Asymmetric Earnings Management Responses to Targeted Ratings*

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Abstract

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Keywords: Accounting Discretion; Ratings Agencies; Accruals; Earnings Management; Audit Quality; Insurance; Reserve Management

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Abstract

This study investigates asymmetric incentives in firms managing earnings in an attempt to achieve a target financial strength rating. We find empirical evidence that firms with an actual rating below their target rating use income-increasing earnings management. However, unlike results from prior research, we find no evidence that firms above their target rating manage earnings. These results are consistent with findings in the literature examining the impact of ratings on capital structure decisions. Our findings are robust to a variety of alternative definitions of target rating. We additionally find evidence that this earnings management can be mitigated through external monitoring. These findings indicate that firms have incentives to reach a target rating if they are rated below their target, but not above their target.

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1. Introduction

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

Studying earnings management, broadly, is itself not easy since observing the actual management of earnings is very difficult. Though valiant attempts are made to derive a measure of earnings management, measurement error certainly exists. Similarly, since firms rarely (if ever) announce a ratings goal, studying incentives around a "target" rating, that must be estimated, also introduces measurement error. Our data allows us to minimize the

measurement error associated with these two important variable constructions. Further, the results presented account for what measurement error does remain.

In order to minimize this measurement error, we turn to the property and liability (P&L) industry for examination. For a number of reasons, the P&L insurance industry is an excellent laboratory to investigate this specific issue. First, we minimize the measurement error around earnings measurement by using loss reserve errors as a measure of earnings management. Each year insurers accrue a liability for unpaid losses. Over time, they must disclose how these estimated losses develop as they reflect actual losses paid and changes in estimates. This allows for observability of the actual error made in the original accounting estimate. McNichols (2000) suggests that commonly used earnings management models based on model residuals (e.g., Jones, 1991; Dechow et al., 1995; Kothari et al., 2005) can be unreliable and instead recommends focusing on specific accruals that are material to a firm.[1] Indeed, loss reserve errors have been frequently used as a measure of managerial discretion, being linked to various incentives, such as income smoothing (Weiss, 1985; Beaver et al., 2003), financial weakness (Gaver and Paterson, 2004; Grace and Leverty, 2012), and executive compensation (Eckles and Halek, 2010; Eckles et al., 2011).

To mitigate measurement error around estimation of a "target rating," we note that a subset of insurers (commercial insurers) are particularly dependent on a specific rating, "A-". A rating of at least "A-" is particularly important for commercial writers, as many corporations will not purchase insurance from insurers with a rating below "A-." Epermanis and Harrington (2006) and Halek and Eckles (2010) find empirical evidence that there are substantial costs associated with an insurer's failure to maintain a rating of at least "A-." Further, Alissa et al. (2013) note that investors are particularly aware of "investment grade"

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

ratings, providing an incentive for firms to managing earnings around a specific rating.[2] Here, we have a specific subsample of firms (those with a commercial focus) where this "investment grade" rationale particularly holds. For these firms we argue an exogenous target is given (i.e., "A-") which allows us to minimize estimation error (associated with estimating a "target rating").

An additional advantage of focusing on the insurance industry is that there exists an industry-specific financial strength rating. A.M. Best (Best) has offered financial strength ratings of insurers since its incorporation in 1899. These ratings represent Best's opinion on an insurer's ability to continue to pay claims to policyholders in the future. Indeed, financial strength ratings have been shown to be positively associated with insolvency risk (Pottier and Sommer, 2002). Unlike credit ratings, which can focus on an individual security, financial strength ratings reflect the firm as a whole.[3] Since ratings serve as an insolvency measure, they are important to an insurer as many corporate insurance purchasers have minimum ratings requirements and personal-lines consumers are price sensitive with respect to ratings (e.g., Berger et al., 1992). Accordingly, losing a high rating is associated with significant costs (Doherty and Phillips, 2002). Stock markets also react negatively to ratings downgrades (Halek and Eckles, 2010; Wade et al., 2015). For these reasons insurers will have incentives to achieve and maintain a high target rating.

Another advantage of using insurers stems from regulatory reporting requirements. Because most firms are required to report financial information to regulators, our sample is broader, consisting of different organizational forms. The insurance industry has a variety of ownership structures including public and private stock firms, as well as mutual companies. Therefore, our study is not restricted to only publicly traded firms. These differing

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

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

organizational forms each have separate agency conflicts that may influence the incentives of managers to manipulate loss reserves (Mayers et al., 1997; Cummins et al., 1999).

We find evidence that firms manage earnings upward, through under-reserving (i.e. under-reporting losses), when they are below their target financial strength rating. We fail to find evidence of reserve management for firms that have an actual rating above their target financial strength rating. This result is robust to alternative definitions of target rating. More specifically, in addition to using an ordered probit model to estimate a target rating (as in Alissa et al. (2013)) we also focus on insurers writing predominantly commercial lines and measure their target as "A-."[4] We also use past ratings as a proxy for a target rating and adapt a model from the target leverage literature (e.g., Flannery and Rangan, 2006) to test our hypotheses that firms will manage reserves to attain a target rating.

Alissa et al. (2013) is the most similar study to ours. They find that firms use accruals-based and real activities earnings management in order to attempt to achieve a target S&P credit rating. Our study extends and improves on Alissa et al. (2013) in several very important ways. First, we explicitly examine the asymmetric effect of managerial incentives around ratings. That is, we examine whether incentives to manage earnings differ between above-target rating firms and below-target rating firms.[5] Our empirical finding that incentives do differ between these two groups is a significant contribution that is both consistent with literature examining how firms adjust leverage following ratings changes (Kisgen, 2006, 2009) and intuitively appealing with regards to managerial incentives.[6] This finding is strikingly stable across all of our tests.

Second, we utilize a unique group of firms that allows us to minimize estimation error

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

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

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

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

Our study contributes to the literature on earnings management, in general, and loss reserve management, in particular. Our study also contributes to the literature on ratings, providing further evidence that ratings are highly important to firms (Kisgen, 2006, 2009). The findings in this paper both extend and complement the findings of Alissa et al. (2013) and provide further support for the idea that firms manage earnings in response to deviations from expected ratings, albeit in an asymmetric fashion.

The rest of our paper proceeds as follows. In Section 2 we provide background on insurer loss reserve errors and financial strength ratings, as well as a brief summary of prior literature. In Section 3 we develop our testable hypotheses. In Section 4 we describe our research design. In Section 5 we describe our data and provide our empirical results. In Section 6 we end with a brief conclusion.

2. Background

2.1. Loss Reserves

Insurer loss reserve errors are frequently used as a measure of managerial discretion in the accounting and insurance literature (e.g., Petroni, 1992; Beaver et al., 2003; Grace and Leverty, 2010). Loss reserves are typically the largest liability on a property-liability insurer's balance sheet representing the estimated cost of settling claims. In general, a firm's actuaries will present a recommended range of acceptable loss reserves, with management choosing the ultimate loss reserve amount. As claims occur over time and new information is gathered on existing claims, an insurer will revise their original and prior loss reserve estimates. These revisions, called development, indicate whether an insurer initially under- or over-reserved. An insurer under-reserved if the original loss reserve was less than the developed reserve and over-reserved if the original loss reserve was greater than the developed reserve. This information, as well as information on the settlement of claims, is reported by all insurers to the National Association of Insurance Commissioners (NAIC) in annual statutory filings on Schedule P.

An excerpt from a Schedule P can be found in Table 1. These data are used to construct the loss reserve error for firm i as follows:

$$Error_{i,t} = Incurred\ Losses_{i,t} - Incurred\ Losses_{i,t+n} \tag{1}$$

This error is calculated as the initial loss reserve estimate in year t minus the total incurred losses in year $t+n$. The sum of the boxed values under column 6 in Table 1 are the incurred losses in year t and the sum of the boxed values under column 11 are the incurred losses in year $t+n$. The error, also used in previous studies (e.g., Beaver et al., 2003; Gaver and Paterson, 2004; Grace and Leverty, 2010), will be positive if the initial loss reserve estimate

is overestimated and negative if the initial loss reserve is understated.[7] Consistent with the majority of prior literature (e.g., Petroni, 1992; Beaver et al., 2003; Grace and Leverty, 2010), we use a five year development horizon. To control for insurer size and to express the loss reserve error as a percentage, this difference is scaled by total assets.

McNichols (2000) notes several advantages in using loss reserve errors as a measure of earnings management compared to other accruals-based measures. For one, it is a material accrual, as the loss reserve is generally the largest liability on an insurer's balance sheet. Also, due to reporting requirements, the development of loss estimates over time is observable, allowing for the comparison of initial estimates to the original accounting estimate. The discretionary manipulation of loss reserves has been frequently studied in the literature as a result of its strength as a measure of earnings management. Loss reserve errors have been linked to various incentives such as earnings smoothing (Weiss, 1985; Grace, 1990; Beaver et al., 2003), avoiding financial weakness (Petroni, 1992; Gaver and Paterson, 2004; Grace and Leverty, 2012), and increasing executive compensation (Eckles and Halek, 2010; Eckles et al., 2011; Eastman et al., 2015). Studies have also examined the relation between external monitoring and insurer loss reserve errors (Petroni and Beasley, 1996; Gaver and Paterson, 2001, 2007; Grace and Leverty, 2013).

2.2. Financial Strength Ratings

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

[7]There are other measures of reserve error that have also been used in the literature. Petroni (1992), Eckles and Halek (2010), and Eastman et al. (2015) use total incurred losses after 5 years minus the initial estimate. This produces the negative of the measure we use. Weiss (1985) and Grace and Leverty (2012) use the initial estimate minus losses paid after 5 years. Grace and Leverty (2013) use a measure based on stochastic loss reserving models as used in the actuarial science literature which they call the *full information reserve error*.

of interest to regulators, consumers (corporate or individual), and agents.

Doherty and Phillips (2002) examine whether rating standards have changed over time, and find evidence that the increased stringency of A.M. Best is one potential explanation for the capital buildup of P&L insurers in the 1990s. Pottier and Sommer (2002) find empirical evidence that A.M. Best ratings are better predictors of insolvency compared to measures used by regulators (e.g., Risk-Based Capital (RBC) ratios). Epermanis and Harrington (2006) document that firms experience a decrease in premiums written following ratings downgrades. They find that this effect is stronger for firms that write primarily in commercial lines of insurance. Halek and Eckles (2010) examine market reactions to financial strength ratings changes. They document significant negative market reactions to ratings downgrades. Additionally, Halek and Eckles (2010) find evidence that reactions are significantly higher in magnitude for firms that experience the loss of a rating of "A-." Wade et al. (2015) find empirical evidence of abnormally high short selling for insurers prior to a ratings downgrade. This suggests that investors can anticipate ratings downgrades and profit from negative reactions.

3. Hypothesis Development

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

Alissa et al. (2013), however, note there may also be incentives for above-target-rating firms to *reduce* their financial strength rating. Graham and Harvey (2001) survey CFOs

and find that firms view a rating that is higher than expected as an unnecessary cost.[8] Alissa et al. (2013) conclude, following their empirical analysis, that firms above (below) their target rating tend to manage earnings downward (upward). However, their empirical strategy does not allow them to disentangle whether this result is driven by above-target firms or below-target firms (or both). We propose that the costs associated with being below a target rating are significantly greater than those imposed for being above a target rating. We, therefore, separately examine above-rating and below-rating firms in our analysis.

As firms are penalized by consumers and investors for having a low rating and they (potentially) incur unnecessary costs for being above target ratings, they have an incentive to manage reserves if they are not at their target rating.[9] Therefore, firms below their target rating could make income-increasing earnings management decisions (under-reserving) in an effort to achieve a higher financial strength rating. Further, firms above their target rating could make income-decreasing earnings management decisions (over-reserving) in an effort to achieve a lower financial strength rating. This is consistent with the empirical findings of Alissa et al. (2013) on a sample of non-financial firms using credit ratings. We additionally examine whether the empirical findings in Alissa et al. (2013) are driven by either above-target or below-target firms.

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

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

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

performance in an effort to achieve a higher (lower) rating.

We, therefore, propose the following hypothesis:

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

A finding supporting both hypotheses would be consistent with Alissa et al. (2013). We also expect that if the finding of Alissa et al. (2013) is driven by one group of firms, it will be those that are below their target rating in opposed to those that are above their target rating. The costs for being below a target are significantly than any costs that a firm may incur for being above their target. For example, Epermanis and Harrington (2006) finds that firms experiencing a ratings downgrade see a larger and statistically stronger decline in net premiums written compared to firms experiencing an upgrade. Similarly, Halek and Eckles (2010) find that there is an asymmetric response to ratings changes from the stock market, where downgrades experience a larger decline in stock price compared to ratings upgrades.

We, therefore, propose the following hypothesis:

H2: *Firms below their target financial strength rating will tend to under-reserve while firms above their target rating will not manage reserves.*

A finding in support of this hypothesis is consistent with the findings in Alissa et al. (2013). However, it provides an incremental contribution by finding evidence of an asymmetric response to deviations from a target rating, consistent with findings in the target leverage literature (Kisgen, 2006, 2009).

Prior research has examined how external monitoring can influence insurer reserving practices (e.g., Petroni and Beasley, 1996; Gaver and Paterson, 2001, 2007; Gaver et al., 2012). When establishing loss reserves, firms are required to obtain an auditor to assess the accuracy of management's estimate. In addition to being examined by auditors, actuaries

are also required to assess and submit an opinion regarding the adequacy of management's initial loss reserve estimate.[10] High quality monitoring by both audit firms and actuarial firms could result in a lessened ability for managers of insurance firms to manage reserves. Notably, Gaver and Paterson (2001) find evidence that high quality monitoring by both audit and actuarial firms results in more conservative loss reserve estimates.

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

We, therefore, propose the following hypothesis:

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

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

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

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

4. Research Design

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

$$\begin{aligned} Rating_{i,t} = {} & \gamma_1 Size_{i,t} + \gamma_2 Product\ Diverse_{i,t} + \gamma_3 Longtail_{i,t} + \gamma_4 Reinsurance_{i,t} \\ & + \gamma_5 Geo\ Herf_{i,t} + \gamma_6 Growth_{i,t} + \gamma_7 ROA_{i,t} + \gamma_8 ROI_{i,t} + \gamma_9 Kenny\ Ratio_{i,t} \\ & + \gamma_{10} Earthquake_{i,t} + \gamma_{11} Surplus_{i,t} + \gamma_{12} Group_{i,t} + \gamma_{13} Hurricane_{i,t} + u_{i,t} \end{aligned} \quad (2)$$

where:

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

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

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

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

[12]Using net premiums written data from the Underwriting and Investment Exhibit (Part 1B-Premiums Written) in the annual statutory filings, we make the following adjustments as described in Berry-Stölzle et al. (2012). Fire and Allied Lines is defined as the sum of "Fire" and "Allied Lines." Accident and

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

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

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

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

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

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

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

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

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

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

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

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

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

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

An alternative methodology includes a set of regulatory ratios, the Insurance Regulatory Information System (IRIS) ratios, as control variables in the ratings determinants model. However, prior research, such as Petroni (1992), Gaver and Paterson (1999, 2004), and Grace and Leverty (2012) examine whether insurers manipulate reserves in order to avoid violating four IRIS ratios, which would trigger regulatory intervention. Therefore, since reserve manipulation can affect the IRIS ratios, we must first calculate the "unmanipulated" IRIS ratios. Here, we remove the observed error in reserves, essentially assuming a reserve error of zero.[15] Using the following model, we again estimate ordered probit models for each year in our sample using "unmanipulated" IRIS ratios:[16]

$$Rating_{i,t} = \alpha_1 Size_{i,t} + \alpha_2 Mutual_{i,t} + \alpha_3^{'} X_{i,t}^{IRIS} + \eta_{i,t} \tag{3}$$

where $Rating_{i,t}$ is firm i's A.M. Best financial strength rating in year t, where 8 corresponds to the highest rating ("A++") and 1 corresponds to the lowest rating ("B-") in year t. $Size_{i,t}$ is the natural log of firm i's assets in year t. $Mutual_{i,t}$ is a binary variable equal to 1 if firm i is organized as a mutual in year t and 0 otherwise. $X_{i,t}^{IRIS}$ is a vector of firm i's unmanipulated IRIS ratios in year t. η is a random error term. We estimate a separate model

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

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

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

for each year in our sample (1992-2008). We next use the estimated coefficients from these models to calculate a target rating using a firm's observed IRIS ratios (i.e., those including any reserve manipulation). We use this target as an alternative definition of a firm's target financial strength rating.

Consistent with Alissa et al. (2013), we use the results from these ordered probit models to construct a firm's target financial strength rating.[17] This target rating is the rating that has the highest fitted probability from equation (2) or equation (3). We then construct $Difference_{i,t}$, which is $Rating_{i,t}$ minus the target rating. $Difference_{i,t}$ is positive for firms with actual rating above expected rating (over-rated firms) and negative for firms with actual rating below expected rating (under-rated firms).

Table 2 provides the distribution of actual ratings compared to target ratings. These results are generally as expected, as most ratings are at their target. Fewer firms are predicted to have low ratings ("B+" or less) compared to the actual number of firms with these ratings. The largest deviation appears at "B++", where only 18 firm-years have "B++" as a target, while 1,589 firm-years have a rating of "B++". A possible explanation for this is the importance for many firms of attaining a rating of at least "A-." We note that the number of firms targeting an "A-" rating (7,848) is substantially larger than the number of firms with "A-" rating (4,735). If it is important for firms to have an "A-" rating this could explain the low number of firms targeting a "B++" rating.

Table 3 provides the average reserve error scaled by total assets by the intersection of actual and target rating. Positive values indicate over-reserving while negative values indicate under-reserving. Overall, there are no strong trends in this table. There are a few cases of firms below their target rating under-reserving, but these results are not consistent.

Table 4 examines whether *Difference* provides an adequate measure of target rating for

[17] Empirical results from our ordered probit models of equation (2) and equation (3) are presented in the appendix.

a firm. We would expect to see a firm's actual rating move toward its target rating over time if this is a reasonable measure of target rating. As in Alissa et al. (2013), we estimate: $\Delta Difference_{i,t+k} = \theta_0 + \theta_1 Difference_{i,t} + \omega_{i,t}$. A negative estimated coefficient of θ_1 indicates mean reversion and would provide evidence that ratings do trend towards the target rating. The results in Table 4 provide evidence that *Difference* mean reverts over $t+1$, $t+3$, and $t+5$.

This method of measuring deviation from a target rating captures a firm's target rating in that it is the rating a firm can expect to receive based on its observable firm characteristics. Since A.M. Best does not make its exact rating formula public, firms cannot take actions to directly influence their rating. According to A.M. Best, they also take into account qualitative factors when assessing their rating (A.M. Best, 2014). Therefore, based on observable factors, this fitted value of a target rating proxies the financial strength rating a firm is targeting. In Section 5.3 we employ different measures of target ratings as robustness checks.

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

$$RE_{i,t} = \beta_0 + \beta_1 Difference_{i,t} + \beta_2^{'} X_{i,t} + \beta_3^{'} I_t + \epsilon_{i,t} \tag{4}$$

where $RE_{i,t}$ is reserve error scaled by total assets. $Difference_{i,t}$ is the difference between $Rating_{i,t}$ and a firm's target financial strength rating. We also disaggregate $Difference_{i,t}$ into two binary variables, *Above Target* and below *Below Target* to examine the potential of an asymmetric effect in being either above or below a target rating. $X_{i,t}$ is a vector of firm-level control variables to account for discretionary and non-discretionary determinants of a firms' loss reserve error. I_t is a vector of year fixed effects. $\epsilon_{i,t}$ is a random error term.

We include the following variables is necessary to isolate the effect of deviations from a target financial strength rating on loss reserve errors. Long-tailed lines of business require more managerial discretion, which would provide managers more discretion over reserves (Petroni and Beasley, 1996; Beaver et al., 2003; Grace and Leverty, 2010). *Growth* controls for the incentive to under-reserve in an attempt to take advantage of growth opportunities. Harrington and Danzon (1994) find that firms will use reinsurance to attempt to hide this under-reserving, so we also include *Reinsurance*. *Tax Shield* proxies for an insurer's taxable income, as an insurer can over-reserve to delay its current tax liability (Grace, 1990; Petroni, 1992; Eckles and Halek, 2010). We measure *Tax Shield* as an insurer's net income plus developed reserves, scaled by assets. We include *Size* as larger insurers are likely to have advantages in accurately calculating reserves as they, for example, likely employ more actuaries (Aiuppa and Trieschmann, 1987). *Product Diverse* and *Geo Herf* control for firm complexity, which is likely to increase the difficulty in correctly estimating the initial loss reserve. Managers of firms organized as mutuals are likely to have less discretion compared to managers of stock firms, so we include a mutual binary variable (Mayers et al., 1997; Cummins et al., 1999).[18] Firms organized as groups may reserve differently compared to unaffiliated firms, so we include a group indicator variable (Powell et al., 2008). Firms may also have incentives to smooth earnings and could under-reserve in order to attain a positive profit (Beaver et al., 2003). We control for this incentive with *Small Profit*. Finally, prior literature has found evidence that financially weak insurers tend to under-reserve (Petroni, 1992; Grace and Leverty, 2012). Similar to Grace and Leverty (2010, 2012) we regress a binary variable equal to one if an insurer became insolvent on an insurer's IRIS ratios and then use predicted values from this model as our measure of *Insolvent*.

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

5. Results

5.1. Data

Our data on insurer financial strength ratings come from A.M. Best from 1992 to 2008.[19] Other insurer characteristics come from insurer's annual statutory filings with the NAIC from 1991 to 2013.[20] We include only property-liability insurers domiciled in the United States. Life and health insurers are excluded, as their managers have less discretion in reserving practices due to the existence of well-established actuarial tables (Petroni, 1992). Additionally, the statutory filings for life and health insurers do not contain sufficient data to calculate five-year loss reserve errors.

Our final sample consists of firms who have been rated by A.M. Best and have statements from annual statutory filings with the NAIC from 1991 to 2013. Our analysis is based on affiliated and unaffiliated individual insurers.[21,22] We keep only stock and mutual firms in our sample.[23] We exclude observations that are missing any of the variables needed for the analysis. Values of *Reinsurance*, *Geo Herf*, *Product Diverse*, and *Longtail* that are outside their theoretically possible range (i.e., less than zero or greater than one) are set equal to the bounded value. We exclude firms who have an A.M. Best financial strength rating that is lower than a "B-", as these firms are severely vulnerable to insolvency.[24] All continuous

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

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

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

[22]Eckles and Halek (2010), Eckles et al. (2011), and Eastman et al. (2015) conduct their analysis on groups and unaffiliated single insurers. Grace and Leverty (2010, 2012) conduct their analysis at the affiliated and unaffiliated single insurer level, but report that their results are robust to conducting analysis at the group and unaffiliated insurer level.

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

[24]This is consistent with Alissa et al. (2013), who find that their results do not change based on restricting

variables are winsorized at the 1 percent level.

Table 5 provides summary statistics for our sample. From 1992 to 2008, the sample consists of 18,680 firm-year observations which represents 1,909 unique firms. Using assets as a scaling factor, the average magnitude of RE is 0.0110. The median reserve error is positive, indicating that the majority of firms over-reserved in our sample, which is consistent with prior studies on reserve errors (e.g., Beaver et al., 2003; Gaver and Paterson, 2004; Grace and Leverty, 2010). Specifically, 61.9 percent of the firm-years in our sample had a firm over-reserving. The average firm in the sample has an A.M. Best financial strength rating between A- and A ($Rating$=5.4781). The median rating is an A ($Rating$=6). The average value of *Difference* is -0.2170 which indicates that the average firm is below their expected financial strength rating.

5.2. Main Results

Table 6 provides the results from our OLS model examining whether deviation from a target financial strength rating is a significant determinant of insurer loss reserve errors. The dependent variable is loss reserve error scaled by total assets (RE). Standard errors are presented beneath each coefficient estimate in parentheses. Standard errors are bootstrapped and account for firm-level clustering. A potential issue with the analysis in Alissa et al. (2013) is that they do not account for the presence of an estimated independent variable in their estimation. Since we follow their methodology, *Difference* contains an estimate (from our ordered probit models) of each firm's target rating. We perform 1,000 bootstrap replications to deal with any issues related to *Difference* being a generated regressor (Pagan, 1984).[25]

Column (1) of Table 6 provides a baseline model that does not include any variables

their sample to firms with an S&P rating greater than "B-."

[25]In untabulated results, we also perform feasible generalized least squares estimation of our model. Prior studies, such as Grace and Leverty (2012) and Eastman et al. (2015) use this methodology in estimating the determinants of reserve errors. Our results are statistically consistent with the results presented in the paper.

controlling for deviations from a target financial strength rating. The results in column (2) include *Difference* as an independent variable. The estimated coefficient of *Difference* is positive and statistically significant at the 1 percent level. This is consistent with our hypothesis and provides evidence that firms above (below) their target financial strength rating tend to over- (under-)reserve. This is also consistent with the results in Alissa et al. (2013). However, as with Alissa et al. (2013), this construction of *Difference* does not allow us to disentangle asymmetric incentives to manage reserves whether a firm is above or below their target rating. We, therefore, create two binary variables equal to one if a firm is above (*Above Target*) or below (*Below Target*) their target financial strength rating and zero otherwise. The results from this model are presented in column (3) of Table 6. These results are consistent with an asymmetric response to being above and below a target rating. Specifically, the estimated coefficient of *Above Target* is not statistically significant, providing empirical evidence that firms with a rating above their target do not appear to manage reserves. However, the estimated coefficient of *Below Target* is negative and statistically significant at the 1 percent level. This provides empirical support for our hypothesis that firms with a rating below their target tend to under-reserve (income-increasing discretionary accruals). Taken together, these results also suggest that firms have more incentive to manage reserves when their actual rating is below their target rating, but not when their actual rating is above their target rating.

The results in columns (2) and (3) of Table 6 use a full set of control variables to calculate our *Difference*, and also, therefore, our *Above Target* and *Below Target* variables. In columns (4) and (5) of Table 6 we the alternative approach to estimating target ratings using a firm's IRIS ratios. These results are consistent with those in columns (2) and (3). The estimated coefficient of *Difference* is significant and positive, which is consistent with our hypothesis. Again, however, when we allow for an asymmetric response to being above a target rating or below a target rating, we only find evidence of reserve management for firms below

their target rating. Specifically, the estimated coefficient of *Above Target* is not statistically significant, but the estimated coefficient of *Below Target* is significant at the five percent level and is negative, indicating under-reserving.

Overall, the results in columns (2), (3), (4), and (5) of Table 6 provide empirical support for our hypothesis that firms manage reserves to achieve a target financial strength rating. In addition, we find evidence that this result is driven by firms whose actual ratings are below their estimated target ratings. These firms tend to under-reserve, whereas firms whose actual ratings are above their target ratings do not tend to manage reserves.

5.2.1. Natural Experiment–Commercial Insurers

One potential issue with the analysis in Alissa et al. (2013) and our prior analysis is the question of whether we are accurately capturing a firm's actual target financial strength rating. A particular advantage of focusing on the P&L insurance industry is that we have a subset of firms where we can identify an (essentially) exogenously determined target rating. Specifically, P&L insurers who write predominantly commercial lines have particularly strong incentives to target a rating of at least "A-." Prior research, such as Epermanis and Harrington (2006) and Halek and Eckles (2010), find evidence that a rating of "A-" is particularly important for commercial insurers.

In order to test whether insurers particularly target a rating of "A-," we employ the following two ordinary least squares (OLS) regressions:

$$RE_{i,t} = \pi_0 + \pi_1 Difference_{i,t} + \pi_2^{'} X_{i,t} + \pi_3^{'} I_t + \epsilon_{i,t} \tag{5}$$

$$RE_{i,t} = \psi_0 + \psi_1 Above\ A\text{-}_{i,t} + \psi_2 Below\ A\text{-}_{i,t} + \psi_3^{'} X_{i,t} + \psi_4^{'} I_t + \epsilon_{i,t} \tag{6}$$

where $RE_{i,t}$ is reserve error scaled by total assets. *Difference* is a firm's actual financial strength rating minus a firm's target rating, which in this case is "A-." $Above\ A\text{-}_{i,t}$ is a binary variable equal to one if a firm has an actual financial strength rating above "A-"

and zero otherwise. *Below A-*$_{i,t}$ is a binary variable equal to one if a firm has an actual financial strength rating below "A-" and zero otherwise. $X_{i,t}$ is a vector of firm-level control variables to account for discretionary and non-discretionary determinants of a firms' loss reserve error. I_t is a vector of year fixed effects. $\epsilon_{i,t}$ is a random error term. A positive estimate of π_1 would be consistent with firms over-reserving if they are above their target rating and under-reserving if they are below their target rating. However, as in our previous analysis, we also include models that allows for an asymmetric response to above-rating and below-rating firms. A positive estimate of ψ_1 would be consistent with over-reserving when a firm is above their target rating, while a negative estimate of ψ_2 would be consistent with under-reserving when a firm is below their target rating. In this case we focus on firms operating in commercial lines, since a rating of "A-" is particularly important for these firms. Accordingly, we estimate this model for firms writing at least a certain amount of commercial lines.[26] Specifically, we estimate equations (5) and (6) separately for firms writing more than 60, 70, and 80 percent of net premiums written in commercial lines.

Table 7 provides OLS estimates of the determinants of reserve errors for firms writing more than 60, 70, and 80 percent of their annual net written premiums in commercial lines. The dependent variable is reserve error scaled by total assets (*RE*). Columns (1), (3), and (5) are models where *Difference* is the variable of interest (i.e., equation (4)). We predict a positive and significant relationship between *Difference* and *RE*. In columns (2), (4), and (6), the variables of interest are *Below A-*, where we predict a negative sign, and *Above A-*, where we predict a positive sign. However, if there is an asymmetric response to being above or below a target rating, we would fail to find significance for the estimated coefficient of *Above A-*. Columns (1) and (2) are for firms writing more than 60 percent of net premiums written

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

in commercial lines, columns (2) and (3) are for firms writing more than 70 percent of net premiums written in commercial lines, and columns (5) and (6) are for firms writing more than 80 percent of net premiums written in commercial lines. Standard errors are presented beneath each coefficient estimate and are clustered at the firm level. All regressions include year fixed-effects.

Overall, the results in Table 7 are consistent across the three subsets of commercial-lines focused firms. In columns (1), (3), and (5), the estimated coefficient of *Difference* is significant and positive. This is consistent with firms with ratings above "A-" over-reserving and firms with ratings below "A-" under-reserving. Additionally, we again find an asymmetric response once we include binary variables for above- and below-target firms with only below-target firms showing any evidence of reserve management. Specifically, the results in columns (2), (4), and (6) provide empirical evidence that firms below their target rating of "A-" tend to under-reserve. The estimated coefficient of *Below A-* is negative and significant at the one percent level in all three models. However, we fail to find statistical significance on *Above A-* in any of the models where it is included. Here, using an "exogenously" given rating target, we find qualitatively similar results from before with an estimated rating target.

5.3. Additional Tests

In addition to the natural experiment discussed above, we now consider two additional alternative measures of a firm's target financial strength rating.

5.3.1. Past Ratings as Target Ratings

Another potential way to measure a firm's target financial strength rating is to examine a firm's past rating. If a firm's target is relatively consistent over time and a firm generally is at its target rating, this measure should capture a firm's target rating and any deviation from it in the current period. Accordingly, we calculate three alternative targets using a firm's past rating. Specifically, we use a firm's prior year rating (*Rating* in $t-1$) as well as

the firm's rolling average financial strength rating over the past two and past three years. For each of these measures of target, we construct *Difference* as before, where it is a firm's *Rating* minus target rating. We then re-estimate equation (4), again controlling for discretionary and non-discretionary determinants of a firm's loss reserve error. We also estimate models including binary variables representing if a firm is above or below its target rating instead of *Difference* to examine whether the incentive to manage reserves is stronger for above-target or below-target rating firms.

Table 8 provides results for our OLS estimation of the determinants of insurer reserve error. The variable of interest in columns (1), (3), and (5) is *Difference* while the variables of interest in columns (2), (4), and (6) are *Above Target* and *Below Target*. Columns (1) and (2) use a firm's rating in year $t-1$ as a measure of target, columns (3) and (4) use a firm's average rating over the past two years as a target rating, and columns (5) and (6) use a firm's average rating over the past three years as a target rating. All models include year fixed effects. Firm-level clustered standard errors are presented beneath each coefficient estimate.[27]

In all three models including *Difference* (columns (1), (3), and (5)) the estimated coefficient of *Difference* is positive and statistically significant at the one percent level. This empirical result is consistent with both our hypothesis as well as our previous empirical results. In our models allowing for an asymmetric response to above-target firms and below-target firms, we find evidence that below-target firms tend to understate reserves, while we fail to find evidence of reserve management for above-target firms. Specifically, we find a negative and statistically significant estimated coefficient on all three models including *Below Target* (columns (2), (4), and (6)). We fail to find significance for the estimated coefficient of *Above Target* in any model where it is included.

[27]Unlike in our main results, we do not bootstrap these standard errors since *Difference* no longer contains an estimated component, as was the case when measuring target rating using an ordered probit model.

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

5.3.2. Alternative Target Rating Estimation

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

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

$$Rating^{*}_{i,t} = \beta X_{i,t-1} \tag{7}$$

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

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

$$Rating_{i,t} - Rating_{i,t-1} = \lambda \left(Rating^*_{i,t} - Rating_{t-1} \right) + \delta_{i,t} \tag{8}$$

where each year a firm closes a certain proportion of the gap between it's actual rating (*Rating*) and its target rating (*Rating**). This proportion of the gap is λ in equation (8). We substitute equation (7) into equation (8), which provides the following model:

$$Rating_{i,t} = \lambda \beta X_{i,t-1} + (1 - \lambda)\, Rating_{i,t-1} + \delta_{i,t} \tag{9}$$

We now empirically estimate this model, where *Rating* is a function of a firm's past rating (at $t-1$) and a vector of firm-specific characteristics. We can specifically estimate the value of the speed of adjustment, λ. Next, we rearrange equation (8) to yield an empirical estimate of a target rating as follows:

$$Rating^*_{i,t} = \frac{1}{\lambda} \left[Rating_{i,t} - Rating_{i,t-1} - \delta_{i,t} \right] + Rating_{i,t-1} \tag{10}$$

We then calculate *Difference* as before, where *Difference* is defined as *Rating* minus *Rating** from equation (10). We estimate equation (4) with this alternative definition of target rating. We also, as in our prior analysis, provide results for a model including binary variables *Above Target* and *Below Target*. One issue here is that this methodology produces a continuous

variable *Rating**. This creates an issue in identifying the model since we need an omitted category, which was firms at their target rating in prior models. Since this model creates continuous values for *Rating**, firms will only be at their target rating if *Rating** is *exactly* equal to *Rating*. We, therefore, round values of *Rating** to create a discrete target rating variable.[28]

Table 9 provides OLS estimates of models estimating the determinants of loss reserve errors scaled by total assets. Column (1) includes *Difference* as the variable of interest, while column (2) includes binary variables for firms above their target rating (*Above Target*) and for firms below their target rating (*Below Target*). Standard errors are included in parentheses beneath each coefficient estimate. Standard errors account for firm level clustering. Standard errors are bootstrapped to account for the presence of an estimated regressor (Pagan, 1984). Both models include year fixed-effects.

The results in column (1) of Table 9 are consistent with firms above their target rating over-reserving and firms below their target rating under-reserving. However, in our second model, which allows us to identify whether this is driven by above- or below-target firms, we find evidence that firms below their target rating under-reserve, as seen in the negative estimated coefficient of *Below Target*, while we fail to find evidence of reserve management for firms above their target rating. These results are consistent with our prior results.

5.4. External Monitoring

We next examine whether external monitoring can mitigate the behavior of firms below their target ratings. We have provided empirical evidence in this paper that firms below their target rating tend to understate their reserves. Extant studies in the area of loss reserve management have examined the interaction between external monitors (i.e., auditors) and reserve management (e.g., Petroni and Beasley, 1996; Gaver and Paterson, 2001, 2007). We

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

propose that high quality external auditing can detect and prevent management of the loss reserve in an attempt to achieve a target financial strength rating. In examining insurer loss reserves, we consider not only the audit firm, but also the external actuaries responsible for the "Statement of Actuarial Opinion" which speaks to the adequacy of the loss reserve. Gaver and Paterson (2001) find evidence that high quality auditing and also a high quality external actuary is necessary to prevent biased loss reserves. We therefore examine whether the combination of "high quality" auditing and actuaries results in a reduced ability of firms below their target rating under-reserving.

For our empirical analysis considering external monitors, we require the identify of the external auditor and the external actuarial firm responsible for auditing each firm's statutory filings. This information is reported in the statutory filings each year, but is only available in the data provided from the NAIC from 2005 to 2008.[29] Therefore, we perform our analysis on the sub-sample of firms with available information on the audit firm and actuarial firm from 2005 to 2008.

Consistent with Gaver and Paterson (2001), we construct a binary variable (*Big 4*) that is equal to 1 if a firm's financial statements were examined by both a Big 4 auditor and a Big 4 actuary and 0 otherwise.[30] We include this variable in equation 4 and also interact it with *Below Target* to examine whether it mitigates under-reserving.[31] We predict that if high quality external monitoring is effective in mitigating reserve management, the estimated coefficient on the interaction term *Big 4*Below Target* will be positive. We perform Wald tests to examine whether the overall effect of *Below Target* + *Big 4*Below Target* is equal

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

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

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

to 0. A non-significant test statistic of the Wald test is consistent with high quality external monitoring reducing the ability of firms to manage reserves if they are below their target rating. In addition to testing this for our main model, we also examine whether external monitoring reduces reserve management using our test of commercial lines insurers.

The results of our main model are presented in Table 10. We present results from OLS models with standard errors presented beneath each coefficient estimate. We perform 1,000 bootstrap replications to account for the presence of an estimated regressor in these models. The dependent variable is the five-year reserve error scaled by total assets. All regressions include year fixed effects.

The results in column (1) of Table 10 are a re-estimation of equation 4. Since we are now examining a reduced sample due to the limited availability of data needed to construct our *Big 4* variable, we establish that our main result of a negative and significant estimated coefficient on *Below Target* holds during the sample period from 2005 to 2008. The results on column (2) of Table 10 include *Big 4*. The estimated coefficient on *Big 4* is not statistically different from zero. However, our main result, that *Below Target* loads negatively and significantly, holds.

The main result of interest in Table 10 is in column (3). Here, the estimated coefficient on the interaction term *Big 4*Below Target* is positive and significant, indicating that firms below their target financial strength rating that also have a Big 4 audit firm and a Big 4 actuarial firm tend to over-reserve. The p-value for the Wald test (presented at the bottom of Table 10) that the estimated coefficients of *Below Target* and *Big 4*Below Target* is equal to zero fails to reject the null hypothesis (p-value = 0.9839). This provides empirical evidence that high quality external monitoring mitigates the ability of firms to manage reserves if they are below their target financial strength rating.

Table 11 provides results from our commercial lines test of reserve management for commercial lines insurers including *Big 4*. Since a rating of "A-" is an exogenous rating we

can take to be a target for firms writing predominantly in commercial lines, this provides a clean test of reserve management to achieve a target rating. As in Section 5.3.1, we examine insurers writing more than 60, 70, and 80 percent of net premiums in commercial lines. In columns (1), (3), and (5) we estimate models excluding *Big 4* to establish that our main results of a negative and significant estimated coefficient of *Below A-* holds on our reduced sample period from 2005 to 2008 (which is when the data necessary to calculate *Big 4* is available). The results in columns (2), (4), and (6) of Table 11 include *Big 4* and the interaction term *Big 4*Below A-*. We perform a Wald test of whether the estimated coefficient of *Below A-* plus the estimated coefficient of *Big 4*Below A-* is equal to 0. Failure to reject the null supports our hypothesis that high quality auditing reduces the ability of firms to manage earnings if they are below their target financial strength rating.

The results in columns (1), (3), and (5) indicate that our prior result that firms below a rating of "A-" tend to under-reserve. The estimated coefficient of *Below A-* is negative and significant (at the one percent level) in all three models, indicating that our result holds for this sub-sample. In columns (2), (4), and (6) of Table 11, we include *Big 4* and the interaction term *Big 4*Below A-*. *Big 4* is only significant in column (4) and in this case it is negative, which is not consistent with higher quality monitoring resulting in more conservative financial reporting (as found in Gaver and Paterson (2001)). However, we find that the estimated coefficient of *Big 4*Below A-* is positive in all three models, though it is not statistically different from zero. The Wald tests that the estimated coefficients of *Below A-* and *Big 4*Below A-* are equal to zero are presented at the bottom of the table. In all three cases, the p-values indicate that the test fails to reject the null (p-values > 0.10 in all three cases). This provides support for our hypothesis that firms below their target rating ("A-" in this case) do not tend to under-reserve if they have both a Big 4 auditor and a Big 4 actuary. This is consistent with stronger external monitoring reducing the ability of firms to manage reserves.

6. Conclusion

In this paper we provide strong evidence that firms manage their loss reserves in an effort to attain a target financial strength rating from A.M. Best. Specifically, firms that are below their target financial strength rating tend to under-reserve, while we find no evidence of reserve management for firms that are above their target rating. This is consistent with the findings of Alissa et al. (2013) who find similar results using accruals and real activities measures of earnings management. However, Alissa et al. (2013) do not attempt to differentiate between above- and below-target rating firms. We, therefore, contribute to the literature on earnings management by documenting a response to deviations from target ratings only by firms with ratings below their target. This is consistent with similar studies on leverage adjustments following ratings changes (Kisgen, 2006, 2009). Additionally, using loss reserve errors provides strong support for firms managing earnings in an attempt to achieve a target rating. We also find the result to be consistent across several additional tests where we consider alternative definitions of a target rating.

The results in this paper contribute to the literature on insurer reserve manipulation as well as financial strength ratings. We are the first to provide evidence of loss reserve management vis-à-vis financial strength ratings. The deviations from a target rating are found to provide a marginal incentive to manage reserves after controlling for other factors that are determinants of loss reserve errors. Additionally, we are the first study to apply the idea of a target rating to insurer financial strength ratings. We find evidence that firms have a target rating and that ratings converge to the target rating over time.

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Table 1: Excerpt from Schedule P—Part 2

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

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

Table 2: Distribution of Actual Ratings compared to Target Ratings

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

Note: This table shows the distribution of actual financial strength ratings by target financial strength ratings. Target ratings are calculated based on estimation of equation (2). Expected ratings are the rating level with the highest fitted probability from equation (2). Actual ratings are presented by row and expected ratings are presented by column.

Table 3: Reserve Errors by Intersection of Actual and Target Ratings

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

Note: This table shows the average loss reserve error by the intersection of actual and target rating. Positive values indicate over-reserving while negative values indicate under-reserving.

Table 4: Reversion to Target Ratings

Dependent Variable: $\Delta Difference_{t+k}$

	t+1	t+3	t+5
Difference	-0.1731***	-0.3507***	-0.4763***
	(0.0056)	(0.0101)	(0.0133)
Intercept	-0.0190***	-0.0312***	-0.0599***
	(0.0056)	(0.0118)	(0.0168)
R^2	9.46%	19.96%	27.73%
Observations	16,093	12,927	10,178

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

Table 5: Descriptive Statistics

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

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

Table 6: Main Regression Results

Dependent Variable: Reserve Error

	(1)	(2)	(3)	(4)	(5)
Difference		0.0041***		0.0019*	
		(0.0010)		(0.0010)	
Above Target			-0.0016		-0.0027
			(0.0024)		(0.0024)
Below Target			-0.0103***		-0.0064**
			(0.0026)		(0.0026)
Size	-0.0027***	-0.0022**	-0.0022**	-0.0021**	-0.0022**
	(0.0009)	(0.0009)	(0.0009)	(0.0010)	(0.0009)
Reinsurance	-0.0324***	-0.0356***	-0.0351***	-0.0360***	-0.0356***
	(0.0043)	(0.0045)	(0.0046)	(0.0047)	(0.0044)
Tax Shield	0.1513***	0.1789***	0.1781***	0.1684***	0.1704***
	(0.0296)	(0.0295)	(0.0317)	(0.0312)	(0.0303)
Geo Herf	0.0026	0.0076*	0.0076*	0.0076*	0.0077*
	(0.0042)	(0.0042)	(0.0043)	(0.0045)	(0.0046)
Mutual	0.0088**	0.0081**	0.0081**	0.0078**	0.0078**
	(0.0035)	(0.0036)	(0.0035)	(0.0036)	(0.0037)
Product Diverse	-0.0056	-0.0008	-0.0009	-0.0008	-0.0009
	(0.0050)	(0.0054)	(0.0053)	(0.0054)	(0.0051)
Longtail	0.0226***	0.0191***	0.0193***	0.0192***	0.0195***
	(0.0058)	(0.0061)	(0.0059)	(0.0066)	(0.0062)
Group	0.0003	0.0004	0.0008	0.0000	0.0003
	(0.0043)	(0.0045)	(0.0047)	(0.0046)	(0.0046)
Growth	0.0004	-0.0002	-0.0001	-0.0003	-0.0002
	(0.0007)	(0.0008)	(0.0007)	(0.0008)	(0.0008)
Small Profit	-0.0074**	-0.0077**	-0.0078**	-0.0078**	-0.0078**
	(0.0037)	(0.0038)	(0.0037)	(0.0039)	(0.0039)
Small Loss	-0.0094	-0.0063	-0.0061	-0.0060	-0.0062
	(0.0071)	(0.0060)	(0.0063)	(0.0061)	(0.0061)
Profit	0.0096***	0.0075***	0.0076***	0.0083***	0.0082***
	(0.0029)	(0.0027)	(0.0027)	(0.0030)	(0.0029)
Insolvent	-0.1246	-0.0436	-0.0419	-0.0498	-0.0482
	(0.1239)	(0.1324)	(0.1340)	(0.1410)	(0.1333)
Intercept	0.0500***	0.0418**	0.0439**	0.0398**	0.0422**
	(0.0194)	(0.0190)	(0.0190)	(0.0201)	(0.0187)
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	7.56%	8.56%	8.48%	8.29%	8.30%
Wald χ^2	697.05	746.52	679.94	689.15	681.70
Observations	20,898	18,680	18,680	18,680	18,680

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

Table 7: Commercial Lines Regression Results

Dependent Variable: Reserve Error

	>60%		>70%		>80%	
	(1)	(2)	(3)	(4)	(5)	(6)
Difference	0.0037***		0.0037**		0.0042**	
	(0.0014)		(0.0017)		(0.0020)	
Above A-		-0.0026		-0.0039		-0.0064
		(0.0034)		(0.0038)		(0.0043)
Below A-		-0.0179***		-0.0195***		-0.0245***
		(0.0052)		(0.0061)		(0.0071)
Size	-0.0046***	-0.0042***	-0.0054***	-0.0051***	-0.0064***	-0.0060***
	(0.0014)	(0.0013)	(0.0016)	(0.0015)	(0.0018)	(0.0017)
Reinsurance	-0.0373***	-0.0360***	-0.0388***	-0.0376***	-0.0396***	-0.0381***
	(0.0058)	(0.0057)	(0.0067)	(0.0066)	(0.0078)	(0.0077)
Tax Shield	0.1485***	0.1495***	0.1510***	0.1515***	0.1515***	0.1517***
	(0.0376)	(0.0375)	(0.0423)	(0.0422)	(0.0462)	(0.0462)
Geo Herf	0.0028	0.0032	0.0021	0.0024	0.0009	0.0013
	(0.0052)	(0.0052)	(0.0060)	(0.0060)	(0.0068)	(0.0068)
Mutual	0.0132***	0.0130***	0.0177***	0.0172***	0.0223***	0.0215***
	(0.0048)	(0.0048)	(0.0062)	(0.0061)	(0.0076)	(0.0075)
Product Diverse	-0.0010	-0.0018	0.0042	0.0038	0.0125	0.0121
	(0.0056)	(0.0056)	(0.0069)	(0.0068)	(0.0078)	(0.0077)
Longtail	0.0260***	0.0259***	0.0266***	0.0264***	0.0277***	0.0273***
	(0.0063)	(0.0062)	(0.0065)	(0.0064)	(0.0067)	(0.0067)
Group	-0.0081	-0.0077	-0.0098	-0.0095	-0.0104	-0.0101
	(0.0055)	(0.0055)	(0.0062)	(0.0062)	(0.0068)	(0.0068)
Growth	0.0003	0.0003	0.0007	0.0007	0.0011	0.0010
	(0.0008)	(0.0008)	(0.0010)	(0.0010)	(0.0011)	(0.0011)
Small Profit	-0.0020	-0.0021	-0.0022	-0.0021	-0.0021	-0.0022
	(0.0048)	(0.0048)	(0.0057)	(0.0057)	(0.0069)	(0.0069)
Small Loss	-0.0113	-0.0123	-0.0144	-0.0156	-0.0231	-0.0243*
	(0.0086)	(0.0086)	(0.0108)	(0.0107)	(0.0144)	(0.0143)
Profit	0.0139***	0.0142***	0.0163***	0.0167***	0.0203***	0.0206***
	(0.0036)	(0.0036)	(0.0042)	(0.0042)	(0.0047)	(0.0047)
Insolvent	-0.1044	-0.0965	-0.0894	-0.0822	-0.0975	-0.0896
	(0.1545)	(0.1549)	(0.1646)	(0.1652)	(0.1833)	(0.1841)
Intercept	0.0738***	0.0734***	0.0882***	0.0895***	0.1075***	0.1106***
	(0.0277)	(0.0267)	(0.0313)	(0.0304)	(0.0365)	(0.0354)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F-Stat	21.65	21.36	18.16	18.08	14.05	14.05
R^2	10.20%	10.32%	10.70%	10.87%	10.80%	11.10%
Observations	14,674	14,674	12,039	12,039	9,644	9,644

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

Table 8: Past Rating as Target Results

Dependent Variable: Reserve Error

	Last Year		Last 2 Years		Last 3 Years	
	(1)	(2)	(3)	(4)	(5)	(6)
Difference	0.0045***		0.0047***		0.0049***	
	(0.0014)		(0.0016)		(0.0017)	
Above Target		0.0042		0.0037		0.0027
		(0.0030)		(0.0029)		(0.0030)
Below Target		-0.0083***		-0.0083***		-0.0077***
		(0.0028)		(0.0029)		(0.0030)
Size	-0.0020**	-0.0021**	-0.0015	-0.0016	-0.0014	-0.0014
	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Reinsurance	-0.0321***	-0.0320***	-0.0303***	-0.0301***	-0.0285***	-0.0284***
	(0.0045)	(0.0045)	(0.0048)	(0.0048)	(0.0053)	(0.0053)
Tax Shield	0.1563***	0.1569***	0.1402***	0.1407***	0.1366***	0.1372***
	(0.0341)	(0.0340)	(0.0387)	(0.0386)	(0.0441)	(0.0441)
Geo Herf	0.0022	0.0022	0.0031	0.0032	0.0051	0.0052
	(0.0043)	(0.0043)	(0.0045)	(0.0045)	(0.0049)	(0.0048)
Mutual	0.0066*	0.0066*	0.0049	0.0049	0.0021	0.0021
	(0.0036)	(0.0036)	(0.0037)	(0.0037)	(0.0038)	(0.0038)
Product Diverse	-0.0034	-0.0033	-0.0005	-0.0004	0.0023	0.0025
	(0.0053)	(0.0053)	(0.0057)	(0.0057)	(0.0063)	(0.0063)
Longtail	0.0235***	0.0236***	0.0238***	0.0239***	0.0236***	0.0238***
	(0.0060)	(0.0060)	(0.0064)	(0.0064)	(0.0069)	(0.0069)
Group	0.0010	0.0011	0.0011	0.0013	0.0012	0.0014
	(0.0046)	(0.0045)	(0.0047)	(0.0047)	(0.0051)	(0.0050)
Growth	0.0011	0.0011	0.0014*	0.0014*	0.0014	0.0014
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0010)	(0.0010)
Small Profit	-0.0074*	-0.0074*	-0.0073	-0.0073	-0.0088*	-0.0088*
	(0.0041)	(0.0041)	(0.0045)	(0.0045)	(0.0052)	(0.0052)
Small Loss	-0.0121	-0.0122	-0.0095	-0.0095	-0.0063	-0.0064
	(0.0080)	(0.0080)	(0.0081)	(0.0081)	(0.0083)	(0.0083)
Profit	0.0078***	0.0076**	0.0096***	0.0093***	0.0074**	0.0073**
	(0.0029)	(0.0029)	(0.0031)	(0.0031)	(0.0034)	(0.0034)
Insolvent	-0.1237	-0.1230	-0.0674	-0.0670	-0.3381**	-0.3382**
	(0.1584)	(0.1582)	(0.1654)	(0.1650)	(0.1671)	(0.1667)
Intercept	0.0346	0.0352*	0.0212	0.0225	0.0335	0.0352
	(0.0210)	(0.0211)	(0.0212)	(0.0213)	(0.0215)	(0.0217)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F-Stat	17.89	17.47	13.67	13.41	10.78	10.66
R^2	7.21%	7.22%	6.57%	6.61%	6.58%	6.61%
Observations	17,855	17,855	15,343	15,343	12,581	12,581

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

Table 9: Target Rating Model Results

Dependent Variable: Reserve Error		
	(1)	(2)
Difference	0.0016**	
	(0.0007)	
Above Target		0.0006
		(0.0023)
Below Target		-0.0051**
		(0.0024)
Size	-0.0030***	-0.0029***
	(0.0010)	(0.0010)
Reinsurance	-0.0338***	-0.0333***
	(0.0043)	(0.0043)
Tax Shield	0.1518***	0.1532***
	(0.0295)	(0.0291)
Geo Herf	0.0035	0.0035
	(0.0041)	(0.0043)
Mutual	0.0082**	0.0083**
	(0.0035)	(0.0035)
Product Diverse	-0.0054	-0.0053
	(0.0050)	(0.0049)
Longtail	0.0226***	0.0227***
	(0.0058)	(0.0059)
Group	0.0002	0.0003
	(0.0043)	(0.0045)
Growth	0.0004	0.0004
	(0.0007)	(0.0007)
Small Profit	-0.0075**	-0.0074**
	(0.0037)	(0.0038)
Small Loss	-0.0097	-0.0095
	(0.0071)	(0.0067)
Profit	0.0091***	0.0091***
	(0.0028)	(0.0028)
Insolvent	-0.1114	-0.1123
	(0.1219)	(0.1220)
Intercept	0.0564***	0.0559***
	(0.0202)	(0.0206)
Year FE	Yes	Yes
R^2	7.64%	7.64%
Wald χ^2	702.21	705.02
Observations	20,898	20,898

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

Table 10: Main Model with External Monitoring

Dependent Variable: Reserve Error

	(1)	(2)	(3)
Above Target	-0.0030	-0.0029	-0.0031
	(0.0033)	(0.0034)	(0.0033)
Below Target	-0.0080**	-0.0081**	-0.0149***
	(0.0038)	(0.0038)	(0.0050)
Big 4		-0.0035	-0.0005
		(0.0038)	(0.0041)
*Big 4*Below Target*			0.0148**
			(0.0063)
Size	-0.0016	-0.0015	-0.0021*
	(0.0011)	(0.0010)	(0.0011)
Reinsurance	-0.0238***	-0.0241***	-0.0252***
	(0.0055)	(0.0057)	(0.0056)
Tax Shield	0.1889***	0.1871***	0.1921***
	(0.0447)	(0.0447)	(0.0456)
Geo Herf	-0.0003	-0.0005	0.0002
	(0.0053)	(0.0055)	(0.0056)
Mutual	-0.0055	-0.0054	-0.0053
	(0.0039)	(0.0039)	(0.0040)
Product Diverse	0.0176***	0.0175***	0.0177***
	(0.0062)	(0.0066)	(0.0062)
Longtail	0.0389***	0.0388***	0.0390***
	(0.0076)	(0.0075)	(0.0074)
Group	-0.0048	-0.0045	-0.0060
	(0.0051)	(0.0050)	(0.0050)
Growth	-0.0007	-0.0007	-0.0008
	(0.0015)	(0.0015)	(0.0015)
Small Profit	-0.0105	-0.0104	-0.0105
	(0.0068)	(0.0068)	(0.0068)
Small Loss	-0.0125	-0.0127	-0.0123
	(0.0121)	(0.0121)	(0.0120)
Profit	0.0032	0.0033	0.0032
	(0.0043)	(0.0043)	(0.0043)
Insolvent	-0.0127	-0.0146	-0.0304
	(0.1482)	(0.1497)	(0.1373)
Intercept	0.0319	0.0315	0.0426*
	(0.0222)	(0.0227)	(0.0228)
Year FE	Yes	Yes	Yes
Below Target+*Big 4*Below Target* = 0			0.9839
R^2	5.72%	5.76%	6.08%
Wald χ^2	132.98	138.08	134.16
Observations	4,239	4,239	4,239

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

Table 11: Commercial Lines Results with External Monitoring

Dependent Variable: Reserve Error

	>60%		>70%		>80%	
	(1)	(2)	(3)	(4)	(5)	(6)
Above A-	-0.0037	-0.0030	-0.0026	-0.0019	-0.0030	-0.0020
	(0.0045)	(0.0045)	(0.0051)	(0.0051)	(0.0059)	(0.0058)
Below A-	-0.0240***	-0.0301***	-0.0275***	-0.0341***	-0.0324***	-0.0430***
	(0.0077)	(0.0080)	(0.0094)	(0.0094)	(0.0107)	(0.0108)
Big 4		-0.0077		-0.0092*		-0.0098
		(0.0047)		(0.0054)		(0.0064)
*Big 4*Below A-*		0.0158		0.0172		0.0265
		(0.0142)		(0.0184)		(0.0197)
Size	-0.0023*	-0.0025*	-0.0029*	-0.0031*	-0.0033*	-0.0037**
	(0.0014)	(0.0014)	(0.0016)	(0.0016)	(0.0018)	(0.0019)
Reinsurance	-0.0269***	-0.0278***	-0.0291***	-0.0297***	-0.0337***	-0.0343***
	(0.0068)	(0.0067)	(0.0077)	(0.0076)	(0.0090)	(0.0088)
Tax Shield	0.0733	0.0696	0.0791	0.0761	0.0664	0.0643
	(0.0913)	(0.0926)	(0.1031)	(0.1048)	(0.1101)	(0.1124)
Geo Herf	0.0020	0.0014	0.0018	0.0008	0.0053	0.0038
	(0.0062)	(0.0062)	(0.0072)	(0.0071)	(0.0081)	(0.0079)
Mutual	0.0016	0.0016	0.0033	0.0029	0.0076	0.0071
	(0.0053)	(0.0053)	(0.0067)	(0.0067)	(0.0078)	(0.0077)
Product Diverse	0.0122*	0.0124*	0.0133	0.0129	0.0178*	0.0172*
	(0.0064)	(0.0064)	(0.0081)	(0.0080)	(0.0093)	(0.0091)
Longtail	0.0394***	0.0389***	0.0398***	0.0391***	0.0408***	0.0401***
	(0.0076)	(0.0076)	(0.0078)	(0.0078)	(0.0081)	(0.0081)
Group	-0.0077	-0.0090	-0.0101	-0.0113	-0.0116	-0.0136*
	(0.0065)	(0.0063)	(0.0074)	(0.0071)	(0.0082)	(0.0078)
Growth	0.0003	0.0003	0.0006	0.0005	0.0013	0.0012
	(0.0015)	(0.0015)	(0.0016)	(0.0016)	(0.0017)	(0.0017)
Small Profit	-0.0068	-0.0049	-0.0051	-0.0033	-0.0048	-0.0022
	(0.0097)	(0.0096)	(0.0108)	(0.0108)	(0.0117)	(0.0117)
Small Loss	-0.0112	-0.0117	-0.0134	-0.0140	-0.0163	-0.0171
	(0.0134)	(0.0132)	(0.0148)	(0.0145)	(0.0169)	(0.0165)
Profit	0.0134*	0.0141**	0.0144*	0.0147*	0.0171*	0.0176*
	(0.0072)	(0.0072)	(0.0084)	(0.0084)	(0.0091)	(0.0091)
Insolvent	-0.0601	-0.0833	-0.0529	-0.0772	-0.0471	-0.0808
	(0.1500)	(0.1473)	(0.1571)	(0.1539)	(0.1551)	(0.1497)
Intercept	0.0477	0.0538*	0.0614*	0.0686**	0.0661*	0.0780**
	(0.0292)	(0.0293)	(0.0335)	(0.0337)	(0.0378)	(0.0382)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
*Below A-+Big 4*Below A-* = 0		0.2909		0.3457		0.3853
F-Stat	5.34	4.94	5.05	4.64	5.28	4.83
R^2	5.71%	6.00%	6.01%	6.33%	7.16%	7.66%
Observations	3,478	3,478	2,873	2,873	2,343	2,343

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

Appendix A: Ordered Probit Models

The following tables present results from estimation of cross-sectional ordered probit models. Table A1 and Table A2 present results from estimation of equation (2) for each year of our sample. Table A3 and Table A4 present results from estimation of equation (3) for each year in our sample. The estimated coefficients from these models are used to create a target rating variable for each firm-year in our sample.

Table A1: Ordered Probit Regression Results: 1992-1999

Dependent Variable: *Rating*

	1992	1993	1994	1995	1996	1997	1998	1999
Size	0.3148***	0.2950***	0.3415***	0.3405***	0.3266***	0.3264***	0.3500***	0.4097***
	(0.0280)	(0.0286)	(0.0299)	(0.0282)	(0.0296)	(0.0271)	(0.0277)	(0.0303)
Hurricane	-0.0818	-0.0951	-0.0955	-0.0873	-0.2042*	-0.3050***	-0.1679	-0.1998
	(0.1153)	(0.1110)	(0.1093)	(0.1090)	(0.1138)	(0.1155)	(0.1090)	(0.1216)
Product Diverse	0.0195	0.1839	0.0861	0.1797	0.2986**	0.3251***	0.3383***	0.2878**
	(0.1341)	(0.1304)	(0.1268)	(0.1158)	(0.1207)	(0.1162)	(0.1121)	(0.1168)
Longtail	-0.0913	0.0432	0.0306	0.0300	0.1023	0.0843	-0.0537	0.1223
	(0.1284)	(0.1231)	(0.1189)	(0.1149)	(0.1199)	(0.1178)	(0.1150)	(0.1245)
Reinsurance	0.3423**	0.3733***	0.6738***	0.5233***	0.4776***	0.6226***	0.8135***	1.0679***
	(0.1355)	(0.1354)	(0.1405)	(0.1353)	(0.1377)	(0.1404)	(0.1340)	(0.1444)
Growth	0.1046*	0.0025	0.1725**	0.2129***	0.0654	0.1109**	0.1405*	0.1299**
	(0.0619)	(0.0447)	(0.0691)	(0.0793)	(0.0559)	(0.0559)	(0.0733)	(0.0524)
Geo Herf	0.0127	-0.1007	-0.1295	-0.2181**	-0.1486	-0.2231**	-0.2475**	-0.1992*
	(0.1051)	(0.1020)	(0.1003)	(0.0995)	(0.1025)	(0.1075)	(0.1056)	(0.1101)
ROA	0.6090	4.5245***	3.4179***	4.4644***	3.6797***	3.9349***	2.6021***	3.5464***
	(0.7831)	(0.8443)	(0.8232)	(0.8892)	(0.9036)	(0.9011)	(0.7983)	(0.9066)
ROI	-1.1722	-5.1663***	4.7474**	-2.4201	-3.7648*	-1.9143	-2.0223	-4.4718*
	(1.7128)	(1.6974)	(2.1482)	(2.1381)	(2.1672)	(2.1163)	(1.8059)	(2.3352)
Kenny Ratio	-0.2165***	-0.1059	-0.1156*	-0.2085***	-0.0544	-0.1364*	-0.1460**	-0.0501
	(0.0632)	(0.0657)	(0.0645)	(0.0636)	(0.0664)	(0.0704)	(0.0742)	(0.0793)
Earthquake	2.8072	1.7007	5.3864	-1.6208	-1.2017	3.7460	2.3382	-6.4742**
	(4.0796)	(5.4041)	(4.0222)	(3.4265)	(3.1870)	(3.7413)	(4.2441)	(3.0605)
Surplus	1.8773***	1.8482***	2.0315***	1.8122***	2.0384***	1.4574***	0.9835***	1.8459***
	(0.2910)	(0.2994)	(0.3046)	(0.2838)	(0.3112)	(0.2897)	(0.2770)	(0.3162)
Group	0.2454***	0.2887***	0.2610***	0.3384***	0.3562***	0.3271***	0.3382***	0.4184***
	(0.0882)	(0.0857)	(0.0854)	(0.0799)	(0.0817)	(0.0830)	(0.0810)	(0.0876)
Observations	1,173	1,240	1,246	1,277	1,187	1,131	1,126	1,104
Wald χ^2	363.89	367.01	470.24	535.67	469.31	490.53	518.99	717.09
Model p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo-R^2	0.0902	0.0927	0.1181	0.1151	0.1099	0.1191	0.1164	0.1467

Note: This table presents results from cross-section estimates of an ordered probit model for years 1992-1999. The dependent variable, *Rating* is a firm's A.M. Best financial strength rating, where 8 corresponds to the highest rating ("A++") and 1 corresponds to the lowest rating ("B-"). *Size* is the natural log of a firm's assets. *Product Diverse* is 1 minus a line-of-business Herfindahl index. *Longtail* is the percentage of premiums written in long-tailed lines. *Reinsurance* is reinsurance ceded divided by the sum of reinsurance assumed and direct premiums written. *Geo Diverse* is a Herfindahl index of direct premiums written in the 50 U.S. states and Washington D.C. *Growth* is the change in net premiums written from year $t-1$ to year t. *ROA* is a firm's net income divided by total assets in year t. *ROI* is a firm's net investment income divided by total assets in year t. *Kenny Ratio* is net premiums written divided by policyholder surplus. *Earthquake* is the percentage of net premiums written in earthquake insurance. *Surplus* is policyholder surplus divided by total assets. *Group* is a binary variable equal to 1 if a firm is a member of a group and 0 otherwise. *Hurricane* is the percentage of direct premiums written in hurricane-prone states. Constants and threshold parameters are omitted. Robust standard errors are in parentheses beneath each coefficient estimate. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table A2: Ordered Probit Regression Results: 2000-2008

Dependent Variable: *Rating*

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Size	0.4134***	0.4468***	0.3923***	0.3583***	0.3730***	0.3851***	0.3683***	0.3646***	0.3758***
	(0.0291)	(0.0298)	(0.0279)	(0.0281)	(0.0279)	(0.0304)	(0.0293)	(0.0271)	(0.0256)
Hurricane	-0.1380	-0.0808	-0.1336	-0.0875	0.0691	-0.0365	-0.1037	-0.2358**	-0.3080***
	(0.1046)	(0.1075)	(0.1015)	(0.0995)	(0.1013)	(0.1034)	(0.1067)	(0.1080)	(0.1072)
Product Diverse	0.1383	0.3391***	0.1567	0.4006***	0.2469**	0.0904	0.1492	0.2297**	0.2430**
	(0.1090)	(0.1116)	(0.1099)	(0.1066)	(0.1177)	(0.1161)	(0.1106)	(0.1141)	(0.1082)
Longtail	-0.0154	-0.0531	-0.1392	-0.2481**	-0.0596	-0.0331	-0.1346	-0.2123*	-0.0772
	(0.1125)	(0.1124)	(0.1113)	(0.1134)	(0.1215)	(0.1194)	(0.1223)	(0.1277)	(0.1277)
Reinsurance	0.7979***	0.5279***	0.4589***	0.3313***	0.5595***	0.8916***	0.8045***	0.6437***	0.8708***
	(0.1397)	(0.1383)	(0.1292)	(0.1266)	(0.1375)	(0.1446)	(0.1391)	(0.1355)	(0.1234)
Growth	0.1200*	0.0083	0.1566***	0.1908**	0.1134**	-0.0529	-0.0769	-0.0030	-0.0035
	(0.0637)	(0.0523)	(0.0417)	(0.0779)	(0.0450)	(0.0696)	(0.0630)	(0.0602)	(0.0269)
Geo Herf	-0.1625	-0.0224	0.0846	0.0396	-0.1136	-0.1521	-0.2115**	-0.2045*	-0.1002
	(0.1082)	(0.1039)	(0.1021)	(0.1035)	(0.1035)	(0.1054)	(0.1042)	(0.1068)	(0.1026)
ROA	3.8348***	2.0846**	3.2730***	3.6092***	5.0442***	3.4309***	4.7123***	1.9895**	3.7343***
	(0.8198)	(0.8548)	(0.8366)	(0.9490)	(0.8706)	(0.9978)	(1.0103)	(0.9448)	(0.7656)
ROI	-5.7571***	0.0556	-2.7779	-2.9301	0.0999	1.5788	-8.1043***	-0.6468	-3.9028**
	(1.9437)	(2.0256)	(1.7508)	(2.0175)	(2.3672)	(3.0043)	(2.6945)	(2.6797)	(1.8931)
Kenny Ratio	-0.0833	-0.1329*	-0.1763***	-0.0884	-0.0350	-0.0306	-0.1229	-0.2221**	-0.0300
	(0.0712)	(0.0723)	(0.0673)	(0.0667)	(0.0755)	(0.0861)	(0.0953)	(0.0999)	(0.0743)
Earthquake	4.6685	6.3356	-4.8563	-5.8567**	-3.2972	-0.3391	1.6755	2.0349	-4.6043
	(4.1863)	(4.4331)	(3.0033)	(2.6723)	(3.0965)	(4.4533)	(4.0110)	(4.2694)	(3.5528)
Surplus-to-Assets	1.3379***	1.7545***	1.2780***	1.5099***	1.9744***	1.9203***	1.7828***	1.5963***	1.7879***
	(0.2848)	(0.2945)	(0.3014)	(0.2739)	(0.3169)	(0.3392)	(0.3384)	(0.3249)	(0.2742)
Group	0.5241***	0.4416***	0.4740***	0.4403***	0.3526***	0.3350***	0.3785***	0.4365***	0.4314***
	(0.0820)	(0.0797)	(0.0759)	(0.0753)	(0.0777)	(0.0822)	(0.0786)	(0.0783)	(0.0759)
Observations	1,220	1,220	1,201	1,140	1,182	1,167	1,208	1,172	1,224
Wald χ^2	588.96	565.42	539.44	504.45	539.64	650.69	610.24	649.41	608.88
Model p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo-R^2	0.1239	0.1167	0.1203	0.1195	0.1259	0.1406	0.1362	0.1407	0.1321

Note: This table presents results from cross-section estimates of an ordered probit model for years 2000-2008. The dependent variable, *Rating* is a firm's A.M. Best financial strength rating, where 8 corresponds to the highest rating ("A++") and 1 corresponds to the lowest rating ("B-"). *Size* is the natural log of a firm's assets. *Product Diverse* is 1 minus a line-of-business Herfindahl index. *Longtail* is the percentage of premiums written in long-tailed lines. *Reinsurance* is reinsurance ceded divided by the sum of reinsurance assumed and direct premiums written. *Geo Diverse* is a Herfindahl index of direct premiums written in the 50 U.S. states and Washington D.C. *Growth* is the change in net premiums written from year $t-1$ to year t. *ROA* is a firm's net income divided by total assets in year t. *ROI* is a firm's net investment income divided by total assets in year t. *Kenny Ratio* is net premiums written divided by policyholder surplus. *Earthquake* is the percentage of net premiums written in earthquake insurance. *Surplus* is policyholder surplus divided by total assets. *Group* is a binary variable equal to 1 if a firm is a member of a group and 0 otherwise. *Hurricane* is the percentage of direct premiums written in hurricane-prone states. Constants and threshold parameters are omitted. Robust standard errors are in parentheses beneath each coefficient estimate. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table A3: Ordered Probit Regression Results-IRIS Ratios: 1992-1999

Dependent Variable: *Rating*								
	1992	1993	1994	1995	1996	1997	1998	1999
Size	0.2756***	0.3620***	0.3933***	0.4104***	0.3864***	0.4134***	0.4067***	0.3657***
	(0.0213)	(0.0222)	(0.0225)	(0.0226)	(0.0221)	(0.0229)	(0.0221)	(0.0210)
Mutual	0.1448*	0.0313	0.0007	-0.1138	-0.1227*	-0.1767**	-0.2995***	-0.3617***
	(0.0760)	(0.0725)	(0.0721)	(0.0704)	(0.0724)	(0.0758)	(0.0777)	(0.0767)
GPW-to-Surplus	0.0004***	0.0005***	0.0007***	0.0006***	0.0009***	0.0010***	0.0013***	0.0014***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
NPW-to-Surplus	-0.0048***	-0.0031***	-0.0034***	-0.0030***	-0.0036***	-0.0040***	-0.0046***	-0.0048***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0006)	(0.0005)
ΔNPW	-0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	-0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Surplus Aid	-0.0288***	-0.0200***	-0.0236***	-0.0314***	-0.0259***	-0.0276***	-0.0396***	-0.0389***
	(0.0063)	(0.0062)	(0.0061)	(0.0061)	(0.0064)	(0.0068)	(0.0068)	(0.0063)
Operating Ratio	-0.0003	-0.0001	-0.0005	-0.0007**	-0.0008**	-0.0001	0.0005*	-0.0001
	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0002)
Investment Yield	-0.0042	-0.0096	0.0177	-0.0216	-0.0274**	-0.0189	-0.0095	-0.0196
	(0.0192)	(0.0210)	(0.0218)	(0.0136)	(0.0127)	(0.0249)	(0.0243)	(0.0141)
$\Delta Surplus$	-0.0044***	-0.0053***	0.0003	-0.0024*	-0.0024*	-0.0035***	-0.0049***	0.0034**
	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0014)	(0.0015)	(0.0014)
Liabilities-to-Surplus	-0.0034***	-0.0148***	-0.0138***	-0.0158***	-0.0106***	-0.0144***	-0.0060***	-0.0030***
	(0.0010)	(0.0017)	(0.0016)	(0.0018)	(0.0014)	(0.0017)	(0.0011)	(0.0010)
Gross Agents' Balances	0.0021	0.0072***	0.0016	0.0034	0.0014	0.0108***	-0.0002	-0.0015
	(0.0023)	(0.0024)	(0.0024)	(0.0026)	(0.0028)	(0.0029)	(0.0031)	(0.0034)
One-Year Development	3.8193	-0.4317	1.2104	-0.0858	0.2203	-2.5998	0.6171	4.2423
	(2.4902)	(3.5742)	(3.4347)	(1.5931)	(0.9763)	(1.8382)	(2.3774)	(3.0871)
Two-Year Development	-2.3193	-1.1548	-0.0141	0.3147	-0.3207***	1.6394	0.1906	-3.1358*
	(1.4838)	(2.3372)	(2.1141)	(1.6838)	(0.1233)	(1.2317)	(0.3629)	(1.7302)
Reserve Deficiency	0.0025**	0.0002	0.0011	0.0032***	0.0012	0.0030**	0.0009	0.0035**
	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0014)	(0.0014)	(0.0014)	(0.0015)
Observations	1,140	1,238	1,268	1,279	1,203	1,127	1,096	1,122
Wald χ^2	309.71	402.23	485.13	565.32	472.83	502.99	486.76	513.05
Model p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo-R^2	0.0804	0.0938	0.1084	0.1214	0.1091	0.1248	0.1230	0.1263

Note: This table presents results from cross-section estimates of an ordered probit model for years 1992-1999. The dependent variable, *Rating* is a firm's A.M. Best financial strength rating, where 8 corresponds to the highest rating ("A++") and 1 corresponds to the lowest rating ("B-"). *Size* is the natural log of a firm's assets. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *GPW-to-Surplus* is gross premiums written divided by surplus. *NPW-to-Surplus* is net premiums written divided by surplus. ΔNPW is the change in net premiums written. *Surplus Aid* is surplus aid divided by surplus. *Operating Ratio* is the two-year overall operating ratio. *Investment Yield* is net investment income over cash and invested assets. $\Delta Surplus$ is the gross change in surplus. *Liabilities-to-Surplus* is adjusted liabilities divided by liquid assets. *Gross Agents' Balances* is gross agents' balances (in collection) divided by surplus. *One-Year Development* is one-year reserve development divided by surplus. *Two-Year Development* is two-year reserve development divided by surplus. *Reserve Deficiency* is the estimated current reserve deficiency divided by surplus. Constants and threshold parameters are omitted. Robust standard errors are in parentheses beneath each coefficient estimate. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table A4: Ordered Probit Regression Results-IRIS Ratios: 2000-2008

Dependent Variable: *Rating*									
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Size	0.4177***	0.4453***	0.4127***	0.3996***	0.3836***	0.3962***	0.3987***	0.4355***	0.3914***
	(0.0227)	(0.0235)	(0.0222)	(0.0226)	(0.0222)	(0.0225)	(0.0217)	(0.0249)	(0.0217)
Mutual	-0.3743***	-0.1271	-0.0904	-0.0881	-0.0469	0.0262	-0.0006	0.1125	0.0503
	(0.0762)	(0.0775)	(0.0748)	(0.0745)	(0.0749)	(0.0765)	(0.0780)	(0.0854)	(0.0780)
GPW-to-Surplus	0.0013***	0.0007***	0.0007***	0.0006***	0.0008***	0.0011***	0.0010***	0.0009***	0.0009***
	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
NPW-to-Surplus	-0.0050***	-0.0052***	-0.0043***	-0.0043***	-0.0045***	-0.0050***	-0.0049***	-0.0061***	-0.0047***
	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0007)	(0.0005)
ΔNPW	0.0000	0.0000	0.0001***	0.0000	-0.0000	0.0000	-0.0000	-0.0001	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.0000)
Surplus Aid	-0.0394***	-0.0499***	-0.0470***	-0.0523***	-0.0443***	-0.0356***	-0.0395***	-0.0372***	-0.0518***
	(0.0058)	(0.0061)	(0.0055)	(0.0061)	(0.0061)	(0.0071)	(0.0078)	(0.0088)	(0.0084)
Operating Ratio	-0.0004	0.0002	-0.0004*	-0.0003	-0.0006**	0.0004	-0.0008***	-0.0001	-0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0002)
Investment Yield	-0.0105	0.0019	-0.0001	0.0262	0.0151	0.0188	-0.0221	0.0491*	0.0008
	(0.0193)	(0.0236)	(0.0139)	(0.0189)	(0.0181)	(0.0181)	(0.0226)	(0.0262)	(0.0188)
$\Delta Surplus$	0.0003	0.0013	0.0012	-0.0009	-0.0003	-0.0055***	-0.0012	-0.0036*	-0.0011
	(0.0015)	(0.0015)	(0.0013)	(0.0012)	(0.0014)	(0.0013)	(0.0015)	(0.0019)	(0.0016)
Liabilities-to-Surplus	-0.0002**	-0.0003***	-0.0003***	-0.0004***	-0.0003***	-0.0004***	-0.0004***	-0.0005***	-0.0005***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Gross Agents' Balances	-0.0033	0.0031	-0.0014	0.0039*	0.0021	0.0013	-0.0020	0.0016	-0.0010
	(0.0027)	(0.0023)	(0.0020)	(0.0022)	(0.0021)	(0.0022)	(0.0021)	(0.0029)	(0.0025)
One-Year Development	3.3577	1.2969*	-2.9657	2.1966	3.7605*	8.4604***	-0.0015	1.6090	-0.6492
	(4.2628)	(0.6756)	(3.0374)	(2.5852)	(1.9309)	(1.9558)	(0.0010)	(5.5644)	(3.3333)
Two-Year Development	-5.8396**	-0.3184	-2.1512	-3.7678***	-6.5294***	-8.7191***	-0.5236**	-6.2977**	0.0692
	(2.8140)	(0.3461)	(2.3663)	(1.4007)	(1.8718)	(1.9306)	(0.2488)	(3.0440)	(3.1221)
Reserve Deficiency	-0.0006	-0.0004	0.0010	0.0016	0.0037***	0.0041***	0.0051***	-0.0020	0.0032*
	(0.0014)	(0.0012)	(0.0012)	(0.0013)	(0.0014)	(0.0014)	(0.0016)	(0.0021)	(0.0017)
Observations	1,195	1,139	1,264	1,243	1,248	1,219	1,227	908	1,249
Wald χ^2	598.68	571.64	585.69	520.39	487.99	470.93	466.72	436.85	448.60
Model p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo-R^2	0.1394	0.1393	0.1305	0.1174	0.1098	0.1099	0.1108	0.1407	0.1075

Note: This table presents results from cross-section estimates of an ordered probit model for years 2000-2008. The dependent variable, *Rating* is a firm's A.M. Best financial strength rating, where 8 corresponds to the highest rating ("A++") and 1 corresponds to the lowest rating ("B-"). *Size* is the natural log of a firm's assets. *Mutual* is a binary variable equal to 1 if a firm is a mutual and 0 otherwise. *GPW-to-Surplus* is gross premiums written divided by surplus. *NPW-to-Surplus* is net premiums written divided by surplus. ΔNPW is the change in net premiums written. *Surplus Aid* is surplus aid divided by surplus. *Operating Ratio* is the two-year overall operating ratio. *Investment Yield* is net investment income over cash and invested assets. $\Delta Surplus$ is the gross change in surplus. *Liabilities-to-Surplus* is adjusted liabilities divided by liquid assets. *Gross Agents' Balances* is gross agents' balances (in collection) divided by surplus. *One-Year Development* is one-year reserve development divided by surplus. *Two-Year Development* is two-year reserve development divided by surplus. *Reserve Deficiency* is the estimated current reserve deficiency divided by surplus. Constants and threshold parameters are omitted. Robust standard errors are in parentheses beneath each coefficient estimate. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.