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Insurer Reserve Error and Executive Compensation

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Abstract

This article investigates incentives of insurance firm managers to manipulate loss reserves in order to maximize their compensation. We find that managers who receive bonuses that are likely capped or no bonuses tend to over-reserve for current-year incurred losses. However, managers who receive bonuses that are likely not capped tend to under-reserve for current-year incurred losses. We also find that managers who exercise stock options tend to under-reserve in the current period.

Introduction

This article investigates whether managers of insurance firms manipulate loss reserves in order to maximize their total compensation. Events such as the downfall of Enron, WorldCom, and Tyco have highlighted the importance of prudent managerial practices, especially procedures involving managerial discretion. Insurance firms have not been exempt from scandals resulting from accounting manipulations. AIG came under scrutiny for manipulating accounting results in order to meet earnings goals. Among other charges, former New York state Attorney General Eliot Spitzer "alleges that AIG adjusted its accounting books with unsupported accounting entries to increase the company's reserve levels before issuing its quarterly [earnings] reports. Mr. Smith [CEO, Howard I. Smith] is accused of personally supervising the entries, referred to as 'topside' or 'top level' adjustments, instructing employees to make changes" (National Underwriter, 2005).[1]

There is a significant academic literature on the manipulation of accounting data by insurance firms in order to circumvent regulatory scrutiny or smooth tax liability.

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[1] AIG executives are also under scrutiny for various other accounting manipulations, including initiating reinsurance transactions designed to overstate the value of the firm. In sum, these various manipulations could serve to either increase or decrease firm earnings.

Grace (1990) and Petroni (1992) are seminal papers that explore the use of loss reserving practices by insurance firms to avoid regulatory action and to smooth earnings. In addition to discretionary reserving practices, Petroni and Shackelford (1999) found that insurance companies shift their premiums and losses across states in order to manipulate state taxes paid.

There also exists a separate literature that suggests managers (of noninsurance firms) use discretionary accounting methods to increase their compensation (Healy, 1985; Gaver, Gaver, and Austin, 1995; Holthausen, Larcker, and Sloan, 1995). This does not mean that the manager will always try to boost reported income. For instance, if a firm falls well below a targeted earnings threshold needed to trigger a bonus payment to the manager, the manager does not always have enough discretion to raise earnings above the threshold (at least legally). In this case, the manager has an incentive to minimize current-period income to increase possible discretion in future periods.

While there is a substantial literature investigating insurance earnings smoothing for regulatory compliance or tax minimization, and a substantial literature investigating managers' use of accounting discretion to affect their compensation, there has been little research linking these two literatures.[2] We investigate the incentives of insurance executives to increase their total compensation through the manipulation of accounting results. Insurance company executives have at least one discretionary accounting accrual that can influence their total compensation: loss reserving. Further, because of statutory reporting, any estimation errors made in the initial establishment of loss reserves can ultimately be identified as the actual losses are realized and reported over subsequent years.

We extend the insurance literature by examining the relationship between compensation of insurer executives and their loss reserve estimation practices. We hypothesize that insurance company executives will use their discretion over loss reserves to maximize the value of particular compensation components (e.g., bonuses, payment in restricted company stock and options).

The remainder of the article is organized as follows. The second section discusses related literature. The third section develops the research hypotheses and the economic models. The fourth section provides details on the sample data and analysis methodology. The fifth section presents the empirical results, and the final section concludes.

RELATED LITERATURE

The manipulation of accounting results by managers has been extensively investigated within the accounting, finance, and insurance literatures. Within the insurance literature, several authors have investigated how managers of insurance firms use loss reserve estimation to manipulate the financial standing of the firm. Managers have been shown to use loss reserve estimation to influence accounting results such

[2] In a working paper, Browne, Ma, and Wang (2006) consider the relationship between awarding stock options to insurance company executives and the accuracy of loss reserve estimates. However, Brown, Ma, and Wang do not examine the value of the stock options granted or any other compensation variables in their study.

as earnings (Grace, 1990; Beaver, McNichols, and Nelson, 2003), as well as to temporarily evade regulatory scrutiny (Petroni, 1992; Gaver and Paterson, 2004). Until the early 1990s, most of this strand of research focused on the use of loss reserve estimation to smooth an insurer's income (Grace, 1990, provides a review). Grace (1990) went a step further in modeling this empirical result by showing an insurer's incentive to smooth earnings is the minimization of their associated tax liability.

In a more recent study, Beaver, McNichols, and Nelson (2003) find that property–casualty insurance firms do indeed use reserve estimation practices to manipulate reported earnings. They find that firms with small levels of positive earnings tend to understate their loss reserves. Beaver, McNichols, and Nelson posit this as a result of firms' preferences not to report small losses. They also find that firms with relatively large levels of earnings overstate their loss reserves consistent with the notion that firms smooth their income in efforts to minimize tax liabilities.

Petroni (1992) was the first to make the connection between insurer earnings manipulation and the potential for firms to use reserving practices to influence the performance ratios that determine if firms are placed under regulatory scrutiny. She shows that financially weak firms do understate their reserve estimates, presumably to avoid any regulatory attention. She also shows this under-reserving practice was more prevalent for the weakest firms most susceptible to regulatory scrutiny. Using a methodology similar to Beaver, McNichols, and Nelson (2003), Gaver and Paterson (2004) find evidence that weak insurers under-report their loss reserve estimation in order to evade regulatory intervention that is triggered by reflecting substandard Insurance Regulatory Information System (IRIS) ratios. Most recently, Grace and Leverty (2005) find results inconsistent with these prior studies, suggesting that firms may not be manipulating reserves to avoid regulatory scrutiny or avoid taxes.

Also related to our research are studies that explore the effects of incentive-based compensation structures on earnings manipulation. Within the accounting literature, there are several papers that investigate the use of accounting practices by managers to potentially increase the size of their performance-based bonuses. Healy (1985) finds that performance-based bonus plans provide incentives for managers to choose certain accounting procedures in an effort to maximize their overall compensation. Although this maximization is typically thought of as maximizing current-year earnings, Healy points out that there are in fact two potential reasons managers may choose accounting methodologies to actually *decrease* current earnings. First, if the firm's performance is not expected to trigger the bonus, a manager has no incentive to increase earnings through discretionary measures. Second, if the bonus scheme has an upper bound, then a manager of a firm whose earnings will leave the manager above the upper bound similarly has no incentive to increase earnings, as his bonus is already maximized. Hence, incentive-based compensation plans do not *always* induce managers to use discretionary practices to increase earnings. In fact, in both of these cases Healy argues that the manager has an incentive to reduce earnings in an effort to make the bonus in the following year easier to obtain. Gaver, Gaver, and Austin (1995) construct a similar study to Healy but consider only discretionary accruals (as opposed to total accruals as in Healy, 1985) as the variable used to measure managerial discretion. The results of Gaver, Gaver, and Austin differ from Healy

in that managers were found to choose income-increasing accounting policies even if firm earnings subsequently fell below the "bonus threshold." Holthausen, Larcker, and Sloan (1995) find results similar to Gaver, Gaver, and Austin. Specifically, Holthausen, Larcker, and Sloan observe that managers manipulate earnings down when earnings are above the upper bound of the bonus, but they find no evidence of earnings manipulation when earnings are below the "bonus threshold."

Our study provides an analysis of insurer executive compensation and its association with loss reserve estimation errors. We investigate the impact of compensation schemes, such as salary changes, bonuses, restricted stock, exercised options, options awarded, and long-term incentive plans, on both the magnitude and direction of insurers' reserving errors.

HYPOTHESES AND MODELS

Gaver, Gaver, and Austin (1995), Holthausen, Larcker, and Sloan (1995), and Healy (1985) all indicate some level of manipulation of reported earnings by managers through the use of discretionary accounting practices. Presumably, this manipulation is ultimately done in order to maximize managers' total utility. While benefits of tax and regulatory avoidance certainly indirectly accrue to managers, earnings manipulation also affects managers' incentive-based compensation where the benefits accrue directly to managers. Loss reserve estimation by insurance executives is one such discretionary practice. Therefore, *ceteris paribus*, we postulate that insurance executives who derive a larger portion of their total compensation from incentive-based compensation will have larger reserve estimation errors in the direction that optimizes their compensation.[3] There are several compensation components to consider, and related research indicates that each component does not necessarily induce the manager to act in a similar manner.[4]

We divide the discussion of the hypotheses into three parts. First, we consider managerial bonuses and long-term incentive plans because their structure can induce either over- or under-reserving by managers. Then, we discuss compensation elements, which induce only over-reserving by managers (stock options and restricted stock awards). Finally, we discuss compensation components, which induce only under-reserving by managers (option exercises).

Bonuses and Long-Term Incentive Plans

Bonuses and long-term incentive plans reward managers based on either the firm's current-year results (bonuses) or the firm's cumulative results over a number of

[3] Recently, Nam, Wang, and Zhang (2008) show that executives may also alter risk management policies "to manipulate signals they send to the public" (p. 807). Executives' incentives are related to their tenure. We control for the differing incentives of long- and short-tenured managers by averaging the compensation of firm executives each year.

[4] In a theoretical examination of executive compensation and corporate decision making, Han and MacMinn (2006) highlight that different compensation components such as bonuses, restricted stock, and stock options may provide different incentives for managers. Further, they suggest that these differences are not typically considered in the empirical literature.

consecutive years (long-term incentive plans). The earnings management incentives created by these compensation components are not as straightforward as some other components. Specifically, Healy (1985), Gaver, Gaver, and Austin (1995), and Holthausen, Larcker, and Sloan (1995) indicate managers may have incentives to make both earnings-increasing as well as earnings-decreasing decisions based on the structure of a bonus plan. The payoff schemes of the bonuses investigated by these three sets of researchers resemble a generic "call spread."[5] Hence, the incentives of the managers to manipulate firm earnings depend on where earnings are relative to thresholds set in the bonus plans. A manager is shown to have an incentive to implement earnings-decreasing practices if the earnings are above an established upper bound (Healy, 1985; Gaver, Gaver, and Austin, 1995; Holthausen, Larcker, and Sloan, 1995) or if the earnings are well below the threshold where the manager could receive some performance based compensation (Healy, 1985). Alternatively, managers are shown to implement earnings-increasing policies if the firm's earnings are in the range where increased earnings could lead to increased compensation (Healy, 1985; Gaver, Gaver, and Austin, 1995; Holthausen, Larcker, and Sloan, 1995).

In our sample, executives are awarded two types of executive bonus plans. The most common bonus plan, which we simply refer to as a "bonus plan," is similar to those studied by Holthausen, Larcker, and Sloan (1995) and Healy (1985). The executives in our sample are also given bonuses termed "long-term incentive plans." These plans are essentially bonuses paid in 1 year based upon performance from prior years. Following the logic of the earnings manipulation research discussed above, managers may have incentives to either over- or under-reserve, depending on where the firm's performance falls relative to the structure of the bonus plan. For example, managers would have an incentive to under-reserve losses if operating between the bonus threshold and upper limit of the bonus, should such a limit exist. Managers with long-term incentive plans have the same motivations with a bias toward under-reserving losses incurred in the last performance year covered by the incentive plan. Here, a manager may have an incentive to "catch up" in the last performance year covered by the long-term plans.

Not all of our sample data provide sufficient detail regarding the structure of the executive bonus plans (or long-term incentive plans) in order for us to make absolute predictions on the effects these plans may have on loss reserving practices.[6] Due to

[5] That is, the payoff of the bonus is flat (presumably zero) until the first strike price (bonus threshold) is reached. The payoff then increases (though not necessarily in a linear fashion) until the second strike price (the upper bound of the bonus) is reached, at which point the payoff of the bonus again flattens.

[6] Upon reviewing proxy statements for firms in our sample, 74 percent of the sample firms provide information on the structure of bonus payments made to executives. Of these, 56 percent of our (available) sample contain bonus plans with upper bounds while 44 percent indicate the firm's bonus plan does not contain an upper bound. The bounded bonus schemes are exactly the same as the schemes studied in Healy (1985), Gaver, Gaver, and Austin (1995), and Holthausen, Larcker, and Sloan (1995). In these bonus schemes, there exists a lower and upper bound of earnings between which managers are rewarded a bonus and outside of which the bonus is either not paid or capped.

the small sample that contains the exact nature of bonus contracts, we employ an alternative approach to our analysis. We proxy executives' incentives for opportunistic reporting to maximize their bonus payments based on their firm's current-year performance. Specifically, we consider a firm's annual percentage change in net income relative to the property/casualty industry median for our sample period. We categorize a sample firm's annual performance in 1 year relative to this median value as poor, adequate, or good.[7] We then interact this performance indicator variable with the executives' bonus plan payment.[8] For example, executives for an insurer who had a poor year have an incentive to over-reserve in anticipation of not receiving a bonus for that year (although they may still receive a bonus). For an insurer who has an adequate year, its executives may under-reserve in order to maximize their bonus for that year. And for an insurer who has a good year, its executives may again over-reserve since their bonus payment is already likely to have been maximized.[9] This leads to the following three related hypotheses:

H1(a): *Conditional on receiving income from a bonus plan or long-term incentive plan, managers who have exhausted compensation from these plans in period t (as proxied by good firm performance) will have an incentive to make earnings-decreasing reserving decisions and will therefore over-reserve losses incurred in period t.*

H1(b): *Conditional on receiving income from a bonus plan or long-term incentive plan, managers who have not reached their plan limit in period t (as proxied by adequate firm performance) will have an incentive to make earnings-increasing reserving decisions and will therefore under-reserve losses incurred in period t.*

H1(c): *Conditional on receiving income from a bonus plan or long-term incentive plan, managers who anticipate little or no compensation from these plans in period t (as proxied by poor firm performance) will have an incentive to make earnings-decreasing reserving decisions and will therefore over-reserve losses incurred in period t.*

Over-Reserving Inducing Compensation Components

Several observable compensation items can be characterized as long-term incentive schemes. Awarding stock options and restricted stock is intended to align the long-term incentives of the executive and company. The "value" of these securities is not obtained during the year in which they are awarded but rather will be ultimately realized in the future, contingent on the overall value of the firm at that time. Hence, these compensation variables should provide motivation for managers to over-reserve for losses in the current year. Over-reserving creates the perception that the insurer is safe (i.e., has more surplus) and allows future results, such as lower realized losses than expected, to have a positive impact on the firm's value in subsequent years. This leads to our second testable hypothesis:

[7] The median annual percentage change in net income for the property/casualty industry for this period was 7.65 percent. A sample firm's annual performance in 1 year is categorized as poor, adequate, or good if annual percentage change in net income is less than 7 percent, between 7 and 8 percent, or greater than 8 percent, respectively.

[8] We do not interact the performance indicator variable with the long-term incentive plan payment because our data do not indicate which year(s) are considered in that payment.

[9] We thank an associate editor for this suggested approximation method.

H2: *Firms whose managers have larger proportions of stock options awarded and restricted stock awarded as compensation components relative to their total compensation in period t are more likely to over-reserve for losses in period t in order to shift firm value into period t + n when this long-term compensation is realized.*

Under-Reserving Inducing Compensation Components

Several observable compensation items can be characterized as short-term incentive schemes. Options exercised by executives are by definition "in the money" and are therefore in the range where Healy (1985), Gaver, Gaver, and Austin (1995), and Holthausen, Larcker, and Sloan (1995) would suggest earnings-increasing discretionary behavior occurs. Moreover, these generic options are presumably straight call options with no upper bounds (unlike the bonus schemes discussed above that resemble call spreads), which provide incentives for solely earnings-increasing discretionary behavior.

Managers who can transform positive short-term results into higher salaries in the following years (through merit-based raises) also have an incentive to increase current earnings. Thus, we expect managers of insurers to make earnings-increasing reserve errors, i.e., under-reserve, when exercising call options or anticipating an increase in salary. This leads to our *anticipation hypothesis*, *H3*, formally stated as:

H3: *Firms whose managers derive a larger portion of total compensation from the exercising of options in period t or have higher proportional increases in salary from period t to t + 1 have more incentive to under-reserve losses incurred in period t.*

Hypothesis Testing

To test *H1*, *H2*, and *H3*, we employ the following model:

$$\begin{aligned} RE_{i,t} = {} & \beta_0 + \beta_1 LNASSETS_{i,t} + \beta_2 NETINCOME_{i,t} + \beta_3 LONGTAIL_{i,t} \\ & + \beta_4 RSTKHELD_{i,t} + \beta_5 BONUSPOOR_{i,t} + \beta_6 BONUSADEQUATE_{i,t} \\ & + \beta_7 BONUSGOOD_{i,t} + \beta_8 LTPAY_{i,t} + \beta_9 RSTKAW_{i,t} + \beta_{10} STKOPAW_{i,t} \\ & + \beta_{11} SALCH_{i,t} + \beta_{12} STKOPEX_{i,t} + \nu_i + \varepsilon_{i,t}, \end{aligned} \tag{1}$$

where i represents the individual insurers; t represents the year (1992 to 2000); $RE_{i,t}$ represents the reserve estimation error associated with reserves reported for firm i in year t; *LNASSETS* is the natural log of firm assets; *NETINCOME* is the net income of the firm; *LONGTAIL* is the proportion of business written in long-tailed lines; *RSTKHELD* is the ratio of the value of restricted stock held to total executive compensation; *BONUSPOOR* is the percent of total executive compensation received in the form of a bonus for firms whose annual percentage change in net income is below 7 percent; *BONUSADEQUATE* is the percent of total executive compensation received in the form of a bonus for firms whose annual percentage change in net income is between 7 and 8 percent; *BONUSGOOD* is the percent of total executive compensation received in the form of a bonus for firms whose annual percentage change in net income is above 8 percent; *LTPAY* is the percent of total executive compensation received from long-term incentive plan payouts; *RSTKAW* is the percent of total

executive compensation received in restricted stock awarded; *STKOPAW* is the percent of total executive compensation received in options awarded; *SALCH* is the ratio of the forthcoming 1-year change (year t to year $t + 1$) in executive salary relative to total executive compensation for year t; *STKOPEX* is the percent of total executive compensation received in options exercised; ν_i is the company-specific error; and $\varepsilon_{i,t}$ is the random error.[10]

A negative (positive) coefficient of an independent variable in (1) indicates that an increase in that variable is associated with over-reserving (under-reserving). For example, if a long-term incentive compensation variable is found to have a negative coefficient, it implies that the larger the proportional compensation in this long-term component, the larger the initial loss reserve relative to the developed loss reserve. *H2* predicts the coefficients of *RSTKAW* and *STKOPAW* to be negative. Finding a significant coefficient of any of the interacted *BONUS* variables or *LTPAY* is consistent with managers impacting reserving practices in response to these compensation items. More specifically, finding a negative coefficient of *LTPAY* or *BONUSGOOD* (*BONUSPOOR*) is evidence in support of *H1(a)* (*H1(c)*). Conversely, a positive coefficient on *LTPAY* or *BONUSADEQUATE* supports the acceptance of *H1(b)*. Because our data include compensation from long-term incentive plans in the current year based upon performance in the current as well as prior years, we expect a bias toward finding support for *H1(b)* with respect to long-term incentive plans. *H3* predicts the coefficients of *SALCH* and *STKOPEX* to be positive. That is, the larger the value of options exercised by managers relative to their total compensation or the larger their subsequent salary increase, the smaller the initial loss reserve relative to the developed reserve (i.e., incurred losses are initially under-reserved).

We include the value of restricted stock held (*RSTKHELD*) as a control variable, as it presents additional incentives for executives. *RSTKHELD* represents restricted stock currently owned by the executives that may be sold or held at their discretion, so long as the restricted stock conditions have been satisfied. The incentives of executives to manipulate earnings will be determined by their holding period preferences. Executives who prefer to continue holding the restricted stock will be more inclined to undertake earnings-decreasing decisions in an effort to shift positive results to future periods when the restricted stock will be sold. Conversely, executives who prefer to liquidate in the short run are expected to make earnings-increasing decisions in order to maximize the current value of the firm, and therefore their restricted stock (so long as the restricted stock conditions allow). A negative coefficient on *RSTKHELD* suggests that the restricted stock is inducing over-reserving, while a positive coefficient suggests that the restricted stock is inducing under-reserving.

[10] The loss reserve estimation error in year t is the developed loss reserve in year $t + n$ for losses incurred in year t and earlier less the original loss reserve estimate in year t for losses incurred in year t and earlier. In order to control for variation in insurer size and to reflect the loss reserve estimation error as a percentage, this difference is scaled by two factors: (1) total admitted assets and (2) the 5-year developed reserve. We utilize a 5-year development period ($n = 5$). This follows the loss reserve estimation error methodology utilized by Petroni (1992) and Gaver and Paterson (2004).

We further proxy for insurer size (*LNASSETS*) and business mix (*LONGTAIL*) as prior research has shown them to affect reserve estimation error (business mix is significant in Aiuppa and Trieschmann, 1987; Petroni, 1992; size is also significant in Aiuppa and Trieschmann, but not Petroni or Weiss, 1985). *NETINCOME* is used to proxy an insurer's tax liability. Related literature suggests that an insurer may manipulate loss reserves in an effort to minimize current tax liability; hence, we would expect to see an overstatement of reserves for those firms with higher levels of net income. A negative coefficient on *NETINCOME* would reflect such over-reserving. Finally, according to Grace and Leverty (2005) it is possible that these control variables used are not significantly related to reserve errors. Our article can therefore be considered as a further test of the recent results reported by Grace and Leverty. Table 1 offers a summary of the compensation variables examined, their predicted effects on loss reserving, and their associated hypotheses.

DATA AND DESCRIPTIVE STATISTICS

Data for our research come from Form 10-K that publicly traded companies file with the U.S. Securities and Exchange Commission, annual statutory statements filed with the National Association of Insurance Commissioners (NAIC) from 1992 to 2005, and Compustat North America's Executive Compensation (ExecuComp) data available from 1992 to 2000. Form 10-K and ExecuComp provide detailed compensation data on insurance executives while annual NAIC financial statements provide necessary insurer accounting information. Our initial sample of 4,297 executive-year compensation observations reduces to 348 insurer-year observations for 5-year loss reserve error estimations for the following reasons.[11]

First, ExecuComp reports individual annual compensation figures for executive officers while the NAIC reports firm specific as well as consolidated information for insurers who are often composed of multiple insurance companies.[12] Since executive officers represent an entire insurance group (i.e., the publicly traded entity), we utilize consolidated data for each insurance group based on the aggregation of individual insurers within each group.[13] We also cannot make distinctions between which executive(s) were the driving force behind the reserving practices. However, we can rationally assume the executives of each insurance group as a whole were influential in the reserving practices of their respective group as they ultimately agreed to report these reserve amounts. Therefore, we aggregate and average compensation data for

[11] Compensation for 1 year for one executive is defined to be one executive-year compensation observation. Accounting information for 1 year for one insurer is defined to be one insurer-year observation.

[12] For example, in 1992 the Allstate Insurance Group consisted of 11 individual insurance companies. The NAIC reports financial information for each of these 11 companies as well as consolidated information for the entire group.

[13] Some insurer groups do not provide consolidated data for their group to the NAIC and in some cases insurer groups report multiple consolidations for the same group. Hence, we create consolidated data for each insurer group. Our resulting aggregated insurer group data are consistent with those insurers who do report consolidated financial information to the NAIC.

TABLE 1
Model Prediction Summary

Variable	Definition	Predicted Effect on Reserving	Predicted Sign	Associated Hypothesis
Bonus * poor firm performance (*BONUSPOOR*)	Value of current-year performance bonus if firm performance was less than 7%	Over-reserving (Earnings decreasing)	−	*H1(a)*
Bonus * adequate firm performance (*BONUSADEQUATE*)	Value of current-year performance bonus if firm performance was between 7% and 8%	Under-reserving (Earnings increasing)	+	*H1(b)*
Bonus * good firm performance (*BONUSGOOD*)	Value of current-year performance bonus if firm performance was more than 8%	Over-reserving (Earnings decreasing)	−	*H1(c)*
Long-term incentive pay (*LTPAY*)	Value of bonus from long-term incentive plans received in current year	No clear effect	+/−	*H1(a)(b)(c)*
Restricted stock awarded (*RSTKAW*)	Value of restricted stock awarded during the current year	Over-reserving (Earnings decreasing)	−	*H2*
Stock options awarded (*STKOPAW*)	Value of stock options awarded during the current year	Over-reserving (Earnings decreasing)	−	*H2*
Salary (*SALCH*)	Salary change as percent of total compensation for current year	Under-reserving (Earnings increasing)	+	*H3*
Stock options exercised (*STKOPEX*)	Value of stock options exercised during the current year	Under-reserving (Earnings increasing)	+	*H3*

the executives of each insurance group whose compensation data are available. The average number of executive officers per insurance group was just under six for our sample. Also, using executive-year observations would bias our results toward firms with more executives.

Second, our calculation of 5-year loss reserve estimation errors for insurers does not allow us to use data beyond the year 2000. As mentioned, we follow methodology consistent with Petroni (1992) and Gaver and Paterson (2004). A 5-year loss reserve estimation error is the 5-year developed reserve less the original reserve, which was reported 5 years prior. We are able to determine 5-year loss reserve estimation errors for the years 1992 through 2000 only. For example, the 1997 developed loss reserve data are needed to calculate 1992 loss reserve errors and the 2005 developed loss reserve data are needed to calculate 2000 loss reserve errors.

Finally, we limit our initial sample to publicly held property–casualty insurance companies that are domiciled in the United States. Life and health insurers are excluded as managers of these insurers have much less discretion in establishing reserves because a larger portion of their reserves are based upon well-established and well-publicized actuarial tables (see Petroni, 1992). Also, the reserve development for life insurers is not reported to the NAIC, making the observation of loss reserve errors more difficult. ExecuComp provides data on publicly held U.S. and Canadian firms; however, Canadian insurers are excluded from our sample since foreign regulation may effect their behavior. Mutual insurers are excluded from our sample, which contributes to the relatively low number of insurer groups, for two reasons. Mutual insurers do not have stock or stock options to offer their executives. Further, incentive compensation data from mutual insurers (and privately held stock insurers) are self-reported to the NAIC and therefore incomplete. The exclusion of mutual insurers should not be of significant concern since their executive compensation packages are not completely comparable with those of stock insurers, and including mutuals with stocks could lead to biased results.[14] Moreover, Ke, Petroni, and Safieddine (1999) show that more widely held insurance firms are more likely to base their executive compensation packages on objective accounting measures.

The aggregation of executives' compensation data, the utilization of consolidated publicly held stock insurer data, and the data limitations created by our 5-year loss reserve error calculation methodology combine to yield a sample of 348 insurer-year observations based on 63 publicly traded property–casualty insurers.[15]

[14] Analysis of loss reserve estimation error and executive compensation structure may be done on both mutual and stock firms but in separate models with separate hypotheses. Here, we attempt to address half of this analysis (the stock half) and leave the analysis of mutual insurers to future studies that contain more complete executive compensation data for mutual insurers as well as privately held stock insurers.

[15] The resulting sample reflects a relatively large portion of the U.S. property–casualty industry and reflects an even larger relative portion of property–casualty stock insurers, which is the only organizational form of interest to us. For example, in 1999 stock insurers accounted for about 67 percent of the entire property–casualty industry's net premiums written. Net premiums written by our sample of insurers represent approximately 59 percent of all stock insurers, or 39 percent of the entire industry's net premiums written in 1999. These percentages are consistent throughout the years of our sample data.

TABLE 2
Descriptive Statistics

	Mean	Median	Std. Dev.	Min.	Max.
Insurer accounting variables					
5-year reserve error scaled by admitted assets (000) (*RE*)	0.0092	−0.0024	0.0840	−0.1307	0.8424
Admitted assets (000,000,000)	9.004	2.460	14.880	0.006	85.679
Net income (000,000)	318.640	84.546	604.075	−1057.088	4,123.825
Concentration in longer-tailed lines of business (*LONGTAIL*)	0.5000	0.6456	0.3247	−0.0114	1.0087
Compensation variables					
Average total compensation (*TOTALCOMP*) (000,000)	1.710	1.147	1.830	0.177	13.357
Annual salary change (*SALCH*)	0.2040	0.0862	0.5824	−0.2677	7.3802
Average bonus awarded as a percent of average total compensation (*BONUS*)	0.1991	0.1968	0.1276	0.0000	0.7235
Average long-term incentive pay awarded as a percent of average total compensation (*LTPAY*)	0.0446	0.0000	0.1026	0.0000	0.6936
Average value of restricted stock awarded as a percent of average total compensation (*RSTKAW*)	0.0494	0.0000	0.0984	0.0000	0.8268
Average value of restricted stock held as a percent of average total compensation (*RSTKHELD*)	0.2387	0.0000	0.5002	0.0000	5.1662
Average value of stock options awarded as a percent of average total compensation (*STKOPAW*)	0.2768	0.2461	0.2083	0.0000	0.8730
Average value of stock options exercised as a percent of average total compensation (*STKOPEX*)	0.3168	0.0336	1.6070	0.0000	28.9804

Notes: Obs. = 348. The sample consists of cross-sectional data from 1992 through 2000.

Table 2 displays descriptive statistics for our cross-sectional sample of 348 insurer-year observations. The insurance literature has primarily used two loss reserve error scaling factors: total assets and developed reserves. We focus our analysis on the former and divide the 5-year loss reserve error by admitted assets (*RE*). It is important to note that the literature has yet to settle on which scaling factor is most appropriate. To

our knowledge, only Grace and Leverty (2005) have shown any difference in results based on the scaling procedure.[16]

The average magnitude of *RE* is 0.92 percent. The majority of the sample over-reserves losses as the median error is −0.24 percent.[17] In our sample, less than 47 percent of the reserve estimation errors were under-reserving errors. In other words, the insurers tended to over-reserve their incurred losses almost 53 percent of the time. The largest 5-year over-reserving error is by 13.07 percent while the largest 5-year under-reserving error is 84.24 percent.

The average value of total admitted assets is just over $9 billion and the average value of net income is approximately $319 million. These numbers reflect the bias toward large insurers in our sample. The smallest insurer in the sample has assets valued at $6 million. The variable *LONGTAIL* proxies an insurer's product mix, specifically reflecting concentration in longer-tailed lines of business. *LONGTAIL* is computed as the ratio of the sum of an insurer's net premiums written in the following lines of business to its aggregate net premiums written: farm multiperil, homeowners' multiperil, commercial multiperil, medical malpractice, workers' compensation, products liability, automobile liability, and "other" liability.[18] In our sample, this ratio is 50 percent on average with a median value of almost 65 percent. The compensation component variables *BONUS*, *LTPAY*, *RSTKAW*, *STKOPAW*, and *STKOPEX* are ratios relative to the annual average total compensation (ATC) of all the executives of an insurer. Annual total compensation is composed of the following: salary, bonuses, total value of restricted stock awarded, total value of stock options awarded (using

[16] Petroni (1992) and Beaver, McNichols, and Nelson (2003) scale by assets but report that their results are not sensitive to the choice of the scaling variable. Gaver and Paterson (2004) primarily scale by the developed reserve. Grace and Leverty (2005) also primarily scale by assets but do find their results to be sensitive to the scaling variable. We conducted our analysis using both scalars and found our results to be generally consistent across the two scalars. Hence, we report results for the admitted assets scalar and footnote differences in results using the other scalar.

[17] The size and direction of the loss reserve errors of our sample are consistent with those estimated by Petroni (1992) when she scaled by admitted assets. Her sample considered property–casualty insurers from 1979 to 1983 and found mean and median loss reserve estimation errors of 2.1 percent and −0.2 percent, respectively. Similarly, our sample loss reserve errors when scaled by developed reserve are consistent with those estimated by Gaver and Paterson (2004) when they scaled by developed reserves. They examined property–casualty insurers from 1988 to 1993 and found an average overstatement of reserves by 2.75 percent while our sample yielded an average overstatement of reserves by 5.27 percent. However, in the latter years of their sample, over-reserving averaged 5.70 percent in 1992 and 6.04 percent in 1993.

[18] Our definition of long tail lines is consistent with other research (see Berger et al., 2000; Grace and Leverty 2005; Hoyt and McCullough, 2005). We estimate our models using alternative long tail lines specifications, including one that removes farmowners' multiperil, homeowners' multiperil, workers' compensation, and automobile liability, and we also use a measure similar to Petroni and Beasley (1996). Our results are robust to these alternative definitions of long tail lines.

Black–Scholes), long-term incentive payouts, and other perquisites such as signing bonuses, 401(k) contributions, debt forgiveness, severance payments, insurance premiums, and payment for unused vacation. Executives' mean ATC for our sample is $1.71 million with a median value of $1.15 million. ATC for executives ranged from roughly $177,000 to $13.36 million. The average 1-year change in salary for the executives (SALCH) was just over a 20 percent increase; however, this average is skewed by a few large raises. The median 1-year salary change was approximately an 8.6 percent increase. The mean and median value of annual bonuses earned by executives (*BONUS*) relative to their ATC is approximately 20 percent. Similarly, proportions relative to ATC for annual long-term incentive payouts, *LTPAY*, and for the value of restricted stock awarded in a year, *RSTKAW*, yield average ratios of 4.5 percent and 4.9 percent, respectively. *STKOPAW* reflects the value of stock options awarded during the year relative to ATC. The mean value for this ratio is 27.7 percent with a median value of 24.6 percent, indicating that the majority of executives receive some level of compensation in options awarded.[19] The variable *STKOPEX* measures the net value of stock options exercised during the year relative to ATC. On average, executives who exercise their options receive payouts as large as one-third the amount of their ATC. Finally, *RSTKHELD* represents the ratio of restricted stock held to total annual compensation. On average, executives held restricted stock worth approximately 23.8 percent of their total annual compensation.

HYPOTHESES TESTS AND RESULTS

Table 3 shows the results for Model (1). We test *H1*, *H2*, and *H3* using fixed effects regressions to approximate the model given in Equation (1).[20] We estimate our model using the loss reserve errors scaled by total assets, *RE*. Although scaled reserve errors help correct for size heterogeneity, the model also utilizes White's standard errors to correct for slight heteroskedasticity. The fixed effects regression results show support for several of the hypotheses.

The fixed effects regression model shown in Table 3 is overall statistically significant with an *R*-squared of 13.46 percent. Table 3 shows strong support for *H1(a)* and *H1(c)* as the coefficients of *BONUSGOOD* and *BONUSPOOR* are significant and negative in our model. Firms that performed either well or poorly relative to the industry, whose managers are compensated with larger proportions of bonuses, appear to over-reserve current losses. This is consistent with the behavior of managers who, if receiving a bonus, are operating in an earnings range above the upper limit of the bonus, which is proxied by the firm's superior performance. This is also consistent

[19] The magnitude of awarded options relative to bonus compensation in our sample suggests that both options and bonuses are commonly used to motivate executive behavior and both should be included when examining executive compensation incentives for publicly traded property–casualty insurers.

[20] Diagnostics indicate that ordinary least squares regression is not the appropriate estimation technique. The existence of a firm-specific error component indicates that the fixed effects model is the appropriate specification. Further, we did include indicator year variables to test for year effects. The coefficients of the year indicators were neither significantly different from one another nor jointly significant. Hence, these year indicators are omitted from the fixed effects model to maximize the degrees of freedom.

TABLE 3
Results From Fixed Effects Estimation of Equation (1)

Independent Variables	Predicted Sign	5-Year Reserve Error (RE_1) Coefficient	Standard Error† (*p*-value)
Intercept		0.1640	0.1734 (*0.345*)
Bonus ∗ poor firm performance (*BONUSPOOR*)	−	−0.1558**	0.0656 (*0.018*)
Bonus ∗ adequate firm performance (*BONUSADEQUATE*)	+	5.9593**	2.5919 (*0.022*)
Bonus ∗ good firm performance (*BONUSGOOD*)	−	−0.1372**	0.0534 (*0.011*)
Long-term incentive pay (*LTPAY*)	+/−	0.1224	0.0841 (*0.146*)
Restricted stock awarded (*RSTKAW*)	−	−0.0375	0.0546 (*0.492*)
Stock options awarded (*STKOPAW*)	−	0.0110	0.0269 (*0.682*)
Salary[a] (*SALCH*)	+	0.5753	2.2979 (*0.802*)
Stock options exercised (*STKOPEX*)	+	0.0021**	0.0009 (*0.022*)
Restricted stock held (*RSTKHELD*)	+/−	0.0292**	0.0147 (*0.047*)
Natural log of assets (*LNASSETS*)	+/−	−0.0018	0.0061 (*0.768*)
Concentration in longer-tailed lines (*LONGTAIL*)	+/−	−0.2145**	0.0854 (*0.013*)
Net income (*NETINCOME*)	+/−	1.86E-11*	1.00E-11 (0.064)
F-statistic		3.89***	n/a
R-squared		13.46%	n/a

Notes: Obs. = 348.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.
†White's standard errors.
[a]Salary represents annual salary change divided by total compensation.

with the behavior of managers who do not anticipate receiving a bonus as proxied by the firm's weak performance. These managers benefit from earnings-decreasing decisions (over-reserving) that shift earnings to future periods when additional bonus compensation can be realized. Table 3 also shows strong support for *H1(b)*, as the coefficient of *BONUSADEQUATE* is significant and positive. Here, under-reserving maximizes current bonus payments by increasing firm earnings. The nonbinding bonus payments are proxied by firms who have relatively average performance relative to the industry.

The coefficient on *LTPAY* is not significant. An explanation is that long-term incentive plans do not provide clear incentives for over- or under-reserving in a single year.[21] Likewise, neither of the coefficients on *RSTKAW* or *STKOPAW* are significant.[22] Thus, we find no support for *H2*. If the restricted stock and/or options are awarded at any time other than the absolute beginning of the current year, a manager may have an incentive to wait one period (or more) before manipulating reserves. This is particularly true if the options/stock cannot be immediately exercised or sold.

Evidence of managers under-stating reserve estimates in order to either maximize raises for the forthcoming year or maximize the value of the options they exercise over the current year (as predicted by *H3*) would be supported by positive and significant coefficients on *SALCH* and *STKOPEX*. Table 3 shows that the coefficient on the options exercised variable (*STKOPEX*) is significant and in the predicted positive direction.[23] This suggests that managers manipulate reserves to increase the current earnings of the firm and therefore the value of their "in the money" stock options. Recall that while *H2* and *H3* are not mutually exclusive, support for either *H2* or *H3* is nonetheless encouraging. The hypotheses predict either forward thinking managers (implied by *H2*) or managers interested in maximizing their current wealth (implied by *H3*). Thus far, our evidence shows support for managers maximizing their current wealth.

Table 3 also reports a positive and significant coefficient on the restricted stock held (*RSTKHELD*) control variable.[24] Managers holding more restricted stock tend to under-reserve losses in the current period. This earnings-increasing behavior is consistent with managers who may be anticipating selling their shares in the near future and therefore, wish to maximize the current value of the firm.

Model (1) also controls for insurers' product mix, financial leverage, and size. The coefficient of *LONGTAIL* is negative and significant. Hence, insurers with increasing business in longer tail lines are associated with over-reserving losses, which is inconsistent with findings of related literature (Petroni, 1992; Petroni and Beasley, 1996). The coefficient of our financial standing variable (*NETINCOME*) is also positive and significant. This is inconsistent with the notion of insurers managing reserves to minimize current tax liabilities but consistent with the inconsistencies in measuring tax manipulation incentives shown in Grace and Leverty (2005). The coefficient of our insurer size variable, the natural log of assets (*LNASSETS*), is insignificant. Since our sample is biased away from small insurers, and our dependent variable is scaled by total assets, it is not surprising that we find no significance.[25]

[21] The results for the bonus and long-term incentive plan components are unchanged when scaling the reserve error by the developed reserve.

[22] The coefficient of *RSTKAW* is negative and significant when the reserve errors are scaled by the developed reserve.

[23] The coefficient of *STOPEX* is not significant when the reserve errors are scaled by the developed reserve.

[24] The results for restricted stock held are consistent when scaling the reserve error by the developed reserve.

[25] We find a negative and significant relationship between assets and reserve errors when we scaled by developed reserves. This is consistent with prior findings of Aiuppa and Trieschmann (1987).

Finally, several diagnostics tests were performed. Variance inflation factors showed no evidence of collinearity among the independent variables. And, as mentioned above, there was some evidence of heteroskedasticity present; thus, White's standard errors were utilized in the model.

CONCLUSION

Until now, the literature regarding insurer loss estimation error has largely focused on whether managers of firms use reserve estimation to smooth taxes or avoid regulatory scrutiny. Prior research has predominantly ignored the personal incentives of managers to exercise discretion over reserving practices. We find that managers whose compensation packages are more bonus laden are associated with larger, directionally consistent loss reserve errors. Specifically, managers with bonuses expected to be exhausted or not paid tend to over-reserve for current-year incurred losses. This result is consistent regardless of the scaling of the reserve error. We also find that managers holding restricted stock tend to under-reserve current-year incurred losses. However, we find no relationship between the awarding of stock options, the awarding of restricted stock, or long-term incentive plans and reserve errors.

While our results are consistent with managers of stock insurers manipulating earnings based on their compensation incentives, further research is needed to determine the degree to which managers of mutual (and nonpublicly traded stock) insurers impact earnings to maximize their compensation. Analysis of a sample including detailed compensation data for both mutual and privately held stock firms, focusing on bonus plans, would be an ideal extension to this work. Second, we would like to obtain more specific information regarding the structure of the bonus plans. This would allow more rigorous testing of our hypotheses regarding the impact of bonuses on the behavior of managers.

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