}$ | $90^{th}$ | Max |
| *Error* | 0.0026 | 0.1167 | -0.4439 | -0.1169 | -0.0284 | 0.0072 | 0.0525 | 0.1128 | 0.3377 |
| $\lvert Error \rvert$ | 0.0740 | 0.0903 | 0.0000 | 0.0025 | 0.0133 | 0.0431 | 0.0947 | 0.1847 | 0.4439 |
| *Longtail* | 0.6159 | 0.3489 | 0.0000 | 0.0000 | 0.3986 | 0.7083 | 0.9207 | 1.0000 | 1.0000 |
| *Product Diverse* | 0.3939 | 0.3380 | 0.0000 | 0.0000 | 0.0003 | 0.4160 | 0.6803 | 0.8096 | 1.0000 |
| *Geo Herf* | 0.6000 | 0.3805 | 0.0416 | 0.0867 | 0.2014 | 0.6396 | 1.0000 | 1.0000 | 1.0000 |
| *Small Profit* | 0.0323 | 0.1769 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| *Small Loss* | 0.0123 | 0.1101 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| *Profit* | 0.6797 | 0.4667 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| *Reinsurance* | 0.3468 | 0.3010 | -0.0174 | 0.0146 | 0.0937 | 0.2619 | 0.5523 | 0.7992 | 1.1553 |
| *Size* | 18.0853 | 1.8130 | 13.0433 | 15.8961 | 16.9029 | 17.9588 | 19.0737 | 20.3019 | 24.6272 |
| *Tax Shield* | 0.0245 | 0.0594 | -0.1667 | -0.0413 | 0.0009 | 0.0281 | 0.0534 | 0.0830 | 0.2135 |
| *Insolvent* | 0.0222 | 0.0453 | 0.0000 | 0.0004 | 0.0040 | 0.0168 | 0.0280 | 0.0410 | 1.0000 |
| *Mutual* | 0.1543 | 0.3614 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 |
| *Group* | 0.6847 | 0.4648 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

Note: This table reports descriptive statistics for the years 1991 to 2006. The full sample is 1,795 firm-years, consisting of 221 unique firms. *RE* is the five-year loss reserve error scaled by total assets. *Longtail* is the proportion of premiums written in longtailed lines. *Product Diverse* is 1 minus the line of business Herfindahl index. *Geo Herf* is the geographic Herfindahl index. *Small Profit* is a binary variable equal to 1 if a firm has earnings in the bottom 5 percent of the earnings distribution. *Small Loss* is a binary variable equal to 1 if a firm has earnings in the top 5 percent of the negative earnings distribution. *Profit* is a binary variable equal to 1 if a firm has earnings in the top 90 percent of the positive earnings distribution. *Reinsurance* is reinsurance ceded divided by direct premiums plus reinsurance assumed. *Size* is the natural log of total assets. *Tax Shield* is the sum of net income and estimated reserves divided by total assets. *Insolvent* is the estimated probability of insolvency. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *Group* is a binary variable equal to 1 for a group and 0 otherwise.

Table 4.2: Reserve Error Estimation Results

| | *Error* | $\|Error\|$ |
|---|---|---|
| | (1) | (2) |
| *Longtail* | 0.0215*** | 0.0382*** |
| | (2.6172) | (6.0363) |
| *Product Diverse* | -0.0103 | 0.0115* |
| | (-1.1795) | (1.7073) |
| *Geo Herf* | -0.0130* | 0.0283*** |
| | (-1.6486) | (4.6359) |
| *Small Profit* | -0.0018 | -0.0008 |
| | (-0.1106) | (-0.0653) |
| *Small Loss* | -0.0170 | 0.0280 |
| | (-0.6802) | (1.4516) |
| *Profit* | 0.0252*** | -0.0012 |
| | (2.8712) | (-0.1719) |
| *Reinsurance* | -0.0372*** | -0.0097 |
| | (-3.9463) | (-1.3346) |
| *Size* | -0.0056*** | 0.0035** |
| | (-3.1635) | (2.5729) |
| *Tax Shield* | 0.1115* | -0.0737 |
| | (1.7039) | (-1.4567) |
| *Insolvent* | -0.0109 | 0.1524*** |
| | (-0.1764) | (3.1978) |
| *Mutual* | 0.0183** | -0.0363*** |
| | (2.3046) | (-5.9240) |
| *Group* | 0.0050 | -0.0152*** |
| | (0.7895) | (-3.1310) |
| Intercept | 0.0764** | -0.0152 |
| | (2.1697) | (-0.5595) |
| Year FE | Yes | Yes |
| $F$-stat | 5.85 | 5.80 |
| $R^2$ | 7.85% | 8.15% |
| Observations | 1,795 | 1,795 |

Note: This table provides OLS results where the dependent variable is the five-year loss reserve error in column (1) and the absolute value of reserve error in column (2). Standard errors are presented in parentheses beneath each coefficient estimate. ***, **, and * represent significance at the 0.01, 0.05, and 0.10 level, respectively.

Table 4.3: CEO Style Results

| | CEO | Firm | Group | Adj-$R^2$ | Observations |
|---|---|---|---|---|---|
| Dependent Variable: $Error_{i,t}$ | | | | | |
| $F$-statistic | | | | 6.42% | 1,795 |
| ($p$-value) | | | | | |
| Constraints | | | | | |
| $F$-statistic | 2.33*** | | | 14.18% | 1,795 |
| ($p$-value) | (<0.001) | | | | |
| Constraints | 133 | | | | |
| $F$-statistic | 2.22*** | 4.75*** | | 42.72% | 1,795 |
| ($p$-value) | (<0.001) | (<0.001) | | | |
| Constraints | 126 | 220 | | | |
| $F$-statistic | 2.20*** | 4.68*** | 1.67*** | 43.94% | 1,795 |
| ($p$-value) | (<0.001) | (<0.001) | (0.004) | | |
| Constraints | 122 | 220 | 43 | | |
| Dependent Variable: $\|Error_{i,t}\|$ | | | | | |
| $F$-statistic | | | | 4.52% | 1,795 |
| ($p$-value) | | | | | |
| Constraints | | | | | |
| $F$-statistic | 2.28*** | | | 12.90% | 1,795 |
| ($p$-value) | (<0.001) | | | | |
| Constraints | 133 | | | | |
| $F$-statistic | 2.16*** | 4.85*** | | 42.30% | 1,795 |
| ($p$-value) | (<0.001) | (<0.001) | | | |
| Constraints | 126 | 220 | | | |
| $F$-statistic | 2.30*** | 4.47*** | 1.99*** | 43.88% | 1,795 |
| ($p$-value) | (<0.001) | (<0.001) | (0.001) | | |
| Constraints | 122 | 220 | 43 | | |

Note: This table presents significance levels from Wald tests on the joint significance of manager, firm, and group fixed effects. These are from separate regressions where different combinations of fixed effects are included. $F$-statistics and $p$-values are presented in the table. ***, **, and * represent significance at the 0.01, 0.05, and 0.10 level, respectively.

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