Executive Stock Option Compensation and Reserve Errors in the Property and Casualty Insurance Industry

Abstract

Stock options create an incentive for managers of companies to maximize the value of their company's stock. Prior research has hypothesized that managers of insurers manipulate reserve levels to achieve organization goals, including minimization of taxes and income smoothing. The current study tests whether the awarding of stock options to insurance company executives is associated with the accuracy of reserve estimates. We test two competing hypotheses. The first hypothesis is that the granting of options to executives encourages under reserving. This would be the case if inflated earnings resulting from under reserving result in higher insurer stock valuations. The second hypothesis is that grants of options to executives result in more accurate reserving. Empirical support for this hypothesis would suggest the market valuations of insurers' stock take into consideration the perceived accuracy of financial disclosures and that valuations are higher for firms that report more accurate reserve estimates. Consequently, executives holding options will attempt to report reserve estimates as accurately as possible. Our empirical analyses support the hypothesis that insurers that award stock options estimate reserves more accurately than other insurers, other things equal.

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Section I: Introduction

Acknowledgements of accounting errors by publicly traded firms have in recent years led to significant restatements in earnings and sharp drops in the market valuations of some firms. In a handful of sensational cases, Enron and WorldCom being prime examples, criminal charges have been brought against senior executives following investigations into accounting irregularities. While some restatements receive extensive news coverage, others are made largely unnoticed.

Huron Consulting Group (HCG) reports that in 2003 there were 323 accounting restatements. This number is down slightly from 2002 when there were 330 restatements. The four industry groups with the greatest number of restatements were (1) manufacturing with 52, (2) finance, insurance, and real estate with 44, and (3) transportation, communications, electric, gas, and sanitary services with 42, and (4) software with 30. The most common reason for a restatement in 2003 was an error in accounting for reserves and contingencies. This explanation accounted for 17.5% of all restatements. While this area of accounting is complex and fraught with difficulty as estimation is required, the restatements reported in the HCG study do not involve merely changes in estimates. The restatements "*reflect flawed judgments due to oversight or misuse of facts, fraud, or a misapplication of GAAP*." [1]

Although errors in the estimation of an insurance company's loss reserves are not always due to misapplication of GAAP, fraud, or misuse of facts, the errors nonetheless affect the profits that are reported by insurance companies and the amount of tax owed. The effects of insurance company reserve errors on profitability and taxes have received considerable

[1] See http://www.huronconsultinggroup.com/general01.asp?id=593&relatedResourceID=547.

attention by business scholars. In a recent study, Diacon, Fenn, and O'Brien (2003) estimate that over the period 1991 – 1996 UK general insurers over reserved by 5.7% of their capital. They note that over reserving by British insurers over this time period has had the effect of reducing taxes and dividends. Studies of insurer reserve errors in the United States have similarly noted that reserve errors affect the income reported by companies and taxes. See, for instance, Grace (1990) and Petroni (1992, 1996).

When stock options are awarded as part of a compensation package, they may constitute a very significant value to executives, particularly when the underlying stock performs well. Many companies currently grant stock options to their top officers as part of executive compensation, along with salary and bonus. Long-term incentive compensation may include stock option rights, restricted stock grants, and cash payouts from long-term incentive plans. An option award represents the right to purchase company shares at a fixed price. As a matter of practice, virtually all stock options have a 10-year duration, and they generally vest over a 3-5 year period (Murphy and Zimmerman, 1993). Restricted stock awards endow executives with a fixed quantity of shares that have restrictions on resale or transfer. They also have a forfeiture clause invalidating the award if the executive leaves (voluntarily or involuntarily) before the restrictions lapse (Kole, 1997). In general, stock options can be exercised with considerable flexibility; in contrast, the redemption of restricted stock awards is subject to greater constraints. Hence stock options, rather than restricted stock awards, likely provide a more efficient incentive mechanism. In this study, we focus on stock options.

As noted by Hambly and Wendelken (2002), stock-based remuneration now comprises the most lucrative and fastest growing portion of CEO pay. As of the mid-1990s, one-third of total U.S. chief executive officers' compensation was in the form of stock option awards, up

from one-fifth during the 1980s. Chief executives in the S&P 500 tended to receive the most valuable option awards - with a median value of $2.7 million in 2001. An option's value rises as its underlining stock's market price increases. For CEOs receiving options, option awards alone can be as lucrative as salary and bonus combined. Often the options have no value if there is no appreciation in share price. Hence, many publicly traded companies and investors regard options as one of the best compensation devices for incentivizing a CEO to perform well, aligning an executive's interests to those of shareholders. Bryan, Hwang and Lilien (2000) found strong evidence of an increased ratio of the value of CEO stock-based compensation to cash compensation for CEOs of firms with abundant investment opportunities and for firms with volatile earnings relative to stock returns.

In the current study, we examine whether insurer reserve errors are related to whether or not a company awards stock options to its senior executives. There are two reasons to believe that such a relationship may exist.

First, stock options may create an incentive for executives to manipulate the earnings they report through their reserving practices. This may result in either over reserving or under reserving. Insurers may attempt to maximize their profits by over reserving to decrease their tax burden. Taxes would eventually need to be paid as the true value of losses emerged, but by over reserving insurers would delay their taxes, in essence creating a zero interest loan from the government. Similarly, executives may attempt to increase the value of stock options by under reserving and consequently reporting higher earnings.[2]

Second, stock options may provide an incentive to insurance company executives to estimate and report their reserves as accurately as possible. Financial markets may reward

[2] See Erickson, Hanlon and Maydew (2004) for a discussion of the literature and anecdotal evidence linking option based compensation with accounting fraud.

companies that more accurately report their financial results with higher share prices per dollar of earnings. Stock price valuations are based on estimates of future earnings. Companies with a history of reporting accurate financial information to investors may be rewarded with higher valuations per dollar of estimated future earnings, other things equal, than firms that have been less accurate.

Whether stock options are more likely to induce executives to make reserve errors to manage earnings or encourage executives to be accurate in their reserve estimates is the focus of this study. In Section II we review the prior literature on loss reserve errors. Section III reports our data sources, methodology, and empirical results. In Section IV we discuss our empirical results. Section V concludes the paper with a summary of our findings and suggestions for future research.

Section II: Management of Loss Reserves

Scholars have noted that there are a number of different reasons why insurers may want to make errors in establishing their loss reserves. These reasons largely center on the perceived benefits of earnings management.

The literature on reserve errors is exhaustive. Skurnik (1973), Peterson (1981), and Salzmann (1984) discuss methods of estimating reserves. Salzmann also describes the effects of various estimation techniques on the reserve estimates reported. However, their studies primarily concentrated on reserving techniques, and made little effort to explain the effects of errors. Forbes (1969, 1970) discusses the impact of reserve errors on financial statements, and studied the regulation of loss reserving.

Anderson (1973) analyzes the effects of reserve errors on policyholders' surplus. He finds that reserve errors may stabilize underwriting income. Balcarek (1975) and Ansley (1979)

relate inadequate loss reserving to dismal underwriting experience in the 1970s. Ansley hypothesizes that inflation was one of the major reasons for inadequate reserves in the 1970s.

Smith (1980) develops the investigation of reserve errors by testing whether insurers manage loss reserves to smooth underwriting results. His study of a sample of property-liability insurers in the auto liability insurance business shows that the incidence of underestimating and overestimating reserves was not random over the time period of his study. Weiss (1985) further relates reserve errors to unanticipated inflation and illustrates that reserve errors can stabilize earnings reported to regulators and investors.

Grace (1990) develops a general theory of reserving errors and examines the reserve errors of property-liability insurers from 1966 to 1979. She finds that reserving errors aided in the reduction of tax bills.[3] She also finds, consistent with theory, that reserve errors resulted in smoothing of earnings volatility. She indicates that income smoothing may result in higher financial market valuation of an insurer's equity. Beaver, McNichols, and Nelson (2003) provide empirical support that earnings management occurs. Comparing property and casualty insurers that report small positive earnings with those reporting small negative earnings, they find that the former understate reserves to a greater degree.

Petroni (1992) tests whether insurers that are financially weak underestimate their reserves to a greater extent than other insurers, other things equal. The results of her empirical analysis are consistent with this hypothesis. Further, she finds evidence that insurers "close" to receiving regulatory review underestimate their reserves considerably. She defines an insurer as "close" to receiving regulatory review if it would have received review had it posted reserves that were 5% greater than reported. Her findings suggest that financially troubled

[3] Gaver and Paterson (1999) also find tax implications are associated with reserving practices.

insurers under reserve in order to avoid detection by regulatory authorities.

The weight of the above mentioned research on reserve errors suggests that reserve errors are not completely random, but rather are consistent with organizational goals including tax minimization, avoidance of insolvency detection by regulatory authorities, and income smoothing. While this research suggests that management manipulation of reserves may help achieve insurer goals, including maximization of the equity value of the insurer through income smoothing, the possibility exists that the financial markets punish firms with a history of systematic reserve errors by discounting the value of their stock. Anthony and Petroni (1997) test the effects of reserve errors on the value of publicly traded insurance company stocks. They find evidence financial markets provide smaller earnings response coefficients to insurers with more variable reserve estimation error than to insurers with less variation in their estimation error. In a related study, Petroni, Ryan, and Wahlen (2000) distinguish between discretionary and non-discretionary revisions in loss reserve estimates. They define revisions as non-discretionary if, "they unbiasedly reflect new information about claims." Discretionary revisions are those that, "revise bias in initial loss reserve estimates." They hypothesize and report empirical support for a negative relationship between discretionary revisions and stock valuation.

Section III: Methodology and Data

Insurers that offer stock options to executives may deliberately create under reserving errors to inflate reported earnings in an attempt to increase the market value of company stock, and consequently increase the value of stock options held by executives. While pay plans created to provide incentives to executives to maximize profits may include many different components besides options – for instance, bonuses and long-term incentive payouts - research

indicates that executives' stock options are more strongly associated with the incentive to misreport than alternative forms of compensation (see, for instance, Burns and Kedia, 2004). The incentive for such behavior may be stronger when a greater percentage of total compensation is allocated to stock options, which we consider in our empirical analyses.[4] A counter argument, as indicated above, is that executives holding stock options may be more likely to estimate and report reserves as accurately as possible in an effort to maximize the long term value of their options. Therefore, there are two conflicting hypotheses:

Hypothesis one: *Insurers that offer stock options and insurers that allocate a greater percentage of executive compensation in the form of stock options have greater reserve errors than their counterparts.*

Hypothesis two: *Insurers that offer stock options and insurers that allocate a greater percentage of executive compensation in the form of stock options have smaller reserve errors than their counterparts.*

To test our hypotheses we make use of information from the Security and Exchange Commission (SEC) filings on options granted to senior executives of publicly traded insurers. The SEC provides on-line filings of publicly traded companies, including annual reports and other definitive proxy reports (Form DEF 14A). Since 1992 the SEC has required companies to disclose compensation information on executive's earning $100,000 or more per year. This information includes the salaries and bonuses paid to executives. It also includes information on awards of stock options, restricted stock, and long-term incentive plan "payouts" for each executive. These data are reported in the DEF 14A form filed annually by companies with the SEC. We obtained stock options data on all stock companies under Standard Industrial

[4] Efendi, Srivastava, and Swanson (2005) report evidence that firms in which executive exercised a higher dollar value of options were more likely to have an accounting restatement.

Classification (SIC) codes 6331, 6351 and 6361, namely *Fire, Marine and Casualty Insurance*, *Surety Insurance*, and *Title Insurance*.

Reserve errors and other company specific information used in our analyses are derived from the NAIC data set, except for the rating information which is obtained from Best's Key Rating Guide. The NAIC data set contains the information reported on insurers' annual statements that are submitted to state insurance departments. This information allows for the construction of the variable that measures insurers' reserve errors. Our sample includes property casualty insurers that reported positive values on assets and net premium written during the data period of our study, 1995 through 1998. Following Patroni (1992), companies that underwrote more than 25% of their business in surety, credit, accident and health, workers' compensation or reinsurance were not included in our sample. Our final full sample includes 4441 insurer-year observations.

The measure we use to estimate an insurer's reserve errors follows previous work. The size of a reserve error is defined as

$$Error_i = [Reset_{i,j} - Resdev_{i,\,j+5}].$$

$Reset_{i,j}$ is insurer i's estimate of loss reserves reported in year j. $Resdev_{i,\,j+5}$ is the developed claim costs at year $j+5$ by insurer i for loss reserves reported in year j. A positive (negative) value of $Error_i$ indicates insurer i has overstated (understated) reserve errors. An insurer's loss reserve in a given year is calculated by taking the difference between estimated incurred losses and cumulative paid losses in that year. Subtracting cumulative paid losses in a year from the revised estimates of incurred losses five years after the original valuation year gives us the developed claim costs. Previous studies have found that five years are sufficient to observe statistically significant reserve errors (see for example, Smith, 1980 and Kazenski et al,

1992). Following Grace (1990), two scales are applied to our reserve error variable. The first scale is net premium earned. The alternative scale is developed claim costs.[5] Appendix A lists the top ten companies with the greatest scaled reserve errors in each year of our study.

The primary interests of this study are the effects of granting stock options and the weight of stock options in executive compensation on reserve errors. Pooled cross-sectional and time-series regression models are used to test our hypotheses. The general forms of the empirical models used to test our hypotheses follow:

Equation 1:

$$\begin{aligned}\ln\left|ERROR_{i,t}\right| = \alpha + UNDER_{i,t}[&\beta_1 STOCKOPTION_{i,t} + \beta_2 GOODRATING_{i,t} + \\ &\beta_3 TAX_{i,t} + \beta_4 SMOOTH_{i,t} + \beta_5 LONGTAIL_{i,t} + \beta_6 UI_{i,t} \\ &+ \beta_7 MUTUAL_{i,t} + \beta_8 GROUP_{i,t}] + OVER_{i,t}[\beta_9 STOCKOPTION_{i,t} + \\ &\beta_{10} GOODRATING_{i,t} + \beta_{11} TAX_{i,t} + \beta_{12} SMOOTH_{i,t} \\ &+ \beta_{13} LONGTAIL_{i,t} + \beta_{14} UI_{i,t} + \beta_{15} MUTUAL_{i,t} + \beta_{16} GROUP_{i,t}] + u_{i,t}\end{aligned}$$

Equation 2:

$$\begin{aligned}\ln\left|ERROR_{i,t}\right| = \alpha + UNDER_{i,t}[&\beta_1 OPTIONRATIO_{i,t+1} + \beta_2 GOODRATING_{i,t} + \\ &\beta_3 TAX_{i,t} + \beta_4 SMOOTH_{i,t} + \beta_5 LONGTAIL_{i,t} + \beta_6 UI_{i,t} \\ &+ \beta_7 MUTUAL_{i,t} + \beta_8 GROUP_{i,t}] + OVER_{i,t}[\beta_9 OPTIONRATIO_{i,t+1} + \\ &\beta_{10} GOODRATING_{i,t} + \beta_{11} TAX_{i,t} + \beta_{12} SMOOTH_{i,t} \\ &+ \beta_{13} LONGTAIL_{i,t} + \beta_{14} UI_{i,t} + \beta_{15} MUTUAL_{i,t} + \beta_{16} GROUP_{i,t}] + u_{i,t}\end{aligned}$$

where *i* represents insurer *i*, *t* represents year *t* and,

[5] We also estimate alternative models using assets as the scale. The empirical results do not change the conclusion in meaningful ways.

ERROR	=	reserve error scaled by developed claim costs or net premium earned,
UNDER	=	1 if reserve error is negative, 0 otherwise;
STOCKOPTION	=	1 if insurer offers stock options to executives, 0 otherwise;
OPTIONRATIO	=	option values as a percentage of executive compensation;
GOODRATING	=	1 if receiving A or above rating from AM Best;
TAX	=	tax reduction incentive measured by $(UI_{i,t} + II_{i,t} + estimated\ reserve_{i,t}) / assets_{i,t}$ where *UI* = underwriting income and *II* = investment income;
SMOOTH	=	income smoothing incentive measured by $\sum_{j=t-3}^{t-1} (UI_{i,t} + II_{i,t}) / (3 \cdot assets_{i,t})$;
LONGTAIL	=	percentage of premiums written in long-tailed lines;
UI	=	unanticipated inflation measured by $(CPI_{t+3} - CPI_t) / CPI_t - T3Y_t$ where *T3Y* = Treasury yield over a three-year period;
MUTUAL	=	1 if insurer is a mutual company;
GROUP	=	1 if affiliated with a group, 0 otherwise; and,
OVER	=	1 if reserve error is positive, 0 otherwise.

Equation 1 tests the relationship between the **granting** of stock options and reserve errors. In contrast, Equation 2 tests the relationship between the **value** of stock options and reserve errors. We estimate two versions of each equation. In our models the dependent variable is the absolute value of the reserve error of insurer *i* in time period *t*. As mentioned earlier, two scales are applied to the reserve errors. In Models 1 and 2, ERROR1 denotes the reserve error scaled by net premium earned. In Models 3 and 4, ERROR2 denotes the reserve error scaled by developed claim costs. Models 2 and 4 are estimated with a sub-sample of the data which includes only those firms with realized option values in the following year.

In each model we interact dummy variables representing the direction of the reserve error with the factors we hypothesize are associated with the errors. The variable UNDER takes the value 1 if insurer i's reserve error during time period t is negative, and 0 otherwise. The variable OVER takes the value 1 if insurer i's reserve error during time period t is positive,

and 0 otherwise. Controlling for the direction of the reserve error allows us to identify not only the existence of a relationship between our independent variables and reserve errors, but also the direction of any such effect.

The dummy variable STOCKOPTION, which equals 1 if a company issues stock options to executives and 0 otherwise, is of primary interest in our first test equation. In two of our models, we interact this variable with categorical variables indicating whether a company's reserving error for a given year was an under reserving error or an over reserving error. Statistically significant relationships between these interacted variables and the dependent variables measuring reserve errors would be indicative of a relationship between the granting of stock options and reserving practices.

As mentioned above, we estimate the second test equation (Models 2 and 4) with a sub-sample that includes only firms that awarded stock options and for which there were realized positive values for options in the following year. The sub-sample includes 555 company-year observations. For each company we divided exercised option values by the other forms of compensation received by executives as a measure of the weight stock options have on executive compensation (OPTIONRATIO). To assess whether the value of stock options relative to other compensation received by executives is related to reserve errors, we regressed reserve errors on the OPTIONRATIO, using the sub-sample of firms in which executives exercised options in the subsequent year.[6]

Several explanations for reserve errors have been posited and tested in the academic literature. Financial distress of a company may contribute to manipulation of reserves. Petroni

[6] We anticipate that manipulations of claim reserves, if any, are likely to occur before stock options are exercised We also performed analyses using OPTIONRATIO from the current year. The empirical results from the alternative models are consistent with the results reported here.

(1992) found evidence that financially weak insurers tend to understate reserve, and such downward reporting of outstanding claims is greater for insurers that are close to receiving regulatory attention. Gaver's and Paterson's (2001, 2004) work is consistent with this hypothesis . We control financial strength of insurers by incorporating the ratings they receive from AM Best. A dummy variable 1 is assigned to insurers that receive AM Best ratings A or above (GOODRATING). We expect insurers with better ratings to have smaller reserve errors.

Grace (1990) developed a general theory of reserve errors based on the assumption that insurers seek to maximize profits. Her analysis found evidence that reserve errors are motivated by the desire of insurers to minimize taxes and to smooth income. Following Grace, we include a variable measuring an insurer's incentive to use reserve errors to reduce taxes (TAX). This variable is defined as the sum of underwriting income and investment income, plus the estimated reserve. The addition of the estimated reserve is due to the fact that insurer's reported underwriting income has included estimated reserves. Therefore, to reflect the insurer's income level before making reserve decisions we include this estimation. This TAX variable is standardized by an insurer's total assets. It is hypothesized that insurers with higher income, and therefore greater tax liability, will have greater overstated reserve errors.

Insurers also have incentives to adjust reserves to reduce their income variability (see, for example, Grace, 1990, Petroni et al., 2000, and Smith, 1980). Insurers with high earnings in the past are hypothesized to be more likely to smooth current income by under-reserving. Conversely, insurers with lower earnings in the past have an incentive to smooth current income by creating over-reserving errors. As in Grace (1990), we measure an insurer's past earnings by dividing the average of an insurer's underwriting income and investment income over the prior three years by its total assets (SMOOTH).

Previous studies have found that reserve errors correspond to insurers' inability to predict inflation associated with future loss payments. Ansley (1979), Weiss (1985), and Grace (1990) provided empirical evidence that reserve errors are related to unanticipated inflation. We measure unanticipated inflation (UI) as the difference between actual inflation and projected inflation. Actual inflation is calculated by $(CPI_{t+3} - CPI_t)/CPI_t$ where CPI_t represents the consumer price index for year t. The Treasury yield over a three year period is used as a proxy for projected inflation. A positive value of UI suggests that actual inflation is greater than projected inflation during the loss development period.

Insurers that write long-tailed lines are expected to have larger reserve errors, other things equal. It is more difficult to estimate long-tailed insurance claims and thus, greater reserve errors are more likely for long-tailed businesses. Petroni (1992) and Petroni and Beasley (1996) found that reserve revisions are greater for insurers with a greater percentage of business in malpractice insurance. A variable for an insurer's involvement in long-tailed lines of business, LONGTAIL, is included in the model. This variable is defined as the percentage of premium written in workers' compensation, general liability, and auto liability, to total premiums written.

Stock insurers experience market pressure to maximize shareholder value. For that reason, we anticipate that manipulation of reserves is more likely to occur with stock insurers than with mutual insurers. A dummy variable (MUTUAL), which is set equal to 1 if an insurer is a mutual company and 0 otherwise, is included in the empirical model to test whether stock companies and mutual companies have significant differences in their reserving behavior.

Finally, we control for group affiliation. Group affiliation (GROUP) is a dummy variable that equals one if the insurer belongs to an insurance group and 0 otherwise. Insurance

group members may have other ways of smoothing their financial statements than managing reserves and thus are expected to have smaller reserve errors than independent insurers.

Summary statistics for our data are reported in Table 1.

Insert Table 1 About Here

Pooled cross-sectional and time-series regression methods were used to estimate our models. The White test suggested that the variances of residuals across insurers were unequal in our models. Therefore, White's Heteroscedasticity-Consistent Estimators (HCE) were generated to correct for heteroscedasticity. To correct for serial correlation, we assume first-order autoregressive for the error structure where

$$u_{i,t} = \rho\, u_{i,t-1} + \varepsilon_{i,t}$$

The likelihood ratio test suggests that first-order autoregressive models are superior to other alternatives.[7]

Section IV: Empirical Results

For each of our two equations our empirical results are generally similar regardless of the different ways in which the reserve errors were scaled. Table 2 reports the empirical estimations of the four models.

Insert Table 2 About Here

The coefficients on STOCKOPTION are negative in both Models 1 and 3, although statistically significant at the five percent level only in Model 3. These results provide mixed support for the hypothesis that firms offering stock options have smaller understated reserve errors, other things equal. More strongly, the results suggest that firms that offer stock options

7 See Greene (1997) for further discussion.

do not inflate their earnings by under reserving, other things equal. Rather, our findings lend support to the hypothesis that firms offering stock options are more likely to report accurate reserves. Similarly, the coefficients on the STOCKOPTION variables in both Models 1 and 3 are negative and statistically significant at the one percent level for over reserving errors. This provides additional empirical support that insurers that offer stock options to their executives more accurately estimate their loss reserves.

The coefficients on the OPTIONRATIO variable in Models 2 and 4 are negative and statistically significant at the one percent level for under reserving errors. For over reserving, the coefficients are negative, but only significant in Model 4. The results suggest that when the value of exercised options in executive compensation relative to the total value of executive compensation is greater, the loss reserve estimates are more accurate. None of our models provide empirical support for the contention that compensating executives with options results in the reporting of artificially higher profits through the setting of arbitrarily low loss reserves.

In three of our models the financial ratings of the insurers are associated with the magnitude of reserve errors. The GOODRATING variables are negatively significant for over reserving errors in three of the four models, although insignificant at the five percent level for under reserving errors in all of the models. The results suggest that insurers with good AM Best ratings make smaller over reserve errors than firms with lower ratings, but are not more accurate with their under reserving errors.

The variable reflecting income smoothing incentives, SMOOTH, is negatively significant for under reserving errors in three of the four models, and negatively significant for over reserving errors in two of the models at the five percent level. The negative signs of SMOOTH for under reserving errors suggest that companies with higher income in the past

have smaller under reserving errors. Although this result may seem contrary to Grace's (1990) findings, one possible explanation is that companies with higher past earnings are under less pressure to demonstrate good financial performance by creating under-reserving errors.

Consistent with Grace (1990), we find evidence that insurers manipulate reserves for tax purposes. Our proxy for an insurer's incentive to manipulate reserves in order to minimize taxes, TAX, is positive and statistically significant for over reserving errors in three of the four models at the five percent level. In the fourth model, the variable is not significant. Further support for the influence of taxes on reserving practices is provided by the relationship between TAX and under reserving errors. In three of the models the relationship is negatively significant at the five percent level. This suggests that tax based incentives lead to less under reserving, other things equal.

Among the control variables, our results in two of the models are consistent with the hypothesis that insurers writing more long-tailed line business have greater reserve errors, in both over and under reserve directions. In the remaining two models the variable is insignificant. The coefficients on unanticipated inflation provide at best mixed support for the hypothesis that unanticipated inflation is associated with the establishment of reserves at an insufficient level. In two of the models unanticipated inflation is associated with decreased under reserving, while in one of the models it is associated with decreased over reserving.

In all models, both the MUTUAL and GROUP variables are negative and significant at the one percent level. These results very strongly suggest that organizational form is closely associated with reserving practices. Compared to stock companies, mutual insurers are more accurate in the establishment of their reported reserves, with both over reserving errors and under reserving errors being of less magnitude than those of stock insurers. Similarly, insurers

that are members of groups are more accurate with their reported reserves than insurers who are not members of groups.

Section V: Conclusion

In recent years, the awarding of stock options to corporate executives has been criticized by some as creating incentives for managers to engage in actions that will provide a short term boost in the company stock while damaging the long-term prospects of the organization. In the current study we examine the effects on loss reserving practices of awarding stock options to executives of property-liability insurers. We also investigate whether reserving practices are linked to the percent of executive compensation coming from the exercise of stock options. In contrast to the concerns raised by those opposed to the awarding of options as a form of management compensation, we find that stock option grants are associated with more accurate reserving practices. Prior research on reserving practices has found that reserve estimates are prone to management manipulation. Our research is consistent with the hypothesis that stock option grants encourage managers of insurers to maximize share value by reporting information to the financial markets as accurately as possible.

The current research does not distinguish among the different types of options grants that may be made. For instance, some insurers may award options that are in the money, while others may not. Further, some awards may be awarded fully vested, others may take several years to vest. The different conditions applicable to the awards may greatly influence management practices, including those related to establishing reserves. A careful analysis of the differences in the options that are awarded may indicate that some awards are more closely tied to accurate reserving than others.

Future research directed at understanding the relationship between unanticipated inflation and reserving is warranted. This is a particularly complex problem in part due to the difficulty of measuring unanticipated inflation.

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TABLE 1
Descriptive Statistics[†]

Variable	Mean	Std. Dev.	Minimum	Maximum
|ERROR1|	4.146	210.748	0.000	13982.080
|ERROR2|	0.122	2.782	0.000	185.029
STOCKOPTION	0.180	0.384	0.000	1.000
OPTIONRATIO	0.113	0.434	0.000	5.250
GOODRATING	0.740	0.439	0.000	1.000
TAX	1.557	4.781	-6.090	302.663
SMOOTH	0.036	0.149	-0.718	8.402
LONGTAIL	0.442	0.292	0.000	1.000
UI	-0.102	0.027	-0.139	-0.066
MUTUAL	0.262	0.440	0.000	1.000
GROUP	0.748	0.434	0.000	1.000

[†] Variable definitions are as follows:

ERROR1 = reserve error scaled by net premium earned,
ERROR2 = reserve error scaled by developed claim costs;
STOCKOPTION = 1 if insurer offers stock options to executives, 0 otherwise;
OPTIONRATIO = option value as a percentage of executive compensation;
GOODRATING = 1 if receiving A or above rating from AM Best;
TAX = tax reduction incentive measured by $(UI_{i,t} + II_{i,t} + estimated\ reserve_{i,t})/assets_{i,t}$ where UI = underwriting income and II = investment income;
SMOOTH = income smoothing incentive measured by $\sum_{j=t-3}^{t-1}(UI_{i,t} + II_{i,t})/(3 \cdot assets_{i,t})$;
LONGTAIL = percentage of premiums written in long-tailed lines;
UI = unanticipated inflation measured by $(CPI_t+3 - CPI_t)/ CPI_t - T3Y_t$ where T3Y = Treasury yield over a three-year period;
MUTUAL = 1 if insurer is a mutual company; and
GROUP = 1 if affiliated with a group, 0 otherwise.

TABLE 2
Empirical Results Using Heteroscedasticity-Consistent Estimators with AR(1) Error Structure[†]

	Dependent Variable = ERROR1		Dependent Variable = ERROR2	
Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Intercept	-2.078***	<0.001	-2.698***	<0.001
	(0.135)	(<0.001)	(0.147)	(<0.001)
UNDER* ***(Under Reserve)***				
STOCKOPTION	-0.267*		-0.268**	
	(0.150)		(0.130)	
OPTIONRATIO		-0.635***		-0.612***
		(0.189)		(0.181)
GOODRATING	-0.095	0.529	-0.216*	0.004
	(0.129)	(0.497)	(0.116)	(0.402)
TAX	0.034	-0.547**	-0.231***	-0.810***
	(0.068)	(0.256)	(0.056)	(0.244)
SMOOTH	-2.104**	-12.586***	-1.161	-10.694***
	(0.926)	(4.041)	(0.882)	(3.698)
LONGTAIL	1.240***	-0.027	0.802***	0.107
	(0.238)	(0.920)	(0.191)	(0.750)
UI	1.652	-19.628**	0.977	-17.579**
	(1.120)	(8.127)	(1.080)	(7.896)
MUTUAL	-0.410***		-0.492***	
	(0.158)		(0.142)	
GROUP	-0.582***	-3.616***	-0.677***	-4.046***
	(0.140)	(1.328)	(0.134)	(1.304)
OVER* ***(Over Reserve)***				
STOCKOPTION	-0.321***		-0.283***	
	(0.109)		(0.098)	
OPTIONRATIO		-0.080		-0.111**
		(0.057)		(0.049)
GOODRATING	-0.263***	-0.266	-0.286***	-0.506**
	(0.091)	(0.196)	(0.088)	(0.220)
TAX	0.030***	0.141**	0.022***	-0.148*
	(0.001)	(0.060)	(0.007)	(0.080)
SMOOTH	0.005	-4.055**	0.082*	-3.664**
	(0.038)	(1.703)	(0.043)	(1.467)
LONGTAIL	1.237***	-0.075	0.858***	0.036
	(0.170)	(0.446)	(0.154)	(0.409)

TABLE 2 (cont.)

	Dependent Variable = ERROR1		Dependent Variable = ERROR2	
Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**
UI	-0.276	-3.443***	0.827	-2.044
	(0.680)	(1.298)	(0.681)	(1.324)
MUTUAL	-0.388***		-0.571***	
	(0.095)		(0.096)	
GROUP	-0.470***	-2.320***	-0.758***	-2.784***
	(0.102)	(0.353)	(0.104)	(0.384)
-2 log likelihood	15162.5	1765.9	14705.1	1720.1

Note: Standard errors are in the parenthesis below coefficients.
* Significant at 0.10 level ** Significant at 0.05 level *** Significant at 0.01 level

† Variable definitions are as follows:

ERROR1 = reserve error scaled by net premium earned;
ERROR2 = reserve error scaled by developed claim costs.
UNDER = 1 if reserve error is negative, 0 otherwise;
STOCKOPTION = 1 if insurer offers stock options to executives, 0 otherwise;
OPTIONRATIO = option value as a percentage of executive compensation;
GOODRATING = 1 if receiving A or above rating from AM Best;
TAX = tax reduction incentive measured by $(UI_{i,t} + II_{i,t} + estimated\ reserve_{i,t}) / assets_{i,t}$ where UI = underwriting income and II = investment income;
SMOOTH = income smoothing incentive measured by $\sum_{j=t-3}^{t-1}(UI_{i,t} + II_{i,t}) / (3 \cdot assets_{i,t})$;
LONGTAIL = percentage of premiums written in long-tailed lines;
UI = unanticipated inflation measured by $(CPI_t+3 - CPI_t)/ CPI_t - T3Y_t$ where T3Y = Treasury yield over a three-year period;
MUTUAL = 1 if insurer is a mutual company;
GROUP = 1 if affiliated with a group, 0 otherwise; and,
OVER = 1 if reserve error is positive, 0 otherwise.

APPENDIX A
Top Ten Insurers with Highest Reserve Errors Scaled by Assets or Materiality

	Net Premium Earned Scale	Developed Claim Costs Scale
	1998	*1998*
1.	Columbia Ins Co	Global Ins Co
2.	American Bus & Personal Ins Mut Inc	Yel Co Ins
3.	United Farm Family Ins Co	Canonsburg Mut Fire Ins Co
4.	Global Ins Co	Farmers Mut Fire Ins Of Branch Cnty
5.	Coregis Ind Co	Fidelity Excess & Surplus Ins
6.	American Empire Ins Co	Mutual Service Cas Ins Co
7.	General Security Ind Co	Plans Liability Ins Co
8.	Greenwich Ins Co	Coregis Ind Co
9.	Indian Harbor Ins Co	Specialty Surplus Ins Co
10.	Inland Mut InsCo	Dorchester Ins Co Ltd
	1997	*1997*
1.	ZC Specialty Ins Co	Yel Co Ins
2.	Hudson Ins Co	Canonsburg Mut Fire Ins Co
3.	Transport Ins Co	Vintage Ins Co
4.	Healthcare Underwriters Mut Ins Co	Service General Ins Co
5.	American Empire Ins Co	First Specialty Ins Corp
6.	Inland Mut Ins Co	Cities & Villages Mut Ins Co
7.	Coregis Ind Co	Progressive HI Ins Corp
8.	Sea Ins Co Of Amer	ZC Specialty Ins Co
9.	Hanys Ins Co	Genesis Ind Ins Co
10.	Interstate Bankers Cas Co	Regency Ins Co
	1996	*1996*
1.	Century American Cas Co	Western Natl Assur Co
2.	Western Natl Assur Co	Western Continental Ins Co
3.	First State Ins Co	Yel Co Ins
4.	New England Ins Co	Service General Ins Co
5.	New England Rein Corp	Newark Ins Co
6.	Pronational Cas Co	Genesis Ind Ins Co
7.	Indian Harbor Ins Co	First Specialty Ins Corp
8.	Healthcare Underwriters Mut Ins Co	Kansas Bankers Surety Co
9.	Warner Ins Co	Progressive HI Ins Corp
10.	Westchester Surplus Lines Ins Co	First State Ins Co
	1995	*1995*
1.	Indian Harbor Ins Co	Western Continental Ins Co
2.	Saucon Mut Ins Co	Service General Ins Co
3.	Berkley Regional Ins Co	Insura Prop & Cas Ins Co
4.	Westport Ins Corp	Newark Ins Co

APPENDIX A (cont.)

Net Premium Earned Scale

	1995
5.	State Natl Specialty Ins Co
6.	Western Continental Ins Co
7.	Factory Mut Ins Co
8.	Coregis Ind Co
9.	California Cas Comp Ins Co
10.	Insura Prop & Cas Ins Co

Developed Claim Costs Scale

	1995
5.	Gem State Ins Co
6.	Pathfinder Ins Co
7.	Namic Ins Co Inc
8.	Genesis Ind Ins Co
9.	Kansas Bankers Surety Co
10.	Yel Co Ins