On-Site Financial Examination and Reserve Management for US Property-Liability Insurers

Abstract

Insurance regulators play an important role in monitoring the financial condition of insurers. Once every three to five years, state insurance regulators are mandated to perform an on-site examination for each insurer to ensure insurance solvency and protect consumers. This scheduled on-site examination thus provides financially weak insurers incentives to engage in opportunistic reporting. In this paper, we investigates the impact of on-site financial examinations on reserve management for US property-liability insurers. We expect that financially weak insurers intend to underestimate loss reserves to mask their financial conditions when they undergo financial examinations. In addition, since regulators' on-site examination could intensify large auditors' concern for their reputation and litigation risk, we investigate whether large auditors will be more effective in preventing their clients from under-estimate loss reserves when their clients receive on-site examinations. Particularly, we expect that insurers receiving on-site financial examinations report more conservative loss reserves if they are audited by large auditors.

JEL descriptors: M41; M42; G22

Keywords: Insurance Industry; Reserve management; Financial regulation

1. Introduction

One of major differences between insurance and general industries is that the insurance industry is subject to additional layer of monitoring provided by state insurance regulators. Insurance regulators play an important role in monitoring the financial condition of insurers and ensuring that they have the ability to honor their contractual obligations. To ensure the solvency of insurers and the protection for consumers, state insurance regulators are required by law to perform on-site examinations whenever it is necessary. In addition, the law also mandates that all companies be required to receive examinations once every three to five years.[1] After the examination, insurance regulators will have to issue examination reports.[2]

A financial examination looks at the company's financial conditions as of a particular date, usually December 31, to determine whether it meets the financial requirements to continue doing business in the state. In particular, the examination serves to identify as early as possible those insurers experiencing financial trouble, and subsequent regulation intervention may follow. Therefore, the on-site examination may provide financially weak insurers incentives to engage in optimistic reporting. According to prior studies (e.g., Petroni 1992), loss reserve is the most likely accounting item that is subject to such opportunistic behaviors.

According to Statutory Accounting Principles (SAP), a property-liability insurer

[1] Examiners typically account a substantial portion of personnel in the insurance department. They could be state employees or employees of private audit firms, who conduct most of their examination works in insurance company home or branch offices. Expenses associated with on-site examinations are paid by examined companies.

[2] The report contains a summary on financial conditions from the most recent annual statements. It also includes a discussion of adverse findings, material changes and other important regulatory information disclosed by the examination.

must estimate the reserve for unpaid claims resulting from losses that occurred before the balance sheet date. However, since some of the losses may not have been reported to the insurer, estimating the loss reserve requires a great deal of judgment and is thus subject to substantial managerial discretion. In addition, the loss reserve is the largest liability on the balance sheet of a property-liability insurer. Over- or under-reporting the loss reserve could result in a material misstatement. It follows that the insurer may estimate the loss reserve opportunistically to mask its financial status, leading to misjudgment by stakeholders. In particular, studies provide empirical evidence that insurers manage loss reserves to smooth earnings (Weiss 1985; Petroni, Ryan, and Wahlen 2000), minimize tax payment (Grace 1990; Gaver and Paterson, 2001), avoid reporting losses (Beaver, McNichols, and Nelson 2003), and avoid regulatory intervention (Petroni 1992; Gaver and Paterson 2001 and 2004; Grace and Leverty 2010). Furthermore, individual managers may manipulate the loss reserve in order to receive higher compensation (Eckles and Halek 2010).

Empirical evidence shows that in some cases, disclosure or monitoring mechanisms could mitigate these opportunistic behaviors and/or the impact of such behaviors. For example, Anthony and Petroni (1997) and Beaver and McNichols (1998) find that the SEC-mandated disclosures of reserve errors help investors in stock valuation decisions. In addition, monitoring by regulators (Gaver and Paterson 2000) or by large auditors and actuaries (Petroni and Beasley 1996; Gaver and Paterson 2001 and 2007) is associated with relatively conservative reserve estimate among financially weak insurers.

According to Petroni (1992), insurance companies balance the costs and benefits of optimistic reporting. In particular, high quality insurers must develop and maintain a reputation for fairly reporting their financial conditions, and they have more to lose by

overstating their financial conditions. In contrast, low quality firms have higher incentives for optimistic reporting to mask their financial conditions since their desired solvency levels may be lower than that required by regulators. Regulatory intervention increases benefits for low quality firms to optimistic reporting. Studies (e.g. Petroni, 1992) also show that the incentive to manage loss reserve is a function of an insurer's financial condition.

This paper examines the impact of scheduled on-site examination on loss reserve bias. We expect that financially weak insurers have higher incentives to underestimate loss reserves to mask their financial conditions when they undergo financial examinations. In addition, since regulators' on-site examination could intensify large auditors' concern for their reputation and litigation risk, we investigate whether large auditors will be more effective in preventing their clients from under-estimate loss reserves when their clients receive on-site examinations. We expect the magnitude of understatement by financially weak insurers may be mitigated if they are audited by large auditors.

Our paper adds to the literature in many ways. This paper is the first to examine the effect of regulators' on-site examination on insurers' reserve management. Demsetz and Lehn (1985) point out that regulation "provides some subsidized monitoring and disciplining of the management of regulated firms" (p. 1161). On-site examination is probably the most powerful way for regulators to monitor the financial conditions of the regulated companies. However, the efficacy of on-site financial examinations on reserve management is never investigated. Second, prior studies have pointed out that large auditors provide better audit quality. Petroni and Beasley (1996), however, show that insurers audited by large auditors don't report more conservative loss reserves. It is not clear why the superiority of large auditors over small auditors observed in general

industries is not found in the insurance industry. It is possible that the additional layer of monitoring provided by the on-site examination dampens the importance of the monitoring role provided by large auditors. Our empirical results may address this possible substitution effect between regulators' monitoring and large auditors' monitoring. Finally, this paper provides empirical evidence regarding how regulated industries may cope with the regulator's monitoring. Grace and Leverty (2010) find that insurers manage their loss reserves to minimize the cost of price regulation. In this paper, we investigate whether insurers report loss reserve differently in response to the on-site examination.

The remaining part of this paper is organized as follows. Section 2 develops the hypotheses; Section 3 describes the data and methodology; Section 4 presents empirical results; and Section 5 concludes.

2. Hypothesis Development

Healy and Palepu (1991) point out that managers may hold private information and release such information opportunistically. However, the magnitude of such opportunistic reporting may depend on the costs and benefits. For example, studies have provided empirical evidence showing that managers manipulate loss reserve to maximize firm value or their own compensation. In particular, insurers may overstate loss reserve to minimize expected tax (Grace, 1990, and Gaver and Paterson, 2001), and individual managers may manipulate loss reserve to maximize their compensation (Eckles and Halek, 2010).

Regulation also increases benefits for insurers to manage loss reserve. Since regulation imposes costs on insurers, studies have tested and found that insurers may manage loss reserve to minimize regulator intervention and associated costs (Petroni, 1992;

Grace and Leverty 2010). In particular, the insurance industry is subject to financial regulation. One of the well-known financial regulation is the Insurance Regulatory Information System (IRIS) established by the National Association of Insurance Commissioners (NAIC). Insurance regulators use IRIS to screen out financially weak insurers. IRIS composes of 13 ratios for properties-liability insurers, and each ratio has usual range. Insurers having more than four of these ratios outside the usual range may be subject to financial examinations. The examination that follows IRIS test failure is carried out with very little, if any, prior notice. However, since the definitions and usual ranges of IRIS ratios are public information, insurers are able to engage in optimistic reporting. Many studies (e.g., Petroni 1992) have found that the incentive to manage loss reserve is a function of the insurer's financial condition. In addition, financially weak insurers are more likely to underestimate loss reserves to mask their actual financial conditions.

In addition to those IRIS-related financial examinations, insurers are required to undergo regular on-site examinations of financial conditions and demonstrate compliance with market conduct standards once every three to five years. Insurers scheduled for financial examinations are often asked to provide specific information before the examiners' visit. By reviewing this information before visiting the insurer, the examiners can identify potential problems that may exist to reduce the cost and time. During the on-site visit, the insurance department examiners review the insurer' solvency and look at the company's financial condition as of a particular date to determine whether it meets the financial requirements to continue doing business in the state. Insurers identified as financially weak may be subject to subsequent regulatory intervention.

Since state regulators perform on-site examinations on a cyclical basis, insurers

generally have ample notices of when their next examinations will occur. According to Petroni (1992), high quality insurers are more likely to build their reputation for maintaining a fair presentation of their financial conditions. In contrast, low quality insurers are less willing to reveal their financial conditions, and thus are more likely to engage in optimistic reporting. Likewise, Petroni (1992) argue that the incentive to overstate financial conditions is higher for insurers with financially weak conditions. Since on-site examinations may provide financially weak insurers incentives to manage loss reserve, we expect financially weak insurers scheduled for an on-site financial examination will under-estimate their loss reserves. By deflating loss reserve, financially weak insurers can enhance their financial conditions to avoid subsequent regulatory invention. In the meanwhile, financially healthy insurers have no incentives to mask their financial conditions. Thus, we have the following hypotheses:

HYPOTHESIS 1: *Financially healthy insurers will not under-estimate their loss reserve when they undergo on-site financial examinations.*

HYPOTHESIS 2: *Financially weak insurers will under-estimate their loss reserve when they undergo on-site financial examinations.*

During the on-site examinations, regulators may also review the work of the auditors to better understand the financial conditions of the insurer. At the same time, they assess the suitability of the auditors in terms of independence, experience, background, and ethics (Financial Sector Assessment Program, National Association of Insurance Commissioners (NAIC) Self-Assessment, 2009). If the auditor is deemed unsuitable, the

investigators may recommend improvements, and the regulators may consequently increase both the reporting requirements and the frequency of examinations.[3]

The review of the auditor's performance is comprehensive, encompassing the auditor's annual report, communications between the auditor and the insurer, and the audit report itself. During the on-site visit, the examiners replicate some of the work performed by the auditor.[4] If there are large discrepancies, the regulators may deem the audit quality deficient and call the suitability of the auditor into question.

Regulators depend on the work of auditors to complete an on-site examination. A high quality independent audit of the annual financial statement improves the regulators' surveillance on the firm's financial conditions. On the other hand, an unsatisfactory audit increases the risk that the regulators will misjudge the insurer's financial condition, enabling fraudulent financial statements to go undetected.[5] Just as auditors affect the work of regulators, regulators also affect the work of auditors. In particular, insurance regulators may sue and obtain settlements from an auditor responsible for an unqualified audit opinion on an insolvent insurer.[6] Regulatory pressures heighten the auditor's concern both for its

[3] According to *NAIC Financial Condition Examiners Handbook*, five principles exist in the on-site examination process. These principles include: 1. An active board and senior management oversight; 2. Adequate risk management, monitoring and management information systems; 3. Adequate and clear policies, authorization limits and procedures; 4. Comprehensive internal controls; and 5. Processes to assure compliance with laws and regulations. Some of the items are related with auditor's work.

[4] An important duty for auditors in an annual audit is to assess an insurer's internal controls, identify and report the weakness of the internal control to regulators for further review as required by *Annual Financial Reporting Model Regulation*. However, in performing on-site examinations, regulators will also evaluate the internal control process in place. In particular, regulators will assess all significant inherent risks faced by insurers, and assess the internal control processes that can mitigate each identified risk.

[5] For instance, Cummins, Harrington, and Klein (1995) find that the loss reserve in the RBC formula accounts for half of risk-based capital, but deliberate underestimation of the loss reserve negatively affects the predictive power the RBC model in early detection of insolvency. Similarly, Petroni (1992) finds that financially weak insurers bias their estimates of loss reserves downward to avoid regulatory attention.

[6] Not only investors, but also insurance regulators, may bring lawsuits against auditors. In the case "*Vermont Insurance Commissioners versus PwC*", PwC was required in a court of appeals to pay 119.9 million dollars plus interest to the State of Vermont due to PwC's failure "to disclose the insolvency of Ambassador Insurance Company following their 1981 and 1982 audit and negligently issued unqualified and favorable

reputation and for litigation risk, possibly increasing the conservatism of auditors.

Prior studies (Palmrose, 1986) indicate that large auditors provide better audit quality since they have more to lose in an audit failure. Empirical evidence suggests that insurers may manage loss reserve opportunistically.[7] However, empirical evidence also shows that external monitoring from large auditors is associated with relatively conservative reserve estimate among financially weak insurers (Petroni and Beasley 1996; Gaver and Paterson 2001 and 2007). The high stakes involved in the on-site examinations give large auditors an additional incentive to exercise care in the audit of the financial statement. We are interested in the question whether large auditors behave more aggressively in constraining their clients from under-estimating loss reserve. Likewise, we also intend to answer whether financially weak insurers audited by large auditors report more conservative loss reserve when they undergo on-site financial examinations.

HYPOTHESIS 3: *Insurers receiving on-site financial examinations report more conservative loss reserve if they are audited by large auditors.*

HYPOTHESIS 4: *Financially weak insurers receiving on-site financial examinations report more conservative loss reserve if they are audited by large auditors.*

3. Empirical Methodology

3.1. The Benchmark Model

We hypothesize that the on-site examination will provide incentives for financially

audit opinions."

[7] Studies provide empirical evidence that insurers manage loss reserve to smooth earnings (Weiss 1985; Petroni, Ryan, and Wahlen 2000), minimize tax payment (Grace 1990; Gaver and Paterson, 2001), avoid reporting losses (Beaver, McNichols, and Nelson 2003), and mitigate regulatory intervention (Petroni 1992; Gaver and Paterson 2001 and 2004; Grace and Leverty 2010). Furthermore, individual managers may manipulate the loss reserve in order to receive higher compensation (Eckles and Halek 2010).

weak insurers to under-estimate their loss reserve. Thus, the benchmark model is formulated as follows:

$$R_{i,t} = \alpha + \beta \times EXAM_{i,t} + \gamma \times FinancialWeakness_{i,t} + \delta \times EXAM_{i,t} \times FinancialWeakness_{i,t} + \theta \times Controls_{i,t} + \nu_{i,t}$$

where $R_{i,t}$ refers to loss reserve error for insurer *i* in year *t*, *EXAM* dummy variable is equal to 1 if the insurer *i* receives an on-site financial examination in year *t* and 0 otherwise, *Financial Weakness* is equal to 1 if insurer *i* fails the IRIS test in year *t* and 0 otherwise, $Control_{i,t}$ is a vector of control variables, reflecting firms' managerial incentives, types of business, product and geographical diversification, and other firm characteristics.

3.2 The Heckman Self-Selection Model

We also hypothesize that large auditors are more aggressive in constraining their clients from under-stating loss reserve when their clients undergo on-site examinations. A straightforward approach to test this hypothesis is to add an auditor type dummy variable and its interactions term with EXAM in the regression. This approach relies on at least two implicit assumptions. First, the regression assumes that the incremental effects of choosing a Big N auditor on reserve errors are constant across all firms, which justifies the use of a dummy variable to capture differences in reserve errors across auditor types. This assumption can be restrictive, as it does not allow for interactive effects between auditor type and firm characteristics and ignores differences in the demand for Big *N* auditors. Second, the model implicitly assumes that auditors are randomly allocated to client firms. However, it is widely accepted that clients self-select their auditors.

From an econometric perspective, self-selection introduces a bias in the standard OLS regressions. To address this point more formally, consider the following equations:

$$BigN_i^* = \alpha' X_i + u_i$$

Auditor choice equation: $BigN_i = 1$ if $BigN_i^* > 0$

$BigN_i = 0$ if $BigN_i^* \le 0$

Reserve error equation:

$$R_{0i} = \beta_0' Y_i + \varepsilon_{0i} \quad \text{if } BigN_i = 0$$
$$R_{1i} = \beta_1' Y_i + \varepsilon_{1i} \quad \text{if } BigN_i = 1$$

where X_i and Y_i are vectors of exogenous variables in the auditor choice equation and in the reserve error equation respectively, and the error terms, u_i, ε_{0i}, and ε_{1i}, are assumed to be normally distributed with mean zero and variance-covariance matrix given by

$$\Sigma = \begin{bmatrix} \sigma_{00} & \sigma_{01} & \sigma_{0u} \\ \sigma_{01} & \sigma_{11} & \sigma_{1u} \\ \sigma_{0u} & \sigma_{1u} & \sigma_{uu} \end{bmatrix}$$

This self-selection model, which is based on Lee (1979), is quite general in that it allows for simultaneity in the auditor-choice and reserve error equations, as well as for self-selection. The model also allows slope coefficients and the error terms in the reserve error equations to vary across auditor types.

Standard OLS regressions of the self-selection model are potentially misspecified. To show this, we take the conditional expectations of the residuals:

$$E\left[\varepsilon_{0i} \mid BigN_i = 0\right] = E\left[\varepsilon_{0i} \mid u_i \le -\alpha' X_i\right] = \sigma_{0u}\left[\frac{-\phi\left(-\alpha' X_i\right)}{\Phi\left(-\alpha' X_i\right)}\right] = \sigma_{0u}\left[\frac{-\phi\left(\alpha' X_i\right)}{1-\Phi\left(\alpha' X_i\right)}\right] = \sigma_{0u}\lambda_{0i}$$

$$E\left[\varepsilon_{1i} \mid BigN_i = 1\right] = E\left[\varepsilon_{1i} \mid u_i > -\alpha' X_i\right] = \sigma_{1u}\left[\frac{\phi\left(-\alpha' X_i\right)}{1-\Phi\left(-\alpha' X_i\right)}\right] = \sigma_{1u}\left[\frac{\phi\left(\alpha' X_i\right)}{\Phi\left(\alpha' X_i\right)}\right] = \sigma_{1u}\lambda_{1i}$$

Define the inverse Mills ratios $\lambda_{0i} \equiv \frac{-\phi(\alpha' X_i)}{1-\Phi(\alpha' X_i)}$ and $\lambda_{1i} \equiv \frac{\phi(\alpha' X_i)}{\Phi(\alpha' X_i)}$, where the functions ϕ and Φ are the standard normal probability density function and the cumulative distribution function, respectively. In the above equations, if $\sigma_{0u} \neq 0$ or $\sigma_{1u} \neq 0$, then the conditional expectations are nonzero, causing the standard OLS regression to be misspecified. Moreover, in this case, OLS regressions yield biased estimates for the primary parameter of interest, namely the average benefit or cost of auditor choice. To see this, note that the average benefit or cost of auditor choice is given by:

For non-Big *N* clients: $\bar{R}_0 - E[R_1 \mid BigN = 0] = \bar{R}_0 - \beta_1' \bar{Y} - \sigma_{1u} \bar{\lambda}_0$

For Big *N* clients: $\bar{R}_1 - E[R_0 \mid BigN = 1] = \bar{R}_1 - \beta_0' \bar{Y} - \sigma_{0u} \bar{\lambda}_1$

where a bar over a variable denotes its cross-sectional average. If σ_{0u} is positive, then the reserve error differential estimated from OLS regressions will be biased upward for Big *N* clients as $\bar{\lambda}_1 > 0$. Similarly, if σ_{1u} is positive, then the reserve error differential estimated from OLS regressions will be biased downward for non-Big *N* clients, as $\bar{\lambda}_0 < 0$.

3.3 Implementation and Identification

Using the two-stage procedure of Heckman (1979) and Lee (1979), we estimate the self-selection model. In the first stage, consistent estimates for α are obtained from a probit regression of the dummy variable, $Big5_i$, on X_i.

$$BigN_i^* = \alpha' X_i + u_i$$
$$BigN_i = 1 \text{ if } BigN_i^* > 0$$
$$BigN_i = 0 \text{ if } BigN_i^* \leq 0$$

These estimates are used to compute the inverse Mills ratios (IMR), i.e., $\lambda_{0i} = \frac{-\phi(\alpha' X_i)}{1-\Phi(\alpha' X_i)}$ and $\lambda_{1i} = \frac{\phi(\alpha' X_i)}{\Phi(\alpha' X_i)}$.

In the second stage, the reserve error equation is estimated by OLS with the inverse Mills ratio included as an additional explanatory variable. Our self-selection model is given as:

$$R_{0i} = \beta_0' Y_i + \gamma_0 \lambda_{0i} + e_{0i} \quad \text{if } BigN_i = 0$$
$$R_{1i} = \beta_1' Y_i + \gamma_1 \lambda_{1i} + e_{1i} \quad \text{if } BigN_i = 1$$

The coefficients, γ_0 and γ_1, are the estimates for σ_{0u} and σ_{1u}. As a result, the conditional and unconditional expected error terms equal zero

$E[e_{0i} \mid BigN_i = 0] = 0$ and $E[e_{1i} \mid BigN_i = 1] = 0$.

Therefore, the OLS regression generates unbiased estimates once we control for the inverse Mills ratios.

If the *IMR* estimates are significant, then there exists self-selection of auditors in our sample. The reserve error input variables $\{Y_1,\ldots,Y_m\}$ must be a strict subset of the probit choice variables $\{X_1,\ldots,X_n\}$ to satisfy the identification condition governing Heckman Correction models (Wooldridge, 2006).

4. Sample Selection and Variable Definition

4.1 Sample Selection

We include in our sample the years 2001 through 2005. Most of the financial information is taken from the NAIC property-liability insurance database. However, we need a 5-year loss development window to calculate the reserve error. For example, to

measure the reserve error in 2001 (2005), we need to collect the corresponding loss reserve developed in 2006 (2010). We collect the annual statement data needed to compute the IRIS ratios.

Since the analysis also concerns the auditors' incentives, insurers exempted from the required external audit are excluded from our sample.[8] We adopt the sampling criteria proposed by Petroni (1992). In particular, insurers having no loss reserves are excluded. For this reason, we drop insurers who engage in pooling arrangements and who cede all premiums to reinsurers. We also exclude firms that write more than 25 percent of their premiums in surety and credit or accident and health. The above screening criteria generate 5,950 insurer-years.

4.2 Dependent Variables

In the first stage of our Heckman model, the dependent variable is an auditor choice indicator. The second stage employs a continuous measure of the reserve error.

Auditor Choice. Theoretical and empirical research both support the notion that Big *N* auditors are more effective than Non-Big *N* auditors at limiting client opportunism. Because of their technical superiority and independence, they are presumed more likely to detect and disclose misstatements (DeAngelo, 1981). Auditor choice matters to clients, owners, and other stakeholders, since an effective audit checks opportunistic reporting among managers and/or reduces its impact. We define a binary indicator, *BigN*, that is equal to 1 if the insurer chooses a large auditor.

Reserve Error. Loss reserve error is defined as the difference between the total

[8] *Annual Financial Reporting Model Regulation* published by the NAIC requires an external audit of an insurer's financial statements. However, depending on the state, a small insurer, in terms of premiums and/or policy count, may be exempted from the audit requirement.

incurred losses for firm *i* as of a given calendar year *t* and a future estimate in calendar year *t+j* (Petroni 1992). Incurred losses, a statutory accounting term, are losses that are expected to be paid as a result of providing insurance coverage, including the losses that are known to the insurer and those that estimated to have occurred. After reporting the current year reserve estimate, the insurer is required to revise the estimate based on subsequent experience every year for the following ten years.

This paper adopts the commonly accepted practice that five years of loss experience are sufficient to observe a statistically significant reserve error (Petroni 1992; Petroni and Beasley 1996; Gaver and Paterson 2004). Following this literature, we also scale the reserve error by the total (admitted) assets in year *t*. The size of a reserve error is defined as

$$R_{i,t} = (Reserve_{i,t+5} - Reserve_{i,t}) / Asset_t$$

where $Reserve_{i,t}$ is insurer *i*'s estimated loss reserve for year *t*, and $Reserve_{i,t+5}$ is the corresponding developed reserve at year *t+5*. A positive reserve error indicates that the developed reserve exceeds the original estimate, suggesting that the insurer underestimated the reserve error at time *t*, and vice versa.

4.3 Control Variables

Mutual Insurer. The Financial Accounting Standards Board defines a mutual firm as "an entity other than an investor-owned entity that provides dividends, lower costs, or other economic benefits directly and proportionately to its owners, members, or participants" (FASB Concepts Statement No. 4, Objectives of Financial Reporting by Nonbusiness Organizations). The owners of a mutual insurance company are its policyholders. Since ownership rights are not transferrable, mutuals lack some corporate

control mechanisms that are prevalent among stock insurers, such as equity based executive compensation, stock ownership by external blockholders, and takeover threats (Mayers, Shivdasani, & Smith, 1997). The managerial discretion hypothesis states that the restricted control channels may increase the incentives of owner/policyholders to introduce external monitoring, for example by hiring a large auditor. On the other hand, there are other factors that counteract the influence of managerial discretion on auditor choice. Relative to investor-owned firms, mutuals face lower litigation risk (Kerr, 2005), and there are no shareholders demanding brand name auditors to protect their interests (Adams, Sherris, & Hossain, 1997). The impact of mutuality on auditor choice is therefore ambiguous.

The relationship between auditor size and reserve management among mutuals is likewise ambiguous. Some empirical studies suggest that they tend to understate their reserves (Beaver, McNichols, & Nelson, 2003), others find that they tend to overstate (Grace & Leverty, 2010). As in prior studies (He & Sommer, 2010; Mayers & Smith, Ownership Structure across Lines of Property-Casualty Insurance, 1988), we adopt an indicator variable *Mutual* that is set to 1 for a mutual insurer. We do not predict the direction (positive or negative) of this variable's impact, either on auditor choice or reserve conservatism.

Public Insurer. Private firms are more closely held than public firms. The owners can monitor management actions at relatively low cost, mitigating owner-management conflicts (Beaver, McNichols, & Nelson, 2003). Furthermore, private firms do not have the same incentive as their public counterparts to signal the credibility of their financial statements (Balvers, McDonald, & Miller, 1988; Beatty, Ke, & Petroni, 2002; Datar, Feltham, & Hughes, 1991; Feltham, Hughes, & Simunic, 1991; Menon & Williams, 1991;

Simunic & Stein, 1987; Titman & Trueman, 1986). We conjecture that public insurers are more likely than private insurers to choose a big auditor.

Private firms may be less likely to manipulate earnings, since they are not subject to capital market pressures. (Beaver, McNichols, & Nelson, 2003) find that unlike public insurers, private insurers do not manage their reserves to avoid reporting losses. Beatty, Ke, and Petroni (2002) likewise find that private banks are less likely to eliminate small earnings decreases. We predict that public insurers will be more likely to underestimate their loss reserves.

We look to the insurer's ultimate owner to determine whether it is publicly traded. We set the binary *Public Insurer* variable to one if its ultimate owner is listed in the EDGAR database maintained by the US Securities and Exchange Commission

Financial Weakness. By under-reserving, a weak insurer can appear solvent, thereby avoiding regulatory scrutiny (Gaver & Paterson, 2004). Weak insurers may therefore under-reserve to a greater extent than sound ones (Petroni, 1992; Petroni & Beasley, 1996; Petroni, Ryan, & Wahlen, 2000; Penalva, 1998). Harrington and Danzon (1994) hypothesize that firms with poor safety incentives (e.g., because of limited liability or risk-insensitive guaranty funds) deliberately under-report liabilities to increase growth. We expect weakness to be positively associated with under-reserving.

In empirical research, a standard measure of financial weakness is firm performance on the NAIC Insurance Regulatory Information System (IRIS) test (Petroni, 1992; Nelson, 2000; Beaver, McNichols, & Nelson, 2003). The property-liability IRIS consists of 12 financial ratios and associated upper and lower bounds. When a ratio falls outside of the limits, it is tagged as "unusual." Incidence of four or more unusual ratios is taken as

evidence of possible solvency issues, and may trigger NAIC regulatory attention.

An insurer at risk of exceeding its fourth IRIS threshold may deliberately understate its loss reserve to pass the IRIS and avoid ensuing regulatory intervention. A client wishing to engage in such manipulation may avoid the scrutiny of a large auditor (Caramanis & Lennox, 2008). We therefore predict that an insurer at risk of failing the IRIS test will defensively choose a Non-Big *N* auditor, giving it more latitude to mask its condition and avoid reporting a fourth unusual ratio.

We compute the IRIS ratios using the NAIC definition reports. The *Financial Weakness* indicator is set to 1 if the insurer has three or more unusual IRIS ratios.

High Tax Liability. When taxes are high, the insurer may wish to postpone its liability until the future when ultimate claim costs are realized. One way to do this is to overestimate the loss reserve (inflate predicted losses attributable to current premiums) (Grace, 1990). All things equal, the higher the taxes, the more likely the insurer will be to overstate its reserve (Petroni 1992). An insurer that overstates its reserve may prefer smaller auditors, which offer more latitude for managerial discretion.

Insurer tax status is not disclosed by A.M. Best. Therefore, consistent with prior literature (Petroni, 1992; Penalva, 1998; Nelson, 2000), we take the absence of a net operating loss (NOL) carryforward as evidence of high taxes (Scholes, Wilson, & Wolfson, 1990). Insurers that neither pay taxes nor receive prior-year refunds are assumed to have a NOL carryforward (a low tax rate). The *Tax* indicator is set to 1 if the insurer reports no NOL.

Small Profit. Empirical research suggests that across industries, firms manage earnings to avoid reporting accounting losses (Beaver, McNichols, & Nelson, 2003; ;

Weiss, 1985; Grace, 1990). Furthermore, they may likewise manage reserves across the earnings distribution, with the most income-increasing reserves among firms reporting small positive earnings (Beaver, McNichols, & Nelson, 2003). We therefore expect small, positive earnings reports to be associated with under-estimation of the loss reserve and with a preference for smaller auditors that will afford the insurer greater managerial discretion.

The *Small Profit* indicator identifies insurers reporting earnings in the bottom 5% of the positive earnings distribution.

Group Affiliation. Group affiliation usually incurs substantial audit complexity arising from intragroup transactions (Powell & Sommer, 2007), and this may increase the insurer's preference for a large auditor (Chan, Ezzamel, & Gwilliam, 1993). On the contrary, low in-group monitoring costs lead to extensive cross-monitoring among affiliated insurers, which may reduce their motivation to choose a large auditor (Doherty & Smetters, 2005; He & Sommer, 2010). Therefore, the effect of group membership on auditor choice is ambiguous.

Complex intragroup transactions may complicate reserve estimation, resulting in over- or under-estimation. However, empirical evidence suggests that the relationship between affiliation and the reserve error is insignificant (Grace & Leverty, 2010). Thus, we do not predict a direction (positive or negative) for the association between affiliation and reserve conservatism.

The *Affiliated Insurer* variable is set to 1 when the firm is part of a group under common ownership (Powell, Sommer, & Eckles, 2008).

Claim Cycle Length. A long-tailed product is characterized by a long claim cycle, i.e., a lengthy period between initial loss and final claim settlement. Estimating the reserve

for long-tailed lines is difficult, and the greater the proportion of long-tailed lines, the greater the discretion needed (Petroni & Beasley, 1996; Beaver, McNichols, & Nelson, 2003). The impact of cycle length on auditor choice depends on managerial intentions. If the insurer wishes to signal the market that it has voluntarily limited its own ability to mask financial conditions, it may prefer a Big *N* auditor. On the contrary, if it wishes to manage its reserves, it may deliberately select a small auditor that will expend less effort. Thus, we do not predict the impact of cycle length on auditor choice.

The longer the claim cycle, the more difficult the reserve estimation process, and therefore the more likely reserve errors (Petroni & Beasley, 1996; Gaver & Paterson, 2001), whether positive (under-reserving) or negative (over-reserving). We do not predict the direction of the relationship between *Claim Cycle Length* and reserve conservatism.

We follow (Petroni & Beasley, 1996) in computing the *Claim Cycle Length* variable as the ratio of the loss reserve to total liabilities.[9]

Investment Risk. Investment risk measures the insurer's exposure to financial distress resulting from cash flow volatility. An insurer with a high proportion of risky investments may choose a large auditor to signal the market that it has voluntarily limited its freedom to manipulate financial statements and mask financial conditions. On the other hand, a risky firm may deliberately choose a low-quality auditor to avoid disclosing precise financial information (Titman & Trueman, 1986). Therefore, the impact of investment risk on auditor choice could be either positive or negative.

[9] Alternatively, Grace and Leverty (2011) account for the percent of losses incurred in long-tail lines of insurance (as defined by Phillips et al., 1998).

An insurer subject to investment risk may underestimate the reserve to avoid disclosing its true finances (Titman & Trueman, 1986). Thus, we expect investment risk to be negatively correlated with reserve conservatism.

We define *Investment Risk* as the dollar ratio of total common stock and real estate investments to total invested assets.

Reinsurance Ceded. Insurers can redistribute risk by ceding part of their business to other insurers. Reinsurance lowers expected taxes and bankruptcy costs, reduces incentive conflicts with policyholders, optimizes risk sharing among stakeholders, and provides reinsurer services and information (Mayers & Smith, On the corporate demand for insurance: Evidence from the reinsurance market, 1990). An insurer ceding a large proportion of premiums may be closely monitored by the reinsurer. However, the impact of this monitoring on auditor choice is ambiguous. Reinsurer monitoring and control of the firm's managerial activities may reduce its incentive to hire a large auditor (Adams, Sherris, & Hossain, 1997). On the other hand, the reinsurer may demand a quality audit to protect its own interests (Beasley & Petroni, 2001). In sum, reinsurance could either increase or decrease the insurer's propensity to hire a large auditor.

In keeping with (Harrington & Danzon, 1994) and (Grace & Leverty, 2010), we predict that insurers will use reinsurance to hide reserve underestimation.

Following (Mayers & Smith, On the corporate demand for insurance: Evidence from the reinsurance market, 1990), we define *Reinsurance Ceded* as the ratio of premiums ceded to the sum of direct business and reinsurance assumed.

Malpractice. Since the late 1960s, the frequency and severity of medical claims have severely limited the profitability of malpractice lines. Malpractice claims, previously

been rare, became more common and harder to predict (Aiuppa & Trieschmann, 1987). Malpractice insurance is disproportionately characterized by single-line insurers operating under non-standard ownership (e.g., mutuals, risk retention groups, and captives) that shift some of the risk to the policyholder. In some states, tort reforms, including shorter statutes of limitation, collateral source offsets, caps on the magnitude of awards, and/or statutes binding the policyholder to arbitration, have been effective in limiting claims (Danzon, 1986). However, the lack of regulatory uniformity and the "long tail" associated with medical claims have added to the complexity of malpractice insurance. Because of the complexity of the medical malpractice line, we expect malpractice premiums to be associated with the choice of a large auditor.

Previous research (Petroni, 1992; Petroni & Beasley, 1996; Gaver & Paterson, 2001) reveals that over time, the relationship between malpractice premiums and reserve errors has been inconsistent. We therefore do not predict the direction of impact.

We define *Malpractice* as the percentage of net premiums written from malpractice insurance.

Line of business concentration. Line specialization may raise insolvency risk by exposing the insurer to unexpected inflation of unpaid losses (Cummins & Nini, 2002). As a precaution, the insurer may estimate the loss reserve conservatively and choose a Big *N* auditor.

We adopt the Herfindahl index *Line_HHI,* the sum of squared ratio of direct premiums written in each line to total direct written premiums, as our measure of line concentration.

Geographical concentration. Geographically diversified insurers have more

complex operations and require greater managerial discretion than specialized insurers (Mayers & Smith, 1988). The insurer is obligated to conform to heterogeneous regulation by all states in which it is licensed to operate. Diversified insurers should therefore favor Big *N* accounting firms. Geographical concentration should be associated with the choice of a smaller auditor.

We predict that geographically diverse insurer swill overstate their reserves as an additional precaution. Concentrated insurers will by extension be prone to understatement.

We use the Herfindahl index *State_HHI*, the sum of squared ratio of direct premiums in each state to total direct written premiums, as our measure of geographical concentration.

Premium Growth. In empirical research, premium growth has been employed as a proxy for insurer productivity (Mayers & Smith, 1992). On the other hand, researchers and regulators have advanced the view that growth increases insurer risk exposure. During "soft markets," insurers may underprice in order to increase market share, leading to insolvencies and rapidly rebounding prices during ensuing "hard markets" (Harrington & Danzon, 1994; Epermanis & Harrington, 2006). Based on this assumption, the NAIC and A.M. Best financial risk indices penalize insurers for premium growth. When premium growth results from deliberate underpricing, the insurer should avoid scrutiny by choosing a Non-Big 4 auditor. On the other hand, premium growth does not necessary signal expansion of the insurer's risk portfolio. It may reflect increased premiums charged to the existing customer base, which would lower risk (Barth & Eckles, 2009). The impact of premium growth on auditor choice is therefore ambiguous.

We define *Premium Growth* as the year *t+1* to year *t* difference in net premiums

written, divided by year *t* net premiums written.

Firm Size. Big *N* auditors have the technical knowledge, experience, and personnel to handle large clients efficiently. By contrast, smaller auditors lack these resources. We therefore predict that firm size will be associated with the choice of a large auditor.

The impact of size on the reserve error has been neglected in prior studies. An auditor may handle large clients less conservatively for two reasons. First, they are inherently less risky (Johnson & Lys, 1990). Second, they pay higher fees, which gives them greater bargaining power during audits (McKeown, Mutchler, & Hopwood, 1991). The auditor may preemptively adjust its expectations because of the implied threat of losing a large client (Krishnan, Auditor switching and conservatism, 1994). Consistent with this argument, Geiger, Raghunandan and Rama (2005) find that large clients are less likely to receive going concern opinions. We expect size to be correlated with reserve understatement.

As in previous studies, *Firm Size* is defined as the log of total admitted assets.

Leverage. Leverage increases managerial incentives for window dressing, including misleading financial statements (e.g., to mask accounting-based debt covenant violations). Therefore, when management intends to misrepresent financial condition, the firm is less likely to choose a large auditor. On the other hand, management in a levered firm may hire a large auditor to signal the quality of the financial statement to the market. In sum, the impact of leverage on auditor choice could be either positive or negative.

A highly leveraged insurer may withhold precise financial information to avoid potential financial distress costs (Titman & Trueman, 1986). Thus, we expect leverage to be associated with reserve under-estimation.

The *Leverage* variable is defined as the ratio of liabilities to admitted assets.

Reported Loss. In a study of property-liability insurers over an 11-year period, the distribution of reported earnings among was asymmetric, with small positive earnings more prevalent than small negative earnings (Beaver, McNichols, & Nelson, 2003), an indication that insurers manage earnings to avoid reporting losses. Given that a firm reporting a loss is more likely to manage earnings, it should be less likely to choose a Big 4 auditor. In addition, loss reporting gives management incentives for window dressing. Furthermore, loss reports may be positively associated with the occurrence of reserve under-statement (Krishnan & Krishnan, 1997).

We define *Reported Loss* as the absolute value of reported losses, scaled by assets.

The variables employed in the empirical model are summarized in Table 1.

< Insert Table 1 here >

5. Empirical Results

5.1 Summary Statistics

Table 2 reports summary statistics. The means of *ERROR* is -0.0004, suggesting that insurers on average over-estimate loss reserve by 0.04% of their assets. About 26% of our sample receives regulators' on-site examination during the sample period. More than 74% of the sample is audited by large auditors. Of our sample observations, 34.13% are mutuals and 23.08% are publicly traded, with the remaining being privately held. The average claim cycle length is 0.47. About 11% of our sample is characterized by three or more unusual IRIS ratios, meeting the criterion for financial weakness. Affiliated insurers account for 72.49% of the sample. Insurers on average cede 37.51% of premiums to

reinsurance. The average insurer has a product line Herfindahl of 0.46 and a geographical Herfindahl of 0.54. Sample-wide, on average 13.38% of the investment portfolio consists of risky assets. Net premiums written grow at a mean rate of 8.92%. On average, leverage and losses constitute 59.66% and 23.66% of assets. Of the insurer-years, 68.67% fall into the top 90% of the positive earning distribution and 71.87% have a high tax rate.

< Insert Table 2 Here >

We next conduct the t-test and Wilcoxon test to investigate whether insurers receiving on-site examinations report less conservative loss reserves. The results are reported in Table 3. As in Panel A, insurers on average over-estimate loss reserve by 0.17% of their assets if they don't receive on-site examination. However, they under-estimate by 3.6% of assets if they receive on-site examination. Based on the t-test, this difference is statistically significant.

To investigate the effect of auditor type on loss reserve errors, we split our sample by auditor type. Panel B reports the effect of on-site examinations on the reserve errors of Non-Big *N*'s clients. Generally, insurers with small auditors over-estimate loss reserves by 1.20% of assets when they receive on-site examinations. This over-estimation is insignificantly different from the over-estimation of 1.14% of assets in years when they are free from on-site examinations. In Panel C, Big *N*'s clients on average underestimate loss reserve: 0.17% of assets in years without on-site examinations versus 0.90% with on-site examinations. The difference is significant at 5% level, suggesting Big *N*'s clients significantly under-state their loss reserves when they receive on-site examinations.

< Insert Table 3 Here >

Table 4 reports correlation among key variables. The upper triangle presents

Pearson coefficients, while the lower triangle presents Spearman coefficients. Reserve error is negatively correlated with *Claim Cycle Length*, *Line_HHI* and *State_HHI* while positively correlated with *Reinsured Ceded*, *Premium Growth*, *Firm Size* and *Leverage*.

< Insert Table 4 Here >

5.2 Regression Results

4.2.1 Auditor Choice Regression Model

Table 5 reports the empirical results of the two-stage Heckman model. The first column contains the estimates of the Probit model with the dependent variable equaling 1 if the insurer is audited by Big *N* auditors, and zero otherwise. The coefficient of EXAM is insignificantly negative, suggesting that receiving on-site examinations or not doesn't affect an insurer's choice of auditor type. The results also indicate that mutual insurers are more likely to hire small auditors while public insurers with more likely to associated with large auditors.

Geographically diversified insurers are more likely to choose large auditors, consistent with the notion that heterogeneous regulatory standards may bring complexity to geographically diversified insurers and large auditors are more capable of overcoming this complexity. Our results also indicate that insurers taking greater investment risk, or having a higher leverage are more likely to use small auditors, suggesting that higher risk increases the incentives for window dressing by management and thus reduces the incentive to hire large auditors. Insurers with higher growth rates are more likely to use small auditors, indicating that insurers expecting higher growth rate should avoid scrutiny by choosing a Non-Big *N* auditor.

Insurers having a longer claim cycle length, affiliated with a group, using more reinsurance, underwriting more malpractice insurance are more likely to hire large auditors. The results are consistent with our expectation that large auditors are more capable of audit clients with more complex business.

4.2 Reserve Error Regression Model

The second and third columns of Table 5 present the output of two separate OLS models by auditor types. By separating Big *N* and Non-Big *N* models, we allow the slope coefficient vary by auditor type. The reserve error is regressed on a vector of firm characteristics, including inverse-Mills-ratio (*IMR*) estimated from the first-stage probit regression. In the second stage, we need to use a subset of the control variables that we use in the first stage in order to meet the identification constraint. *Reported Loss* and *Profit* are significant in the first stage but become insignificant in the second stage, so we exclude them in the reserve error regression. Heteroskedasticity consistent standard errors are given in parentheses in the reserve error models. The *IMR* are significant in both equations, suggesting insurers self-select their auditor types.

Comparing the coefficients of our variables on the Big N equation with those on the Non-Big N equation, we can see that the effect of each variable on reserve errors varys across auditor type. The coefficients of *Public Stock Insurer*, *Reinsurance Ceded*, *Investment Risk*, *Premium Growth* and *Firm Size* are significant in the Big *N* equation but insignificant in the Non-Big *N* equation. Likewise, the coefficient of *Claim Cycle Length* is significant in the Non-Big *N* equation but insignificant in the Big *N* equation. In addition, the coefficient of *Affiliated Insurer* is significant in both equations but it is positive in the Big *N* equation while negative in the Non-Big *N* equation. These results indicate that

forcing the coefficients of variables to be equal between Big N and Non-Big *N* equations may generate biased results.

The coefficient of *Financial Weakness* is positive and significant at the 1% level in both the Big *N* and Non-Big *N* equations. This results is consistent with the traditional notion that financially weak insurers intend to underestimate their reserves in order to mask their financial conditions. The coefficient of *EXAM* is positive and significant in the Big *N* regression while it is insignificant in the Non-Big *N* regression, indicating that Big *N*' clients report less conservative loss reserve when they receive on-site examinations.

In order to test the effect of on-site financial examinations on reserve management for financially weak (healthy) insurers, we need to add interaction terms of *EXAM* and *Financial Weakness*. We are in the process of completing this analysis.

6. Conclusions

Insurance regulators play an important role in monitoring the financial condition of insurers. Once every three to five years, state insurance regulators are mandated to perform an on-site examination for each insurer to ensure insurance solvency and protect consumers. This scheduled on-site examination thus provides financially weak insurers incentives to engage in opportunistic reporting. In this paper, we investigates the impact of on-site financial examinations on reserve management for US property-liability insurers. We expect that financially weak insurers intend to underestimate loss reserves to mask their financial conditions when they undergo financial examinations. In addition, since regulators' on-site examination could intensify large auditors' concern for their reputation and litigation risk, we investigate whether large auditors will be more effective in

preventing their clients from under-estimate loss reserves when their clients receive on-site examinations. Surprisingly, we find that insurers receiving on-site financial examinations report less conservative loss reserves if they are audited by large auditors.

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Table 1 Variable Definition

Variable	Definition
ERROR	Cumulative adjustment of year *t* loss reserve reported in *t+5*, scaled by admitted assets in year *t*
EXAM	Dummy variable =1 if the insurer receives on-site financial examination, and 0 otherwise
BigN	Dummy variable =1 if the insurer is audited by a large auditor, and 0 otherwise
Mutual Insurer	Dummy variable =1 if the insurer is of mutual ownership
Public Stock Insurer	Dummy variable =1 if the EDGAR database indicates that the ultimate parent is publicly listed
Claim Cycle Length	Loss reserves divided by total liability
Financial Weakness	Dummy variable =1 if fails the IRIS test
Affiliated Insurer	Dummy variable =1 if the insurer belongs to a group
Reinsurance	Percentage of premiums written ceded to reinsurers
Malpractice	Net premium written for medical malpractice divided by total net premium
Line_HHI	Sum of squared percentage of direct premiums written by line
State_HHI	Sum of squared percentage of direct premiums written by state
Investment Risk	The sum of common stock and real estate investments, divided by total invested assets
Size	Natural log of insurer assets
Leverage	Liabilities divided by admitted assets
Premium Growth	Expected growth of net premium written
Profit	Dummy variable =1 for insurers with earnings in the top 90% of the positive earnings distribution
Reported Loss	Dummy variable =1 if the insurer reports loss
Tax	Dummy variable =1 if the insurer has a high tax rate

Table 2 Summary Statistics

Variable	Mean	25th	Median	75th	Std Dev
ERROR	-0.0004	-0.0379	-0.0073	0.0269	0.0871
EXAM	0.2578	0	0	1	0.4375
BigN	0.7440	0	1	1	0.4364
Mutual Insurer	0.3413	0	0	1	0.4742
Public Stock Insure	0.2308	0	0	0	0.4214
Claim Cycle Length	0.4677	0.3125	0.4862	0.6244	0.2131
Financial Weakness	0.1076	0	0	0	0.3099
Affiliated Insurer	0.7249	1	1	1	0.4466
Reinsurance Ceded	0.3751	0.1297	0.3131	0.6000	0.2840
Line_HHI	0.4640	0.2458	0.3761	0.5980	0.2826
State_HHI	0.5448	0.1464	0.4967	1	0.3819
Investment Risk	0.1338	0	0.0770	0.2054	0.1635
Premium Growth	0.0892	-0.0329	0.0655	0.1954	0.3314
Firm Size	18.5064	17.1565	18.3986	19.6250	1.8158
Leverage	0.5966	0.5065	0.6319	0.7109	0.1596
Malpractice	0.0629	0	0	0	0.2318
Reported Loss	0.2366	0	0	0	0.4251
Profit	0.6867	0	1	1	0.4639
Tax	0.7187	0	1	1	0.4497

The sample consists of 2001 - 2005 annual statement data for 5,950 U.S. property-liability insurer-years.
Variable definitions: *ERROR* = (Loss Reserve(t+5) - Loss Reserve (t))/asset; *EXAM* = 1 if the insurer receives on-site examination; *BigN* = 1 if the auditor is a "Big N" accounting firm; *Mutual Insurer* = 1 if the insurer is of mutual ownership; *Public Stock Insurer* = 1 if the EDGAR database indicates that the ultimate parent is publicly listed; *Claim Cycle Length* = loss reserve divided by total liabilities; *Financial Weakness* = 1 if the insurer has three or more unusual IRIS ratios; *Affiliated Insurer* = 1 if the insurer belongs to a group; *Reinsurance Ceded* = premiums ceded, divided by the sum of direct business and reinsurance assumed; *Line_HHI* = Herfindahl measure of line specialization; *State_HHI* = Herfindahl measure of geographic concentration; *Investment Risk* = the sum of common stock and real estate investments, divided by total invested assets; *Premium Growth* = expected growth of net premium written, in year *t*; *Firm Size* = natural log of insurer assets; *Leverage* = liabilities divided by admitted assets; *Malpractice* = proportion of net premium written from Malpractice insurance; *Profit =1* for insurers with earnings in the top 90% of the positive earnings distribution; *Reported Loss* = 1 if the insurer reports loss; *Tax* =1 if the insurer has a high tax rate.

Table 3 Mean Tests and Median Tests on the Equality of *ERROR* by *EXAM*

Panel A Whole sample

	N	Mean	Std Dev	P-value (t-test)	P-value (Wilcoxon)
EXAM = 0	4,416	-0.0017	0.0854	0.0437	0.0945
EXAM = 1	1,534	0.0036	0.0917		

Panel B Non-BigN's clients

	N	Mean	Std Dev	P-value (t-test)	P-value (Wilcoxon)
EXAM = 0	1,121	-0.0120	0.0028	0.9183	0.4664
EXAM = 1	402	-0.0114	0.0048		

Panel C BigN's clients

	N	Mean	Std Dev	P-value (t-test)	P-value (Wilcoxon)
EXAM = 0	3,295	0.0017	0.0817	0.0164	0.0416
EXAM = 1	1,132	0.0090	0.0897		

Variable definitions: *ERROR* = (Loss Reserve(t+5) - Loss Reserve (t))/asset; *EXAM* = 1 if the insurer receive on-site examination.

Table 4 Correlation Table

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1.ERROR	1	-0.0641 (<.0001)	0.1522 (<.0001)	-0.1700 (<.0001)	-0.0975 (<.0001)	-0.0031 (0.8130)	0.0837 (<.0001)	0.1101 (<.0001)	0.1214 (<.0001)	-0.1503 (<.0001)
2.Claim Cycle Length	-0.0477 (0.0002)	1	-0.1425 (<.0001)	0.0111 (0.3909)	-0.1261 (<.0001)	-0.0675 (<.0001)	-0.1501 (<.0001)	0.2408 (<.0001)	0.1801 (<.0001)	0.2517 (<.0001)
3.Reinsurance Ceded	0.1681 (<.0001)	-0.1129 (<.0001)	1	-0.1684 (<.0001)	-0.2095 (<.0001)	-0.1374 (<.0001)	0.0952 (<.0001)	-0.0197 (0.1288)	0.1254 (<.0001)	-0.0642 (<.0001)
4.Line_HHI	-0.1535 (<.0001)	-0.0298 (0.0217)	-0.1805 (<.0001)	1	0.1102 (<.0001)	-0.1319 (<.0001)	0.0164 (0.2064)	-0.1802 (<.0001)	-0.1230 (<.0001)	0.4223 (<.0001)
5.State_HHI	-0.1072 (<.0001)	-0.1561 (<.0001)	-0.2031 (<.0001)	0.1334 (<.0001)	1	-0.0576 (<.0001)	-0.0123 (0.3444)	-0.4599 (<.0001)	-0.1404 (<.0001)	0.0467 (0.0003)
6.Investment Risk	0.0030 (0.8171)	-0.0371 (0.0042)	-0.1942 (<.0001)	-0.1903 (<.0001)	-0.0648 (<.0001)	1	-0.0072 (0.5810)	0.1674 (<.0001)	-0.2317 (<.0001)	-0.0688 (<.0001)
7. Premium Growth	0.0658 (<.0001)	-0.1256 (<.0001)	0.0839 (<.0001)	0.0297 (0.0219)	-0.0136 (0.2952)	0.0037 (0.7786)	1	-0.0283 (0.0292)	-0.0594 (<.0001)	0.0381 (0.0033)
8.Firm Size	0.1047 (<.0001)	0.2635 (<.0001)	0.0024 (0.8525)	-0.2400 (<.0001)	-0.4895 (<.0001)	0.1856 (<.0001)	-0.0184 (0.1555)	1	0.3185 (<.0001)	0.0262 (0.0435)
9. Leverage	0.1400 (<.0001)	0.2041 (<.0001)	0.1506 (<.0001)	-0.1143 (<.0001)	-0.1613 (<.0001)	-0.1552 (<.0001)	-0.0509 (<.0001)	0.3382 (<.0001)	1	0.1362 (<.0001)
10.Malpractice	0.0313 (0.0157)	0.3200 (<.0001)	0.1329 (<.0001)	0.1348 (<.0001)	-0.2137 (<.0001)	-0.0970 (<.0001)	-0.0035 (0.7847)	0.2735 (<.0001)	0.2475 (<.0001)	1

The upper triangle presents Pearson coefficients, while the lower triangle presents Spearman coefficients.
The sample consists of 2001 - 2005 annual statement data for 5,950 U.S. property-liability insurer-years.
Variable definitions: *ERROR* = (Loss Reserve(t+5) - Loss Reserve (t))/asset; *Claim Cycle Length* = loss reserve divided by total liabilities; *Financial Weakness* = 1 if the insurer has three or more unusual IRIS ratios; *Reinsurance Ceded* = premiums ceded, divided by the sum of direct business and reinsurance assumed; *Malpractice* = proportion of net premium written from Malpractice insurance; *Line_HHI* = Herfindahl measure of line specialization; *State_HHI* = Herfindahl measure of geographic concentration; *Investment Risk* = the sum of common stock and real estate investments, divided by total invested assets; *Firm Size* = natural log of insurer assets; *Leverage* = liabilities divided by admitted assets; *Premium Growth* = expected growth of net premium written, in year *t*.

Table 5 Auditor Choice (Big N vs. Non-Big N) and Reserve Error Regression Results

Variable	Probit	Heckman	
		BigN	Non-Big N
Intercept	-8.1157 ***	-0.1551 ***	-0.0188
	(0.404)	(0.028)	(0.061)
EXAM	-0.0206	0.0059 **	-0.0010
	(0.054)	(0.003)	(0.005)
Mutual Insurer	-0.3921 ***	-0.0122 ***	-0.0121 **
	(0.052)	(0.003)	(0.006)
Public Stock Insurer	0.7500 ***	0.0173 ***	-0.0192
	(0.106)	(0.003)	(0.019)
Claim Cycle Length	0.5885 ***	0.0006	-0.1148 ***
	(0.126)	(0.007)	(0.014)
Financial Weakness	-0.0362	0.0360 ***	0.0599 ***
	(0.084)	(0.005)	(0.012)
Affiliated Insurer	1.0057 ***	0.0267 ***	-0.0321 ***
	(0.052)	(0.006)	(0.010)
Reinsurance Ceded	0.9459 ***	0.0283 ***	-0.0011
	(0.098)	(0.005)	(0.015)
Malpractice	0.3086 ***	-0.0361 ***	-0.0318 *
	(0.115)	(0.008)	(0.016)
Line_HHI	0.2757 ***	-0.0196 ***	-0.0362 ***
	(0.095)	(0.006)	(0.010)
State_HHI	-0.3969 ***	-0.0036	0.0064
	(0.071)	(0.004)	(0.009)
Investment Risk	-0.7940 ***	-0.0249 ***	0.0145
	(0.157)	(0.008)	(0.013)
Premium Growth	-0.3728 ***	0.0116 ***	0.0124
	(0.076)	(0.004)	(0.011)
Firm Size	0.4758 ***	0.0082 ***	0.0026
	(0.024)	(0.001)	(0.004)
Leverage	-0.6569 ***	0.0101 ***	0.0495 ***
	(0.172)	(0.008)	(0.017)
Reported Loss	-0.0358		
	(0.095)		
Profit	-0.1545 *		
	(0.086)		
Tax	0.1903 ***	-0.0077 ***	-0.0285 ***
	(0.064)	(0.003)	(0.005)
IMR		0.0324 ***	-0.0343 **
		(0.008)	(0.015)
Year dummies	*Yes*	*Yes*	*Yes*
N	5,950	4,416	1,534
Adj R-square		0.1871	0.1818

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.
Heteroskedasticity consistent standard errors are given in parentheses in the reserve error models.
The sample consists of 2001 - 2005 annual statement data for 5,950 U.S. property-liability insurer-years.
Variable definitions: *ERROR* = (Loss Reserve(t+5) - Loss Reserve (t))/asset; *EXAM* = 1 if the insurer receives on-site examination; *BigN* = 1 if the auditor is a "Big N" accounting firm; *Mutual Insurer* = 1 if the insurer is of mutual ownership; *Public Stock Insurer* = 1 if the EDGAR database indicates that the ultimate parent is publicly listed; *Claim Cycle Length* = loss reserve divided by total liabilities; *Financial Weakness* = 1 if the insurer has three or more unusual IRIS ratios; *Affiliated Insurer* = 1 if the insurer belongs to a group; *Reinsurance Ceded* = premiums ceded, divided by the sum of direct business and reinsurance assumed; *Malpractice* = proportion of net premium written from Malpractice insurance; *Line_HHI* = Herfindahl measure of line specialization; *State_HHI* = Herfindahl measure of geographic concentration; *Investment Risk* = the sum of common stock and real estate investments, divided by total invested assets; *Firm Size* = natural log of insurer assets; *Leverage* = liabilities divided by admitted assets; *Premium Growth* = expected growth of net premium written, in year *t*; *Profit =1* for insurers with earnings in the top 90% of the positive earnings distribution; *Reported Loss* = 1 if the insurer reports loss; *Tax* =1 if the insurer has a high tax rate.